

The factorial structure of professionally-applied physical fitness of students of railway specialties

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Purpose: to define the factorial structure of professionally-applied physical fitness of students – future electrical engineers of railway transport.

Material & Methods: analysis and synthesis of references, questioning, anthropometry, testing, functional tests, and methods of mathematical statistics (the factorial analysis) with application of the computer program "SPSS 17.0". 50 students (young men) of Ukrainian state railway university participated in the research.

Results: the ratio of means of physical culture which are expedient to use for the optimization of professionally-applied physical training of future specialists of the railway branch is defined.

Conclusions: the factorial analysis allowed to distribute means of physical education as follows: physical exercises which are directed to the increase in physical working capacity and overall physical fitness – about 40%; exercises on the development of power qualities – 25%; exercises on the development of high-speed and power endurance – 15%; means which are allocated for the improvement of functions of attention and kinetic sensitivity – 10%; exercises which are directed to the increase in special working capacity – 10%.

Keywords: professionally-applied physical training, dynamics of indicators of physical fitness, electrical engineers of railway transport, factorial structure, physical education.

Introduction

The scientifically-technical progress transforms working conditions of the modern expert by cardinal rank, submits to it more and more increased requirements, needs special preparation, ability to work in the conditions of psychological tension and deficiency of time. Therefore, processes of formation of professional level of competitive experts of different specialties of railway branch acquire the increasing relevance and the importance.

The important role in formation of the harmonious identity of a future expert, his professional skills and abilities is played by physical education, namely professionally-applied physical training which fully promotes the formation of necessary level of professionally important qualities, skills.

Professionally-applied physical training of students in higher educational institutions has to provide formation and development in the course of physical education classes of necessary physical and psychophysical qualities of future experts, applied knowledge, skills which will help them to take control in the shortest possible time of profession and to adapt to conditions of modern production. Therefore, classes on physical education have to be under construction taking into account specific features of certain professional activity, conditions, and to the nature of work, negative factors of production and occupational diseases.

Data of many researches demonstrate that today extremely important search of new forms and methods of the organization of professionally-applied physical training which, in complete system of physical training would promote the formation

of professionally important skills and fully trained future experts for the chosen profession.

The rapid development of science and technique promotes the increase in the importance of a professional in the production process. Character and working conditions are harder and harder every year, even more often there is the replacement of strenuous physical efforts by precisely fulfilled and quick physical actions, and complexity of productions increases the nervously-emotional pressure. All this makes the increased requirements to physical and psychophysical fitness of the modern expert [4; 9].

Variety of modern professions needs the corresponding terms for training of future highly skilled professionals and various approaches to the foundation of structure and contents at implementation of vocational training. Besides, it is important to modern experts to own the certain physical and psychophysical qualities, personal abilities and properties corresponding to the chosen professional activity [1; 3; 5; 7; 8; 10]. All these features develop and improved during professionally-applied physical training and in the subsequent in the course of work performance.

In recent years many scientists pay attention to the definition of students making physical fitness. So, N. V. Yegorova [6] investigated the structure of physical fitness of students of agricultural higher educational institutions. The author has defined that power and high-speed and power preparedness, physical development and functional preparedness of students have the largest weight in the general factorial structure.

High-speed and power qualities, flexibility, endurance and

coordination enter the structure of physical fitness of future dance teachers, according to T. V. Sabantseva [8].

Investigating the factorial structure of physical condition of students who study on the educational direction of preparation "Ecology", I. G. Bondarenko [2] has defined that the most powerful contribution to its development is put by indicators of aerobic endurance, indicators of force and high-speed and power abilities are less important.

The factorial structure of professionally-applied physical fitness of students of technical specialties on the example of the transport branch was studied by N. V. Chukhlantseva, L. Ye. Shesterova [11]. It was established by us that it is expedient to distribute arsenal of the funds of physical education which are allocated for increase in professionally-applied physical fitness of students of transport specialties as follows: on the development of harmonious constitution and general physical qualities – 35%; on the development of power and coordination abilities – 25%; high-speed and power endurance – 20%; on the increase and support of optimum condition of cardiovascular and cardiorespiratory system – 10%; on the general and special working capacity – 10%.

