

Functional readiness and properties of the nervous system peculiarities of art specialties' future teachers

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Abstract

Background and Study Aim The future professional work of students of the Faculty of Arts is characterized by an insufficient level of physical activity of a dynamic nature in combination with a large static load and highly coordinated finger work. Representatives of these specialties have their own psychological characteristics. Purpose: to reveal the peculiarities of the properties of the nervous system and the functional potential of the cardiovascular system of students - future teachers of fine arts and music and, based on the obtained data, to develop recommendations for physical education and sports.

Material and Methods Students of Pedagogical University took part in the study. The total number of students was 812. 24 of them were students of the Faculty of Arts. Future specialists in physical education and sports took part in the number of 25 people. 763 students were representatives of other faculties. Properties of the nervous system were determined using psychophysiological testing. During psychophysiological testing, the reaction time and the number of errors were determined for each test. The indicators of the orthostatic test were used as indicators of functional readiness. In the orthostatic test, the heart rate was measured in the lying position and in the standing position and the difference between these indicators. Statistical analysis involved comparing students of the Faculty of Arts with students of other faculties using parametric methods, since all samples corresponded to a normal distribution.

Results Future teachers of creative specialties have reliably the least mobility in combination with the highest stability of nervous processes in comparison with representatives of other pedagogical specialties. Reliable differences were found between the indicators of orthostatic reactions of students of the Faculty of Arts and the faculty where future sports coaches are trained. Orthostatic regulation is significantly better in students of the Faculty of Physical Education and Sports.

Conclusions It is necessary to adjust the program of physical education of students of creative specialties to increase the interest of students and to match physical exercises to the features of the nervous system of students of the Faculty of Arts. Future teachers of creative specialties can be recommended to engage in any kind of sport or motor activity, but the most suitable for them are exercises that require the development of endurance in combination with the inclusion of cognitive processes and concentration: walks with observation of nature and the city, exercises performed to music, exercises with a concentration on various natural images, etc.

Keywords: students, orthostatic test, psychophysiological functions

Introduction

The formation of a healthy lifestyle of future teachers is of great importance for society [1, 2, 3, 4]. As the great teacher of the 20th century, Maria Montessori [5], pointed out, the future teacher must, first of all, be attractive to children. At the first stage, attractiveness for children is determined by the appearance of the teacher. And in order to have a good appearance, you need to have good health [6]. In addition, future teachers must overcome all the difficulties of studying at the university. Also, their future work is associated with psychological and physical stress [1, 2]. After all, they will need

to effectively interact with children, with parents, with the leadership of the school and education in general, prepare for classes, have time to work with documentation and pay attention to their own family. And most importantly, teachers bring knowledge to future generations. And they also need to convey knowledge about a healthy lifestyle to their students and form in them the skills and abilities to strengthen and preserve health. Only in this way can a healthy nation be formed.

Specialists in creative specialties occupy a special place among future teachers. In general, pedagogy requires creativity. But in society, creative specialties include music, visual arts, and dance. We will look at health-saving technologies for musicians and

artists. Their professional work is characterized by an insufficient level of physical activity of a dynamic nature in combination with a large static load and highly coordinated work of the fingers [7, 8, 9, 10]. Representatives of these specialties have their own psychological characteristics. First of all, they have developed creative thinking with imaginative perception and activation of the right hemisphere of the brain [9]. This is of great importance for the creation of world-class masterpieces, but it provides certain characteristics. This is reflected in the fact that they can, for example, be engaged in a creative project all the time. At the same time, they can forget about anything, even about food and sleep. And all the more they forget about doing physical exercises, which is a necessary condition for a healthy lifestyle [7, 10]. That is why it is necessary for them to choose physical exercises and technologies of physical education in such a way that they are organically combined with art classes and very appealing to future specialists in creative specialties. And this is not accidental. After all, art seeks constant creative improvement.

