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Original Article

Applied physical education for university students

DMITRY VIKTOROV[1], EVGENY CHEREPOV[2], ANDREY FOFANOV[3], YULIA GOMZHINA[4]
[1,2,4,] Department of Physical Education and Health, South Ural State University, Chelyabinsk, RUSSIA
[3] Military institute of physical training, St. Petersburg, RUSSIA

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Abstract
The paper describes the data on the use of applied physical education in South Ural State University students with health problems. The authors' methodology of applied physical education provides the opportunity for the development of professional adaptation. In 2018-2020 academic years, 62 students of various faculties of South Ural State University aged from 16 to 21 years and characterized by various health problems were examined. The aim of the study was to update the concept of applied physical education by taking into account health limitations and the potential of professionally applied physical training. The indicators of the applied physical education methodology, which create the prerequisites for ensuring professional success in students of all medical groups, have been determined.
Key words: **professional and applied physical training, health limitations, applied physical education, professional adaptation**.

Introduction

The specific requirements imposed by industrial professions are associated with successful educational and professional activities (Rvachev V.A., 2016; Talaghir, L.G., Mocanu, G.D., Iconomescu, T.M., & Mîndrescu, V., 2018). As a result, they depend on using the means of physical education with gradual inclusion of requirements to the future profession (Safonova O.A., & Krivoshchekov V.G., 2015). Therefore, the content of physical education is the basis for professional activities as far as it consists of physical training of a professionally applied nature, which involves skill acquisition by a person, namely the ability to assimilate knowledge essential for a future profession. In this case, applied training provides sufficient comprehension and constant reevaluation that result in forming a more holistic approach to physical education at university (Zaitsev A.A. Litasov P.P., & Soroka B.V., 2016).

The ratification of the Federal State Educational Standards (FSES 3 ++) in 2018 led to the fact that universities received the right to apply the programs developed in accordance with these standards. A new category of competencies has been introduced, namely universal competencies (UC). They are completely different in terms of their format and formulation compared the previously accepted general cultural competencies. There is no doubt that a set of universal competencies is truly necessary for a future specialist and they must be formed throughout the entire learning process according to a certain educational program (Order of the Ministry of Education and Science of Russia of November 19, 2013).

Currently, there are changes in universities in the Russian Federation associated with their consolidation, an increase in the number of educational programs, switching to a two-level distance basis of the higher education system, the formation of multidisciplinary universities, etc., which complicates the development of recommendations for essential physical skills, knowledge and special qualities, which guarantee students' success in their future professional activities (Lubysheva L.I., & Cherepov E.A., 2016). This is especially difficult for students with health problems, who experience difficulties with the ability to maintain an appropriate level of applied readiness within the framework of the future profession (Viktorov D.V., 2011).

In Russia, the emphasis is on applied training and, therefore, the ability to share applied knowledge, while skills and other abilities play an auxiliary role. This influences control procedures, which are used for the assessment of knowledge and skills obtained as a product of educational programs. However, professional adaptation, as well as the ability to independently and effectively apply various knowledge and skills, are not quite sufficient despite the long-term existence of the control procedures. As a result, universities are looking for new forms of education that improve the quality of applied training and, consequently, professional adaptation (Yakovleva I.V., & Vlasyuk N.N., 2020).

However, for students with health problems, the possibility of maintaining an appropriate level of applied readiness is associated with certain limitations. Despite the fact that professional and applied physical training belongs to the system of physical education, only one semester is dedicated to this very discipline, which creates

Corresponding Author: DMITRY VIKTOROV, E-mail: viktorovdv@susu.ru

problems associated with the use of traditional PE programs. Therefore, it is necessary to provide systematic and adequate requirements to the functional abilities of students to guarantee their future professional success.

The method of using the means of physical education with gradual inclusion of requirements to the future profession is not new, because, as it was previously said, the content of physical education is the basis for professional activities (Konovalova G.M., 2011). Having a beneficial effect on health and physical fitness, physical exercises directly affect human performance, which inevitably provides comprehensive physical self-improvement. According to the curricula developed on the basis of the Federal State Educational Standard of Higher Education (3+) or the Federal State Educational Standard of Higher Education (3 ++), the last semester of physical education is dedicated to professionally applied physical training (Chekaleva N.V., 2017). However, current changes in the educational system of the Russian Federation make it difficult to provide recommendations that allow students to successfully achieve their future professional success, to develop essential physical and special qualities, to acquire necessary knowledge and skills (Yarmak O., Galan Y., Hakman A., Dotsyuk L., Blagii A., & Teslitskyi Y., 2017).