However, it should be noticed that today researches of factorial structure of professionally-applied physical fitness of specialists of railway branch are almost absent.

The purpose of the research

To define factorial structure of professionally-applied physical training of students – future electrical engineers of railway transport.

Material and Methods of the research

The following methods were used during the research: analy-

sis and synthesis of references, questioning, anthropometry, testing, functional tests, methods of mathematical statistics (the factorial analysis), with application of the computer program "SPSS 17.0".

50 students (boys) of Ukrainian state railway university took part in the research.

Results of the research and their discussion

The factorial analysis of indicators of physical development, physical and professionally-applied physical fitness and functional working capacity was carried out for the purpose of identification of the main components of structure of professionally-applied physical training of students – future electrical engineers of railway transport and definition of optimum ratio of means of physical education.

The substantial characteristic of the main allocated factors is presented in table 1.

The index of back strength (0,921), back strength (0,920), PWC170 (0,901), vital capacity of lungs (0,891), the maximum consumption of oxygen (0,856), vital index (0,801) entered the first factor, with the general contribution of 35,49% of the general total dispersion. According to indicators which entered the first factor it was called "physical working capacity". It should be noted the close connection of indicators of back strength and PWC170.

The second factor, with the general contribution of 13,88% of the general total dispersion, united indicators of high-speed index (0,908), high-speed and power index (0,815), index of endurance (0,715), index of body weight (0,650), and received the name "physical fitness".

Indicators of index of Robinson (0,739), HR at rest (0,724), in-

Table 1
The substantial characteristic of the main allocated factors

Name of factor	Variables	Factorial loads
I factor Physical working capacity	Index of back strength	0,921
	Back strength	0,920
	Pwc170	0,901
	Vital capacity of lungs	0,891
	Maximum consumption of oxygen	0,856
	Vital index	0,801
II factor Physical preparedness	High-speed index	0,908
	High-speed and power index	0,815
	Endurance index	0,715
	Body weight index	0,650
III factor Vital potential	Robinson's index	0,739
	HR at rest	0,724
	Index of adaptation potential	0,679
IV factor Ability of motor analyzer to differentiate effort	Static endurance of muscles of back	-0,677
	Kinaesthetic sensuality without visual control	0,939
V factor Muscular strength of hands	Kinaesthetic sensuality with visual control	0,936
	Hand dynamometry	0,715
	Power index of hand	0,732
VI factor Concentration of attention	Test of Kopilov "Ten eights"	0,619
	Firmness of the concentrated attention	0,735
	Volume, distribution and switching of attention	-0,727

dex of adaptation potential (0,679), static endurance of muscles of back entered the third factor which made 12,22% of the general total dispersion (-0,677). He received the name "vital potential".

The fourth factor, with the general contribution of 7,92% of the general total dispersion, included indicators of kinaesthetic sensuality without visual control (0,939) and kinaesthetic sensuality with visual control (0,936). This factor received the name "kinaesthetic sensuality".

The following indicators entered the fifth factor which made 6,57% of the general total dispersion: hand dynamometry (0,715), power index of hand (0,732), test of Kopilov "Ten eights" (0,619). According to indicators which entered it, it received the name "muscular strength of hands".

With the general contribution of 5,31% of the general total dispersion, we interpret the sixth factor as "concentration of attention", it contained indicators of firmness of the concentrated attention (0,735) and volume, distributions and switchings of attention (-0,727).

Results of the factorial analysis showed that the chosen indicators of expanded complex testing break into six factors with the general contribution of 81,39% (pic. 1).