It should be noted that people at all times sought the unity of physical, intellectual and physical development. So, the great mathematician, philosopher, humanist Pythagoras was the champion of the Olympics in Greece in fist fighting and an innovator in music [8, 10]. And the famous swordsman Miyamoto Musashi [11] pointed out that a real warrior should get acquainted with every kind of art and learn the ways of all professions. This is not accidental, because the possession of a wide range of movements affects the coherence of the work of the central nervous system [12, 13, 14]. That is why athletes need to study the basics of art, and future specialists in creative specialties need to improve their control of their bodies through physical exercises.

The physiological basis of the unity of sport and art is that all levels of the central nervous system participate in the process of controlling movements and forming skills [12, 13]. Therefore, with the development of the perception of beauty and harmony, be it sports movements or works of art, the coherence of the work of the central nervous system is improved. It helps to achieve excellence in all activities. In this connection, art and sport are a single entity.

In our previous studies [15], we established by analyzing specific examples that sport and art have many common features. Both sports and art require motor activity. In sports, these are movements of large muscles, in art - movements of small muscles. Sports and art require a perfect mastery of movements that exceeds generally accepted averages. Ideal technique determines the most rational movements, which are perceived as beautiful. Perception of art develops creativity, non-

standard thinking. So, there is a connection between sports and art that promotes the manifestation of mastery. It is not by chance that many famous actors, musicians, and artists combine art and sports

Let's consider the need to combine art and sports on the example of training musicians. In order to successfully study at a music school, it is necessary to study for 2 hours every day, and in the process of improvement - for 4-6 hours or more [7, 8, 9, 10]. Classes are accompanied by large static loads on the spine, pelvic muscles and lower limbs with high dynamic loads on the muscles of the shoulder girdle. Performances at competitions and concerts also require a high level of endurance and mental stability. Many types of musical art require a high level of physical training. For example, to achieve a good sound on wind instruments, it is necessary to develop the strength of the respiratory muscles. Unfortunately, many young talents do not realize their potential due to insufficient level of health. Therefore, physical exercises are necessary for musicians as an integral means of their professional training. And their teachers should promote sports.

These provisions also apply to all other creative specialties. That is why it is necessary to choose such classes in physical culture and sports, which would be organically combined with the main type of activity, and help to improve in the chosen art form.

To solve the tasks, it is necessary to determine the peculiarities of the functioning of the nervous system of future specialists in creative specialties. The most accessible way of determining the features of the nervous system is based on psychophysiological indicators: reaction speed in different testing conditions and the number of errors when passing these tests [13, 14]. These indicators reflect the mobility and stability of nervous processes. It is also important to determine the functional features of the cardiovascular system and the regulation of vascular tone [16, 17, 18, 19]. This is necessary to determine the impact of lack of physical activity on orthostatic regulation. Orthostatic regulation is a necessary condition for the quality work of a specialist in creative specialties, who, due to the peculiarities of their work, need to spend a lot of time in a standing position.

In our research, the following hypothesis was put forward: students - future teachers of creative specialties have peculiarities of psychophysiological functions and orthostatic reactions in comparison with students of other specialties of pedagogical universities.

Purpose: to reveal the peculiarities of the properties of the nervous system and the functional potential of the cardiovascular system of students - future teachers of fine arts and music and, based on the obtained data, to develop recommendations for physical education and sports.

Material and Methods

Participants

Students of H.S. Skovoroda Kharkiv National Pedagogical University took part in the study. The total number of students was 812. 24 of them were students of the Faculty of Arts. Future specialists in physical education and sports took part in the number of 25 people. Also, 88 future specialists - teachers of junior grades, 76 - future teachers of history, 130 - future teachers of mathematics, physics, biology disciplines took part in the study. Future foreign language specialists took part in the number of 131 students. 93 representatives of preschool education, 198 future Ukrainian language teachers, and 25 future sports coaches also took part in the study. 47 participants of the experiment were representatives of psychological and sociological specialties.

Research Design

The testing procedure was similar to that described in our previous studies [1, 2].

