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Physical education of students with poor health

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ABSTRACT

Purpose: improving the performance of students with weak health by the means of fitness based on unit, person-centred, and systematic approaches. Materials and methods: students with weak health took part in the research (n = 460, age 18.0 ± 0.82 years). The experiment lasted for 9 months. With students of the control group (N1, n = 230 in which 150 are girls and 80 are boys) traditional lessons were held in accordance with the current programme of physical education. For the experimental group (N2, n = 230 in which 150 are girls and 80 are boys) blocks (module) in athletic gymnastics, water fitness, and aerobics were created with detailed competence. Electronic educational resources with video sets of special exercises were made and put into practice taking into account the underlying medical condition. Each unit contains goals and ways of achieving them. Person-centred approach included measuring physiological parameters. The systematic approach consisted of the organising of process of physical education with systematic monitoring of the functional state of the body. Results: by monitoring physical fitness by exercise testing, it was found out that all research subjects had improved their results. However, students in group N2 had achieved much higher figures than students in group N1. The noticeable increase in static, strength and coordination endurance was noted. Conclusion: the research has proven the efficiency of improving the process of physical education for students with weak health based on unit, personally oriented and systematic approaches.
Keywords: Educational approaches; Functional state of the body; Physical fitness; Monitoring of physical activity; Electronic educational resources.

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INTRODUCTION

In the recent years, a decent number of academic works concerning the realisation of physical education of students with weak health were created (Kondakov et al., 2016b; Skurikhina et al., 2016; Gorelov et al., 2013; Stepanova et al., 2015; Bogoeva, 2011; Zykov, 2012; Smirnova, 2006; Lyashenko, 2013; Bartnovskaya et al., 2014). According to the research data, 25-45% of students in Russia have health problems. Experts (Rumba, 2011; Kondakov, 2013; Ovsyannikova, 2015) state that the number of students who suffer from various physical development problems and have chronic illnesses have increased to 35-45%. The main reason of cardiovascular diseases at the student age is the decline in physical activity. It is followed with decrease of heart size, decline in stroke volume and minute blood volume, and increased pulse rate, decreased mass of circulating blood (Rumba, 2011). Ministry of Health of Russian Federation provides data which shows that, among many various diseases of students, the most common are cardiovascular diseases (30-60%). The next most common are musculoskeletal system disorders (25-40%), ophthalmological diseases (13-25%), diseases of the respiratory system etc.

Students of Plekhanov Russian University of Economics (Russia, Moscow), where the experiment was based, are, as a rule, the future workers in intellectual labour. Every year, scientific-and-technological advance increases the number of people performing intellectual labour. One of the defining features of intellectual labour is high tension of central nervous system (Nuzhdina & Sineva, 2008; Maksimov & Ivanova, 2011; Khimich, 2012; Bobko, 2007). As a result of the increase in the amount if intellectual labour, the time people spend on physical activity has declined dramatically. High nervous tension accompanied by low physical activity has quite a negative impact on a person's health, which means the same impact on the efficiency of his life and work performance. (Nuzhdina & Sineva, 2008).

Intellectual labour is often specific in its influence on the human body. (Bukhtiyarov & Matiukhin, 2014; Reznikov & Churin, 2016). For intellectual labour workers, the most typical working position is sitting at the table or in front of the computer. In this, as a rule, bent position with the head put forward, the blood is distributed to organs and tissue unevenly. The legs, bent in hip and knee joints, don't experience even natural physical activity for long periods of time. Many muscle groups are constantly in the state of static tension, especially head, neck, shoulder girdle, and body muscles. Consequently, problems in brain sustenance, and engorgements in the abdomen, pelvic cavity, legs and arms may appear. Moreover, working at the office desk with paper documents or in front of the screen, a person has to look at one object for a long time. This causes the exhaustion of motor muscles in the eyes. In the works of physiologists of labour, it is noted that possible dizziness for many people who perform intellectual labour are the result of low training of the vestibular system, which is the consequence of prolonged putting the head forward without moving (Kapustina, Yushkova & Matyukhin, 2018; Plekhanov, 2018). Hypokinesia worsens the state of the cardiovascular system. As it is commonly known, the brain needs significantly more oxygen to function than other organs. The state of heart and blood vessels is especially essential for intellectual labour workers. (Nuzhdina & Sineva, 2008; Maksimov & Ivanova, 2011).