Taking into account practical recommendations, the system of physical education requires, if possible, a different approach, especially in modern conditions of the pedagogical implementation of professional and applied physical training, which implies a certain transformation of applied physical training. This is also essential because not every PE teacher has sufficient knowledge of the essence of this professional activity. Moreover, some PE teachers are passive and inert in work, this requires their professional adaptation, which also influences the functional fitness of the body.

In our understanding, the PAPT methodology can be actualized by means of using up-to-date information and knowledge aimed at improving the system as a whole. This implies a gradual transformation of applied training, improving its quantitative and qualitative characteristics while preserving the basis. Therefore, actualization consists of the subsequent change in the previously existing PAPT technologies as a result of purposeful pedagogical activity within the framework of modern educational programs and their approaches and methods of physical education.

Materials & methods

62 students of South Ural State University took part in the study. PE classes were conducted according to the system of a gradual involvement into applied physical education, two times per week regardless of the chosen faculty.

The article is based on the hypothesis that adaptation to future professional activities among students with health problems will be successful if the method of teaching applied physical training is changed.

Considering the very large number of various student health problems, it is quite problematic to form two groups that are identical in gender, age, year of study and characterized by the same disease and its signs. However, it was found that one mixed experimental group and one mixed control group with different diseases would be enough for the experiment.

The formation of adaptation, including professional adaptation, typically goes through the following phases:

1) Urgent (initial) adaptation to physical activity characterized by the mobilization of functional systems (external respiration and blood circulation). At this phase, functional tests were used, in particular: Serkin test and Martine-Kushelevsky test.

2) Long-term adaptation, which consists of the structural shifts in the body as a result of accumulated effects of urgent adaptation, which provides an increase in the performance of physiological systems due to an increase in the efficiency of internal systems. In this phase, the force platform test is used, which assesses the quality of the balance function and, thus, allows to monitor the dynamics of motor skill acquisition.

3) Stable adaptation, which implies an increase in power and improves the efficiency of the motor apparatus. This phase is characterized by the power of physical work, therefore, the PWC170 and MOC test was carried out taking into account the recommendations and contraindications for this category of students.

Participants

According to the Federal State Educational Standard, the last semester of physical education is dedicated to professional and applied physical training. Therefore, the following changes were proposed: to shorten the period of adaptation to applied physical activity in compliance with the requirements of the Federal State Educational Standard and to include professionally applied physical education in the program of 2, 4, 6 semesters.

Tabl 1 The experimental program of applied physical education

2 semester	4 semester	6 semester
Mobilization of functional systems (external respiration and blood circulation)	Improving the quality of the balance function	Motor activity (power)
Urgent (initial) adaptation	Long-term adaptation	Stable adaptation

Results

The effectiveness of the method was verified by comparing the same indicators at the end of the 2nd, 4th and 6th semesters. The data obtained are shown in Tables 2, 3, 4.

It can be said that the mobilization of functional systems (external respiration and blood circulation) (stage 1) inevitably leads to improving the quality of the balance function (stage 2), which is associated with motor activity (stage 3).

Table 2 The initial phase of professional adaptation

Indicators	Groups	Stage of the experiment		
		2017-2018	2018-2019	2019-2020
Martine Test	EG	39/61*	64/36*	74/26*
	CG	43/57*	61/39*	69/31*
Serkin Test	EG	46.3/86.7**	48.2/97.5**	59.5/103.4**
	CG	46.7/91.9**	48/103.1**	64.6/116.4**

Note. The number of students (%) by type of reaction: positive (normal) / adverse (hypo, hyper, dys, step); **2nd, 3rd stages (%)

Table 3 Long term phase of professional adaptation

Indicators	Groups	Stage of the experiment		
		2017-2018	2018-2019	2019-2020
CoP velocity, V (mm/s)	EG	24.6±2.6	18.4 ±1.9	17.8 ±1.9
	CG	17.1±2.1	15.9±0.4	16.2±0.5
Ellipse area, S90 (mm2)	EG	235.1±51.6	207.3 ±40.0	169.3 ±31.9
	CG	248.3 ±42.5	241.1 ±38.01	238.82 ±45.4
Length to area ratio, LFS90 (1/mm)	EG	2.72±0.39	2.39 ±0.6	2.11 ±0.41
	CG	2.89±0.14	2.47 ±0.19	2.25 ±0.22
Stability indicator	EG	64.42 ±4.9	76.71 ±4.5	85.08 ±4.12
	CG	65.63±2.37	68.62±3.54	73.32±2.34

