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Dynamics of the level of professionally applied psychophysical and psycho-physiological readiness of students of railway specialties

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Purpose: *to investigate the influence of the experimental program of physical education with increased rate of professionally-applied physical training on the dynamics of psychophysical and psycho-physiological qualities of students of railway professions.)..*

Material & Methods: *in the study, 50 students (boys) of the 1st year of UkrSURT, faculty "Automation, telemechanics and communications" took part. The following research methods were used: theoretical analysis and generalization of scientific literature, pedagogical experiment, testing of professionally important psychophysical and psycho-physiological qualities, methods of mathematical statistics.*

Results: *presented result of testing of psychophysical and psycho-physiological qualities of students of experimental and control groups are. During initial testing set low level the above qualities. The influence of the experimental program on the indices of professionally important psychophysical and psycho-physiological qualities.*

Conclusions: *it found a positive effect of the experimental program of physical education with increased rate of professionally-applied physical preparation on professionally-applied psychophysical and psycho-physiological preparedness of students.*

Keywords: *psychophysical preparedness, psycho-physiological preparedness, professionally-applied physical preparation, psychophysical qualities, students.*

Introduction

New social and economic relations make high demands for modern professionals, including in the field of professional training them. This requires not only improvement of existing, but also the development and implementation of new educational programs for physical education, taking into account the specifics and conditions of professional activity.

Development of the concept of professional development specialist in the current conditions of transformation of production becomes today an important scientific and practical task, therefore the processes of forming a high professional level of competitive specialists are becoming increasingly relevant and significant.

It is known that the effective use of professional knowledge, skills and abilities is possible only with a specialist well-being, health and high efficiency, which can be purchased and developed in the course of employment is professional-applied physical preparation [2; 3]. After all, the more complex are the working conditions, the more perfect should be the level of professional psychophysical and psycho-physiological readiness future specialist, able to respond adequately and solve complex production problems [3].

L. P. Pilipay [8] found that a high professional level requires a significant overall, and in most cases, specific physical fitness preparedness.

Effective performance of tasks of professional activity by modern specialists of the railway industry in conditions of high production intensity and in combination with physical and neuro-emotional loads causes a high need for searching fundamentally new methodological approaches to the process of forming applied physical culture of future specialists. Having perfect professiographic studies of specific professional activities and taking into account their analysis, it is possible to define a fundamentally new approach to the content and organization of professionally applied physical training of students on the basis of the interaction of all mental functions, processes and states in the context of specific professional activities [9].

The study and analysis of scientific literature show that physical education helps create the necessary conditions for optimal development and improvement of physical, psychophysical and psycho-physiological qualities of future specialists, reduce the impact of negative emotions, reduce mental and physical fatigue. E. A. Kolinenko [6] believes that the sedentary lifestyle of a person leads to a worsening of cerebral circulation, and this negatively affects such mental processes as attention, memory, concentration, perception, processing and reproduction of information, etc.

Analysis of the research results of domestic and foreign authors proves the importance and the need to develop a methodology for professional-applied physical, psychophysical and psycho-physiological training of students [3; 5; 8; 11].

It is known that the basis for the implementation of professionally-applied physical training of university students is a professionalogram that reflects the requirements for the professional character of professional activity, contains information on professionally important qualities and is a kind of psychophysical model of the future specialist [9].

Scientific researches of many domestic and foreign authors show that the professional activity of specialists of railway transport makes high demands not only to the level of their physical readiness, but also to their psychophysical and psycho-physiological qualities. For a number of railway professions, long dynamic and static loads are characteristic, high coordination of hand movements, accuracy of motor actions, dexterity of hands and fingers, a sufficiently high level of attention and memory functions, a labile thinking, the ability to maintain an optimal level of efficiency and emotional stability for a long time.

Recently, many scientific works have been devoted to the study of professionally-applied physical training of specialists of various branches of production: motor transport, energy, agriculture, engineering, and others. However, the psychophysical and psycho-physiological features of the professionally applied training of railway professions, in particular, electrical engineers of railway transport, have not been practically studied. So, for today there is no information about the list of the main professionally important qualities of specialists of this specialization and the methodology of their development and improvement has not been developed. Thus, the study of the influence of special means, methods and forms of physical culture on the development and improvement of the professionally important qualities of railroad engineers is important and relevant.

The purpose of the research

to investigate the influence of the experimental program of physical education with increased rate of professionally-applied physical training on the dynamics of psychophysical and psycho-physiological qualities of students of railway professions.

Material and Methods of the research

The study involved 50 students (25 students (boys) experimental and 25 students (boys) of the control group) 1st year UkrSURT, faculty “Automation, telemechanics and communications”. Pedagogical experiment lasted two years

In the course of the experiment, the following research methods were used: analysis and generalization of scientific literature, testing of professionally important psychophysical and psycho-physiological qualities, pedagogical experiment, methods of mathematical statistics.