Therefore, development of efficient approaches to improvement of physical education for students with weak health who are future workers of intellectual labour is important today.

Students with weak health are unable to learn the physical education programme that is typical for all students, and their lessons are based on special teaching methods. (Senter, Appelle & Behera, 2013; Titov, 2013; Kashmina, 2012; Bogoeva, 2011; Zykov, 2012; Smirnova, 2006; Lyashenko, 2013; Bartnovskaya et al., 2014). In the system of higher education of Russian Federation, these students are considered a part of

the special medical group. One of the most difficult problems in the organisation of process of physical education is that many students who have similar health disorders have quite significant differences in the functional state of their bodies and in the level of their physical ability (Adyrkhaev, 2016; Leo & Goodwin, 2016; Kotelevskiy, 2016).

The current situation is made worse by the lack of curricular and extra-curricular physical activities which meet the interests of students. Scientific research on improving physical education of students with weak health found out their preferences concerning the types of fitness-based physical activity (Stepanova et al., 2015; Vengerova et al., 2018; Egorycheva, 2014; Ponyrko, 2013). Along with this, the lack of health-improving fitness programmes was educed (Shutova et al., 2018).

MATERIAL AND METHODS

Participants

Students with weak health took part in the research (n = 460, age 18.0 ± 0.82 years). Students were divided into two equal groups: the control group (N1) and the experimental group (N2), with 150 girls and 80 boys in each group.

The experiment lasted for 9 months and was held in Plekhanov Russian University of Economics (Russia, Moscow). Each group of students with weak health took lessons in physical education 2 times a week, each lesson being 90 minutes long. With students in group N1, traditional lessons were held in accordance with the current physical education programme. Classes included walking, running, general development exercises, games, and monitoring of physical fitness for basic physical qualities.

The improvement of physical education in group N2 is based on modular, personality-oriented and systematic approaches. Blocks (module) were created taking in account the focus on development of professionally important physical qualities and the preferences of students: in athletic gymnastics, water fitness, and aerobics. Each block (module) lasted for three months. The blocks (module) included detailed competence and special exercises. Each lesson consisted of general exercised and personalised sets of exercises taking in account the underlying medical condition. In order to achieve this, with the help of students, electronic educational resources which made it possible to organise autonomous learning during curricular and extracurricular classes were made and put into practice (Bochkareva et al., 2018a).

Person-centred approach included measuring the physiological parameters and the level of physical fitness before and at the end of the experiment. The resting blood pressure and heart rate parameters were measured by participants at home, and the results were fixed in their self-assessment journals. The lung capacity was measured with a portable spirometer during lessons. The response to the load of the cardiovascular system was evaluated using a sample with squats. The squat test is one of the simplest tests. Before taking the test, the participants rest while standing without moving for 3 minutes, after which the heart rate is measured for 1 minute. Then perform 20 deep squats for 30 seconds from the initial position of the leg at shoulder width, hands along the body. When squatting, the hands are brought forward, and when straightening, they are returned to the original position. After performing squats, the heart rate is calculated for one minute. The evaluation determines the rate of heart rate increase after exercise as a percentage.

The increase in the heart rate:

- Up to 20% means an excellent circulatory response to physical exercise;
- From 21 to 40% – good response;

- From 41 to 65% – acceptable response;
- From 66 to 75% – poor response;
- From 76% and higher – very poor response.

For the assessment of static, strength and coordination endurance and monitoring their changes, additional exercise tests on the base of fitness were added: plank position, squats with a body bar, and throwing a stuffed ball (Table 1).

Table 1. Assessment of physical fitness according to additional exercise tests based on the means of fitness.

Type of exercise	Mark	Boys	Girls
Plank position (sec)	5	90	60
Assessment of static endurance.	4	70	50
	3	50	40
	2	40	30
	1	30	20
Squats with a body bar (girls 3 kg; boys 5 kg, number)	5	22	20
Assessment of strength endurance.	4	19	17
	3	17	15
	2	15	13
	1	12	10
Throwing a stuffed ball (a 2 kg ball, the number of	5	10	10
hitting the 50*50 cm target on the floor, distance from	4	8	8
the target is 5 m for boys and 4 m for girls).	3	6	6
Assessment of strength and coordination endurance.	2	4	4
	1	2	2

Autonomous physical activity for students in N2 group included prolonged walking. The number of steps made during the day was counted using fitness bands. The results were recorded daily in the self-assessment journals.