Table 4 Stable phase of professional adaptation

Indicators	Groups	Stage of the experiment		
		2017-2018	2018-2019	2019-2020
PWC170 (comparative)	EG	12.9±1.2	14.4±1.4	16.7±0.5
	CG	13.1±1.1	14.2±1.4	14.8±1.3
VO2max (comparative)	EG	31.9±2.1	37.1±1.7	42.2±0.7
	CG	31.8±1.8	35.6±2.3	37.6±2.5

Discussion

The essential categories of the functional state are described by means of a three-stage breath holding test (Serkin test), which allows to define physical capacities (stage 1), physical abilities (stage 2), energy resources (stage 3). In the 6th semester (2019-2020), both in the control and experimental groups, there are significant differences ($p < 0.05$) compared with the results for 1-2 semesters.

An increase in breath holding at stage 2 indicates that students with health problems have improved their ability to tolerate hypoxic conditions and are characterized by efficient performance of both the respiratory and muscular systems. Based on the interactions between these systems, the effectiveness of our approach for the formation of professional adaptation was substantiated. This can serve as undoubted evidence of the increase in the adaptive potential of the body. When practicing applied means of physical education with students of the experimental group, the formation of motor qualities occurs.

The average group results, as evidenced by the Serkin test, regardless of gender and level of physical fitness, confirm the likelihood of an increase in adaptive shifts that are adequate to physical activity. This substantiates the effectiveness of such an approach for forming professional adaptation and serves as a possible proof of an increase in the adaptive potential of the body.

CoP velocity data show that students from the experimental group demonstrate positive dynamics: the decrease in this value by the 3rd year reflects an overall improvement in the balance function.

The ellipse area indicator, in general, depends on many parameters. However, its significant decrease in the experimental group by 26% from 235.1 to 169.3 confirms the effectiveness of the method proposed. In the control group, the same indicator decreased by only 15.7%.

The total energy (LFS), which characterizes both the maintenance of the posture and the energy spent on these efforts, undoubtedly indicates energy consumption during the study. This indicator, at the same time, has a clearly expressed physical meaning and allows to associate its value with the phase of long-term professional adaptation as accurately as possible (Cherepov E.A., 2015). In a specific case of the experimental group, such minimization of energy costs means efficiency of energy consumption reflected in a pronounced dynamic from 2.72 (1st year) to 2.39 (2nd year) and 2.11 (3rd year). This confirms the conclusions about the dynamism of rearrangements of the functional system in complicated conditions.

In both groups, the stability indicator, which reflects the character of the balance function, does not have significant differences neither before nor after the experiment. This confirms the presence of a stable norm in the majority of students with health problems, as well as the stability of spatial coordination and the effectiveness of technical actions. Among students from the experimental group, this parameter is only accompanied by a decrease in the spread of oscillations.

PWC170 indicators show low results in the second semester in the experimental and control groups. In the fourth semester, in both groups, it became lower than the average data. However, in the 6th semester, in the control group, the relative PWC170 indicator remained at an average level, while in the experimental group the results were considered as above average ($p < 0.05$).

The same is for VO2max data: semester 2, both groups - a very low indicator, semester 4, EG - low, CG - below average ($p > 0.05$), semester 6, EG - average, CG - below average ($p < 0.05$).

Conclusions

Applied methods and means implemented in physical education programs currently do not allow university students to achieve the proper level of professionally significant physical and functional qualities. A decrease in physical activity in senior courses combined with the lack of progressive methods and means of applied physical training do not contribute to the successful acquiring of essential professional skills and knowledge. In contrast to literary sources, indicating that an adapted organism can more easily endure the adverse effects of environmental factors, the loads used do not stimulate students to improve their functional activity, overcome emotional stress and demonstrate high motivation for a future profession.

The use of our methodology of applied physical education, which is based on the advanced information about professional adaptation, provides an increase in the adaptive capacity of the body and allows to form professionally important qualities.

Therefore, our experimental methodology consists of the use of applied training in 2, 4, and 6 semesters, while, according to the Federal State Educational Standard, only the last semester of physical education as a university discipline is associated with the use of applied physical education. Thanks to the use of indicators of functional systems (initial adaptation), the balance function (long-term adaptation), and maximum oxygen consumption (stable adaptation), this method guarantees achieving the planned result of the educational process.

As a result of the study, the data obtained in the EG significantly differed from the same data in the CG ($p < 0.05$).

Since the problem of professional adaptation must be solved by creating a single educational space of professionally applied physical training, it is necessary to introduce this concept in educational institutions of higher education, which, according to their status, have material, legislative and personnel support for the inclusion of forms and means of applied training in the everyday life of students.

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