The method of determining the properties of the nervous system

The determination of the peculiarities of the work of the nervous system was carried out according to the author's psychophysiological testing program [1, 2, 13, 14]. We determined the speed of a simple reaction when you need to press the left mouse button on any picture that appears on the computer screen. The number of errors was also determined in this test. The speed of reaction and the number of errors in the test for a complex discrimination reaction were also determined. The choice of two elements from three options was assumed. Different pictures appeared alternately on the computer screen. If the picture had an image of a geometric shape, you had to press the left mouse button. If an image from the animal world appeared on the computer screen, you had to press the right mouse button. All other images were to be skipped without clicking. When determining the properties of the nervous system, we used the following provisions: the faster the student reacts to the object, the higher the mobility of the nervous system; the fewer mistakes he makes, the greater the stability of his nervous system [1, 2, 13, 14].

Determination of functional capabilities of the cardiovascular system and regulation of orthostatic functions

To determine the functional capabilities of the cardiovascular system, we used the heart rate indicator in the supine position. The lower this indicator was (up to 48-44 beats per minute), the more economically the heart works [6, 16, 19]. We also determined the frequency of heart contractions after the transition from a lying position to a standing position. The smaller this value was, the more developed the mechanism of vascular tone

regulation when changing the position [6, 17, 19].

Statistical analysis

First of all, we checked the samples for normal distribution according to standard methods [1, 2]. In our case, all samples obeyed a normal distribution ($p > 0.05$), and therefore we used parametric methods of processing the results (Student's test). We compared the results of the tests based on psychophysiological indicators and on indicators of orthostatic reactions of students of the Faculty of Arts and students of all other faculties of the Pedagogical University. We also compared students of the Faculty of Arts and students of the Faculty of Physical Education and Sports to identify the impact of sports on selected indicators.

Results

We found reliable differences in the results of the tests of students of the Faculty of Arts and all other faculties of the pedagogical university in only two indicators of psychophysiological functions: the time of a simple visual-motor reaction and the number of errors in the test for the time of a complex reaction to the selection of different images. Students of the Faculty of Arts have a significantly longer latent time of a simple visual-motor reaction ($p < 0.05$) and a significantly lower number of errors in the complex reaction time test (Table 1, Fig. 1, 2).

The speed of reaction characterizes the mobility of the nervous system. An increase in reaction time indicates a decrease in the mobility of nervous processes. Therefore, it can be noted that the students of the Faculty of Arts have a less mobile nervous system in comparison with students of other faculties. Also, the smaller number of errors in the reaction time test for choosing 2 elements out of 3 indicates greater stability of the nervous system of students of the Faculty of Arts in comparison with other faculties of the Pedagogical University.

It should be noted that in the processing of the results in the tests on the number of errors in the test of a complex reaction to the choice of two options out of three and in the orthostatic test, the data of the Faculty of Physical Education and Sports were not included. As we found in our previous studies [2], students of this faculty showed the lowest values of the measured indicators. We excluded them from the analysis in order to discover whether students in the Faculty of Arts differed from those in other non-sporting faculties. The same applies to the comparison of the results of orthostatic reactions (Table 1, Fig. 2).

According to all other indicators, no significant differences were found between the test results of students of the Faculty of Arts and students of all other faculties of the Pedagogical University ($p > 0.05$) (Table 1).

To determine the influence of sports on the

Table 1. Indicators of properties of the nervous system and functional capabilities of the cardiovascular system of students of the Faculty of Arts in comparison with students of other faculties

Indicators	Faculties*	N	\bar{x}	S	m	t	p
Reaction time without selecting images, ms	1	788	391.280	105.333	6.434	-2.218	0.027
	2	24	509.500	141.262	70.631		
Errors in the reaction time test without selecting images, number	1	788	2.338	5.673	0.347	0.207	0.836
	2	24	1.750	1.500	0.750		
Complex reaction time for choosing two options out of three, ms	1	788	515.059	140.775	8.816	0.107	0.915
	2	24	507.500	66.083	33.042		
Errors in the test for the time of a complex reaction to the choice of two options out of three, number	1	763**	7.954	11.066	0.841	6.382	0.000
	2	24	1.250	1.258	0.629		
Heart rate lying down, beats·min ⁻¹	1	763**	72.130	10.544	0.967	-0.354	0.724
	2	24	74.000	2.828	1.414		
Standing heart rate, beats·min ⁻¹	1	763**	89.540	12.817	1.175	-0.924	0.357
	2	24	95.500	5.508	2.754		
The difference between the heart rate standing and the heart rate lying down, beats·min ⁻¹	1	763**	17.310	11.032	1.011	-0.754	0.452
	2	24	21.500	5.745	2.872		