Results of the research and their discussion

During the experiment the students of the experimental group were engaged in physical education according to the experimental program, the students of the control group – according to the traditional.

Testing psychophysical and psycho-physiological qualities was carried out through a variety of tests that allowed to obtain reliable information about the occurrence of certain mental processes.

Based on the results of initial testing, the status of professionally important psychophysical and psycho-physiological qualities among students in the experimental and control groups was not statistically different (p>0,05) (table 1).

Analysis of the test results after the second year of training indicates a probable improvement in all the studied indicators of psychophysical and psychophysiological qualities in the students of the experimental group (p<0,05).

So, the results of the Gorbov test found that at the beginning of the experiment the assessment of the volume, distribution and switching of attention in the students of the experimental group was lower than in the students of the control group, and the arithmetic mean values in both groups corresponded to a low level. At the end of the experiment, the increase in volume, distribution and switching of attention in the students of the experimental group increased by 57,1%, in the control students, by 4,7%, which is equal to the excellent and low level, respectively.

Table 1

Indicators of professionally important attention functions of students in the experimental and control groups before and after the experiment

Indicators	Before experiment				Before experiment			
	EG	CG	Probability evaluation		EG	CG	Probability evaluation	
	$\bar{X}$±m		t	p	$\bar{X}$±m		t	p
Volume, distribution and switching of attention, c. u.	358,64±6,11	340,88±6,82	1,94	>0,05	153,72±1,54	324,76±4,33	37,25	<0,05
Selectivity of attention, c. u.	14,56±0,45	15,12±0,49	0,85	>0,05	24,88±0,07	16,28±0,39	21,54	<0,05
Sustainability of attention, c. u..	13,48±0,43	12,92±0,37	0,99	>0,05	24,12±0,27	13,36±0,24	29,39	<0,05
Voluntary attention, c. u.	20,36±0,35	19,64±0,26	1,66	>0,05	24,88±0,07	20,32±0,24	18,60	<0,05
Concentration of attention, c. u.	160,11±6,56	166,60±7,31	0,66	>0,05	380,68±38,13	190,59±10,06	4,82	<0,05

Selective attention evaluated by the Munsterberg method, at the beginning of the experiment, the students of experimental and control groups responsible assessment of "bad". For two years of classes on the experimental program, the increase in the parameters for the students of the experimental group was 70,9% and began to correspond to the "excellent" score, while in the control group students the indices rose only by 7,7% and remained at a low level.

Steadiness of attention, which was determined by the technique of "confused lines", at the beginning of the experiment, the students of both the experimental and control groups were equal to "3" points, that is, answered an unsatisfactory level on a 9-point scale. At the end of the experiment, the stability of attention in the students of the experimental group increased by 79%, in the control students – by 3,4%, that is equal to "9" and "3", respectively, which is defined as "excellent" and "unsatisfactory" level.

The results of the Burdon test, which examined the concentration of attention, were slightly higher in the beginning of the training for the students of the experimental group than for the students of the control group. At the end of the II year of training, the concentration of attention among the students of the experimental group increased by 137,8%, in the control students – on 14,4%.

Indicators of the voluntary attention level at the beginning of the experiment among the students of the control group were somewhat lower than in the students of the experimental. In general, in the students of both groups they were below the average norm. After the experiment, the indicators of voluntary attention among the students of the experimental group increased by 22,2%, which corresponded to the average rate, in the control group students – by 3,5%, that is, remained at the initial level.

Indicators of sensorimotor reactions of students in the experimental and control groups were not significantly different at the beginning of the experiment (p>0,05) (table 2).

At the beginning of the experiment, the time for simple reactions to light and sound, as well as the response time for the presence of a trait in both groups, was low.

After two years of experiment, the students of the experimental group had a 15,6% decrease in the time of a simple reaction to light and by 9,5% – the time of a simple reaction to sound. Complex reaction time in the presence and absence of feature also improved, it changes equal to 22,2% and 17%, respectively.

In the students of the control group, similar indices received minor improvements, except for the time of simple reaction to sound, where the deterioration of the results occurred 2,3%. Thus, during two years of studies, the time of a simple reaction to light decreased by 1,4%, the time of a complex reaction to the presence and absence of a sign decreased by 0,7% and 0,2%, respectively.

With the help of a teping test, the special efficiency of students was studied, where the number of clicks was calculated for every 30 seconds and the average frequency of movements for the sum of four attempts.

Comparison of the results of the teping test of the students of the experimental group before and after the experiment makes it possible to assert that there is a probability of differences between them (p <0.05), their percentage increase 20,7%. The students of the control group had no positive changes. So, after two years of training, the indicators improved only on 2,8%.