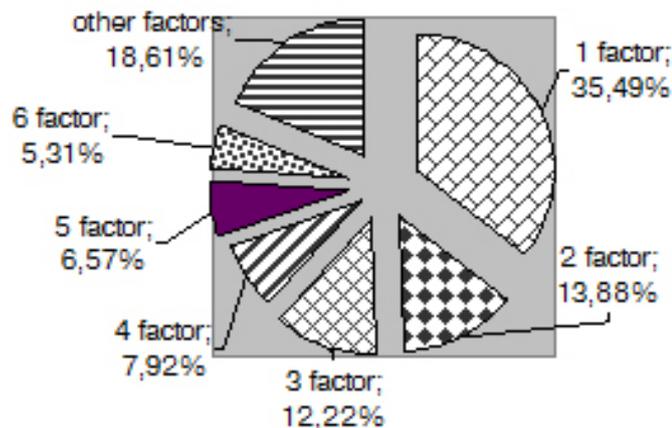


Fig. 1. Percent of contribution to the general dispersion of each factor

However, if to take into account that the dispersion of the received values on all indicators equals 100%, it is possible to find the calculated percentage contribution of each factor to the general structure of professionally-applied physical training (tab. 2).

Thus, results of the factorial analysis give the chance to define optimum structure of means of physical education in the experimental program with the strengthened course of professionally-applied physical training for students – future electrical engineers of railway transport for the purpose of optimization of its influence on professional preparedness of specialists railroad workers (tab. 3).

Therefore, the training material of the experimental program on physical education with the strengthened course of PAPT was distributed on the basis of the factorial analysis as follows: the exercises which are directed to the increase in physical working capacity and overall physical fitness – about 40%; on the development of power qualities – 25%; exercises on the development of high-speed and power endurance – 15%; the exercises which are directed to the improvement of functions of attention and kinaesthetic sensuality – 10%; exercises on the increase in special working capacity – 10%.

Conclusions

1. The analysis of domestic and foreign scientific literature confirms the existence of many thoughts concerning the structure of professionally-applied physical training of students of higher educational institutions, but researches on the definition of structure of PAPT of experts of railway transport practically aren't exist.

2. Results of the factorial analysis of complex testing of students of railway specialties gave the chance to define six factors with the general contribution 81,4% in the structure of professionally-applied physical fitness.

3. The determinate structural components of professionally-applied physical fitness of future electrical engineers of railway transport during the factorial analysis allow to distribute funds of physical education as follows: the physical exercises which are directed to the increase in physical working capacity and overall physical fitness – about 40%; exercises on the development of power qualities – 25%; exercises on the development of high-speed and power endurance – 15%; the funds which are allocated for the improvement of functions of attention and kinaesthetic sensuality – 10%; exercises on the increase in special working capacity – 10%.

The subsequent researches provide the development of the experimental program on physical education with the strengthened course of PAPT for future specialists of railway branch on the basis of the determinate factorial structure.

Table 2
Own values of factors (cumulative) and percentage percent of the explained dispersion

Factors	Own values	Contribution in dispersion of each factors, %	Cumulative own values of factors	Percentage percent, %
1	7,454	35,494	7,454	35,494
2	2,915	13,879	10,369	49,373
3	2,566	12,218	12,935	61,591
4	1,664	7,923	14,599	69,514
5	1,380	6,573	15,979	76,087
6	1,116	5,314	17,095	81,401

Table 3
Percentage value of means of physical education in the experimental program with the strengthened course of PAPT

Name of factor	Orientation of means	Contribution of dispersion of, %	General contribution, %
Physical working capacity	Ability to maintain long, hard, hard work	35,494	43,60
High-speed and power endurance, physical preparedness	High-speed and power endurance	13,879	17,05
Vital potential	Aerobic opportunities of organism	12,218	15,01
Ability of motor analyzer to differentiate effort	Kinaesthetic sensuality	7,923	9,73
Muscular strength of hands	Power abilities	6,573	8,08
Concentration of attention	Concentration of attention	5,314	6,53
Other		81,401	100

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