Notes. * 1 – all faculties that were studied; 2 - Faculty of Arts. ** Data from the faculty of physical education and sports were not included in the processing of the results in the tests for the number of errors in the test of a complex reaction to the choice of two options out of three and in the orthostatic test, since the students of this faculty showed the lowest values of the measured indicators

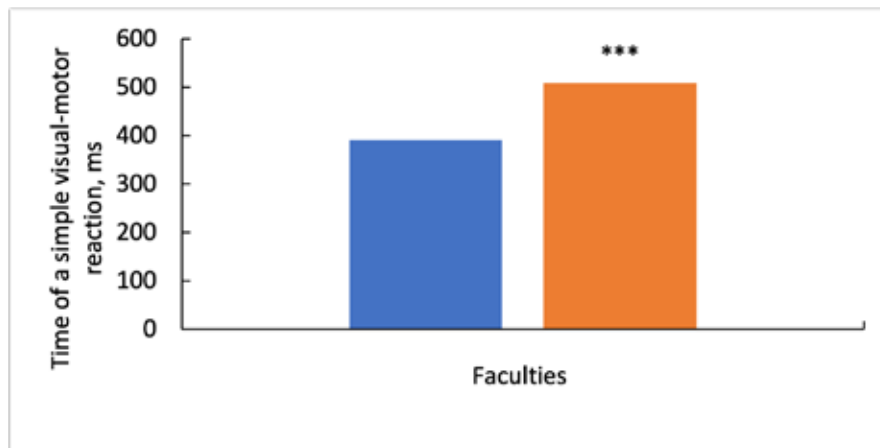


Figure 1. The value of the time of a simple visual-motor reaction in students of the Faculty of Arts in comparison with students of other faculties:

*** - differences are significant at $p < 0.001$

■ - all faculties; ■ - Faculty of Arts

indicators of psychophysiological functions and orthostatic reactions, we compared these indicators among students of the faculties of arts and physical education and sports. The presence of reliable discrepancies was found only for the indicators of orthostatic reactions (Table 2, Fig. 3). The frequency of heart contractions in the lying position is significantly higher in students of the Faculty of Arts compared to students of the Faculty of Physical Education and Sports. This indicator is equal to 62 bpm for students of the Faculty of Physical Education and Sports and 74 bpm for students of the

Faculty of Arts ($p < 0.05$) (Table 2, Fig. 3).

The same applies to the heart rate indicator in a standing position: this value is significantly higher in students of the Faculty of Arts compared to students of the Faculty of Physical Education and Sports ($p < 0.01$). The difference between heart rate in the standing position and in the lying position is also significantly higher in students of the Faculty of Arts compared to students of the Faculty of Physical Education and Sports ($p < 0.05$) (Table 2, Fig. 3).

The obtained data indicate that sports have a positive effect on the functional state of the