Table 2

Indicators of sensorimotor reactions of students in the experimental and control groups before and after the experiment

Indicators	Before experiment				Before experiment			
	EG	CG	Probability evaluation		EG	CG	Probability evaluation	
	$\bar{X}$±m		t	p	$\bar{X}$±m		t	p
Time of a simple reaction to light, ms	316,16±3,24	314,36±4,22	0,34	>0,05	266,76±1,88	309,84±3,62	10,57	<0,05
Time of simple reaction to sound, ms	405,04±6,37	401,04±5,47	0,48	>0,05	366,72±3,11	410,44±4,94	7,49	<0,05
Time of a complex reaction to differences in signs (the average reaction time for the presence of a characteristic), ms	994,72±10,17	998,48±13,57	0,22	>0,05	774,28±9,92	991,08±11,16	14,52	<0,05
Time of a complex reaction to signs of differences (mean reaction time for signs of), ms	991,16±9,14	994,04±18,52	0,14	>0,05	822,68±6,58	992,32±5,75	19,41	<0,05
Teping test	5,79±0,07	5,81±0,07	0,18	>0,05	6,99±0,04	5,97±0,05	16,77	<0,05
Muscular sensitivity of the leading brush with visual control, kg	30,52±0,80	31,28±0,78	0,68	>0,05	24,96±0,59	28,96±1,01	3,41	<0,05
Muscular sensitivity of the leading brush without visual control, kg	32,64±0,78	33,04±1,07	0,30	>0,05	27,84±0,95	33,12±0,66	4,43	<0,05

Table 3

Indicators of mental performance of students in the experimental and control groups before and after the experiment (E. Krepelin technique)

Indicators, c. u.	Before experiment				After experiment			
	EG	CG	Probability evaluation		EG	CG	Probability evaluation	
	$\bar{X}$±m		t	p	$\bar{X}$±m		t	p
Number of correctly composed pairs	130,00±0,33	129,84±0,32	0,35	>0,05	134,60±0,13	130,44±0,29	13,14	<0,05
Time taken to complete the test, s	254,68±8,47	275,84±9,37	1,68	>0,05	188,68±2,45	261,76±6,56	10,43	<0,05
Number of errors	5,00±0,33	5,16±0,32	0,35	>0,05	0,40±0,13	4,56±0,29	13,14	<0,05
Coefficient of efficiency	0,95±0,008	0,95±0,009	0,42	>0,05	0,99±0,003	0,96±0,008	3,77	<0,05

Kinestatic sensuality of the brush was determined by the force of compression of the dynamometer. First, the maximum force of the leading brush was determined, and then with the same hand it was necessary to compress the dynamometer by 50% of the maximum voltage without visual control.

A comparative analysis of the results of the muscle sensitivity of the leading brush without visual and visual control in the experimental group at the beginning of the experiment was slightly lower than in the control group and was assessed as a "below average" level for this age group.

After the end of the pedagogical experiment, the average indices of the muscular sensitivity of the hand without visual control in the students of the experimental group significantly increased, the difference between the visual and non-visual indices was 11,5%.

Analyzing the state of mental capacity for simple but monotonous work (E. Krepelin technique), it is necessary to note the positive dynamics of the indices of the students of the experimental group during two years of physical education. Thus, at the beginning of the experiment, the quantitative performance of work in both groups was almost the same, the number of errors averaged 5, and the time spent on the test varied from 4 min 24 s to 5 min. Coefficient of efficiency corresponds to 0,95 conventional units. However, at the end of the experiment, the number of correct answers in the experimental group 3,5%. In addition, they significantly, by 92%, reduced the number of errors in the performance of this test, the time spent on the test was reduced by 25,9%, and the efficiency factor increased by 4,2% (table 3).

In the control group, after two years of training in the traditional program, the number of correct answers improved by 0,5%, the number of errors decreased by 11,6%, the time spent on the test was reduced by 5,1%, and the efficiency factor increased by 1,1%.

Thus, analyzing the data obtained at the beginning and at the end of the pedagogical experiment, it can be asserted that the results of the study revealed positive and statistically reliable dynamics of the indices of professionally important psychophysical and psycho-physiological qualities among students engaged in physical culture under the experimental program.

Conclusions

1. Analysis of the results of the initial testing of professionally important psychophysical and psycho-physiological qualities of students of the experimental and control groups found that they did not differ statistically.

2. Under the influence of the program with the strengthened course of the professionally applied physical training of the students of the experimental group, the indicators of the quality of attention and intelligence increased significantly ($p<0,05$).

3. It is established that the indices of the professionally important psychophysical and psycho-physiological qualities of the students in the control group increased slightly, and in some cases even worsened.

Prospects for further research

Further research is planned to be directed to the development of a program of professionally-applied physical training for specialists of certain specialties of railway transport, taking into account age, state of health and physical readiness.

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