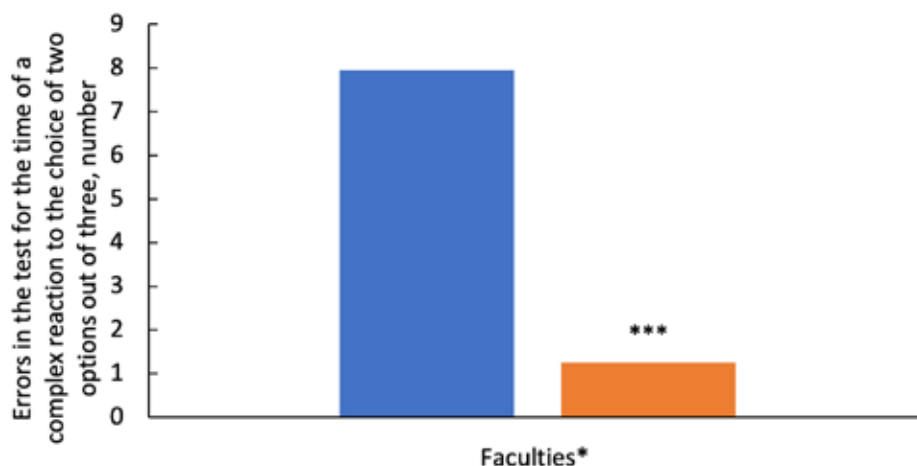


Figure 2. The number of errors in the test for the time of a complex reaction to the choice of two options out of three among students of the Faculty of Arts in comparison with students of other faculties:

* the data of the Faculty of Physical Education and Sports were not included in the processing of the results, since the students of this faculty showed the least number of errors in this test

*** - differences are significant at $p < 0.001$

 - all faculties;  - Faculty of Arts

Table 2. Indicators of properties of the nervous system and functional capabilities of the cardiovascular system of students of the faculties of arts and physical education and sports

Indicators	Faculties*	N	\bar{x}	S	m	t	p
Reaction time without selecting images, ms	1	25	403.750	152.450	76.225	-1.018	0.348
	2	24	509.500	141.262	70.631		
Errors in the reaction time test without selecting images, number	1	25	4.750	8.221	4.110	-0.434	0.680
	2	24	8.250	13.889	6.945		
Complex reaction time for choosing two options out of three, ms	1	25	519.750	72.006	36.003	0.251	0.810
	2	24	507.500	66.083	33.042		
Errors in the test for the time of a complex reaction to the choice of two options out of three, number	1	25	2.000	0.817	0.408	1.000	0.356
	2	24	1.250	1.258	0.629		
Heart rate lying down, beats·min ⁻¹	1	25	62.250	6.652	3.326	-3.251	0.017
	2	24	74.000	2.828	1.414		
Standing heart rate, beats·min ⁻¹	1	25	73.750	7.042	3.521	-4.866	0.003
	2	24	95.500	5.508	2.754		
The difference between the heart rate standing and the heart rate lying down, beats·min ⁻¹	1	25	11.500	3.786	1.893	-2.907	0.027
	2	24	21.500	5.745	2.872		

Note: * 1 – Faculty of Physical Education and Sports, 2 – Faculty of Arts

cardiovascular system and the regulation of vascular tone.

Discussion

The hypothesis, which was put forward in this study, was confirmed regarding the existence of peculiarities of the work of the nervous system according to the indicators of psychophysiological

functions of future teachers of creative specialties. It was found that their reaction speed is lower compared to representatives of other specialties. This indicates that the future specialists of creative specialties have lower mobility of nervous processes. At the same time, students of the faculty of arts have a significantly lower number of errors in the test for determining the reaction time of choosing 2

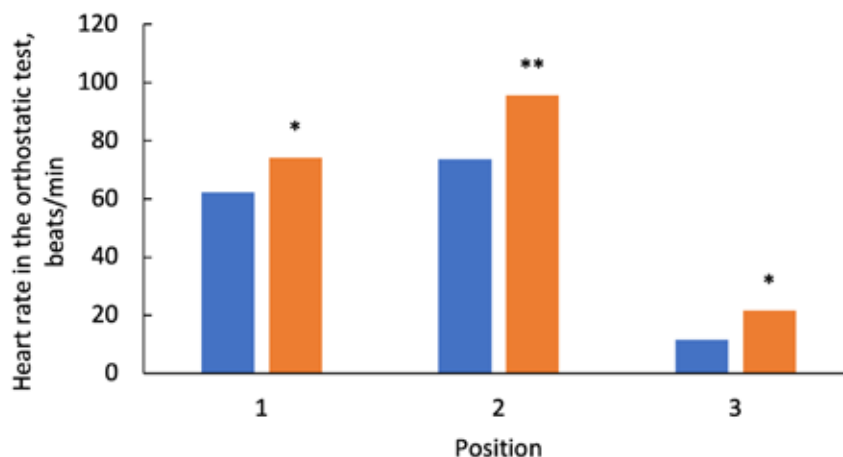


Figure 3. The value of heart rate in the orthostatic test of students of the Faculty of Arts in comparison with the Faculty of Physical Education and Sports: 1 – in the lying position, 2 – in the standing position, 3 – the difference in heart rate between the standing position and the lying position

* - differences are significant at $p < 0.05$

** - differences are significant at $p < 0.01$

■ - Faculty of Physical Education and Sports; ■ - Faculty of Arts

elements out of 3 compared to students of all other studied students - future teachers.

This indicates that future specialists in creative specialties have a higher stability of the nervous system compared to other future teachers [2, 13, 14]. Exceptions are made only by students of the Faculty of Physical Education and Sports. Their number of errors is the lowest among all the experimental students [1]. And this shows that the students of the Faculty of Physical Education and Sports have the greatest stability and strength of the nervous system. Among students of the faculty of arts, the number of errors in the choice reaction test is unreliably different from this indicator of students of the faculty of physical education and sports.

And therefore, we can conclude that students - future teachers of creative specialties are distinguished by low mobility of nervous processes combined with great stability of the nervous system. We can explain this fact by the fact that the specificity of the work of representatives of visual arts and music requires long-term concentration on the canvas they create, or on learning a certain piece of music, which can last several hours every day. Thus, the peculiarities of the nervous system of students of the Faculty of Arts are the ability to concentrate for a long time when it is necessary to do something without mistakes and not to switch attention to other matters. This is due to such properties of the nervous system as high stability (strength) and low mobility of nervous processes [1, 2, 13, 14]. We do not consider the question whether these features of the nervous system of creative

specialties' future teachers are hereditary or they are formed in the process of creative activity.

It is known that the properties of nervous systems are largely hereditary, but can be developed in a certain range [13, 14]. We can note that creative specialties are intuitively chosen by people who have hereditary prerequisites from the side of the properties of the nervous system. And the question arises: what physical exercises are most suitable for future specialists in creative specialties? We believe that the most rational will be exercises that also require a long-term moderate load. At the same time, physical exercises should bring satisfaction to future teachers of creative specialties. Walks and trips deserve special attention [20, 21]. After all, they correspond to the peculiarities of their nervous system, that is, they also require great stability. In addition, these exercises develop endurance, and, accordingly, the cardiovascular system - the main factor of health. During walks, you can observe the beauty of nature or the city. It is most suitable for representatives of creative specialties as appreciators of beauty. It should also be noted that in almost all types of sports and motor activity there are representatives with any properties of the nervous system. After all, the nervous system is capable of adaptation. That is why future teachers of creative specialties can engage in various types of aerobics [22], active and sports games, cycle sports, etc. [23]. Thus, future teachers of creative specialties can be recommended to engage in any kind of sport or motor activity, but the most suitable for them are exercises that require the

development of endurance in combination with the inclusion of cognitive processes and concentration: walks with observation of nature and the city, exercises performed under music, exercises with concentration on various natural images, etc.

Conclusions

1. Future teachers of creative specialties have reliably the lowest mobility in combination with the highest stability of nervous processes in comparison with representatives of other pedagogical specialties. These features of the nervous system of future teachers of creative specialties can be hereditary or formed in the process of creative activity. They determine the application of physical exercises, which are most suitable for future specialists in creative specialties.

2. Significant differences between the indicators of orthostatic reactions of students of the Faculty of Arts and the Faculty of Physical Education and Sports were revealed. Orthostatic regulation is significantly better in students of the Faculty of Physical Education and Sports.

3. It is necessary to adjust the program of physical education of students of creative specialties to increase the interest of students and to match physical exercises to the peculiarities of the nervous system of students of the Faculty of Arts. Future

teachers of creative specialties can be recommended to engage in any kind of sport or motor activity, but the most suitable for them are exercises that require the development of endurance in combination with the inclusion of cognitive processes and concentration: walks with observation of nature and the city, exercises performed to music, exercises with a concentration on various natural images, etc.

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Conflict of interest

The authors declare that there is no conflict of interest.

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