The systematic approach consisted of the organisation of process of physical education with systematic monitoring of functional status and physical fitness of the body.

Statistical analysis

To find out the significance of the results of the experiment the data was processed using the methods of mathematical statistics (Ivanov, 1990). The method of finding the significance of differences between average group results (the arithmetic mean, standard deviation, standard errors of the arithmetic mean) was applied with the usage of Student's t-test. The differences were considered significant with the level of significance $p < .05$. Statistical processing of the results was performed using the standard software package Microsoft Excel 2007.

RESULTS

Based on the test results, no significant differences in physiological parameters and physical fitness between students in groups N1 and N2 were found at the beginning of the experiment. It was learned that before the experiment, students in N1 and N2 had low lung capacity for girls (N1-1658 ± 117.4; N2-1663 ± 115.8 ml) and boys (N1-3494 ± 95.59; N2-3481 ± 97.23 ml). The resting heart rate parameters were on the edge of

normal for girls (N1-84.33 ± 4.51; N2-83.3 ± 5.25) and boys (N1-81.56 ± 1.95; N2-81.55 ± 2.04). The blood pressure parameters weren't very different from normal, both for girls (N1-117.1/77.1 ± 3.37/4.37; N2-118.7/76.6 ± 3.34/5.13) and boys (123/82.1 ± 4.3/5.32; 123.2/82.4 ± 3.82/4.96). The circulatory reaction to physical exercise was acceptable, but closer to the edge of poor (girls N1-63.35 ± 15.12 and N2-63.27 ± 14.8; boys N1-63.6 ± 11.7 and N2-63.9 ± 11.23). Low levels of static endurance (girls N1-47.1 ± 6.86 and N2-47.9 ± 6.98; boys N1-71.5 ± 0.71 and N2-71.38 ± 0.83), strength (girls N1-6.87 ± 1.46 and N2-6.89 ± 1.38; boys N1-7.25 ± 0.83 and N2-7.33 ± 1.08) and coordination endurance (girls N1-5.59 ± 1.83 and N2-5.76 ± 1.76; boys N1-6.36 ± 2.33 and N2-6.4 ± 1.96) were recorded.

At the end of the experiment all students demonstrated an improvement in the functional status and the physiological parameters. For example, the lung capacity parameter for girls in N1 has increased by 6%, and for girls in N2 it has increased by 18% ($p < .05$). For boys in N1 the lung capacity has increased by 1.25%, and for boys in N2 it has increased by 8.5% ($p < .05$). The circulatory reaction to physical activity hasn't changed significantly for group N1 (girls and boys). In group N2, the parameters for girls and boys have increased respectively by 48% and 47% ($p < .05$). The resting heart rate has decreased by 2.6% for girls in N1, for girls in N2 it has decreased by 1.6%. For boys in N1 the parameters haven't changed significantly, for boys in N2, they have decreased by 4.5%. The blood pressure parameters for both boys and girls stayed the same throughout the experiment. The results for heart rate and blood pressure haven't passed the significance test (Table 2).

Table 2. The parameters of functional status of students with weak health at the end of the experiment.

Parameter	**Sex**	**Control group (N1)**	**Experimental group (N2)**	**t**	**p**
		m1 ± m1	m2 ± m2		
ABP (mm Hg)	F	118.3/77.5 ± 1.25/3.7	119.7/78.3 ± 1.11/2.3	1.16/0.18	p > .05/p > .05
	M	121.2/81.2 ± 1.8/5.75	120.7/80.1 ± 2.0/4.76	0.18/0.148	p > .05/p > .05
LC (ml)	F	1767 ± 94.6	2043 ± 56.22	2.5	p < .05
	M	3538 ± 74.42	3806 ± 95.59	2.21	p < .05
Resting CR (bpm)	F	82.17 ± 3.44	81.91 ± 2.88	0.05	p > .05
	M	81.55 ± 2.04	78 ± 1.49	1.42	p > .05
Sit to stand test (%)	F	63.27 ± 6.8	42.77 ± 7.37	2.04	p < .05
	M	65.9 ± 7.23	43.48 ± 6.91	2.41	p < .05

The level of static endurance has increased by 13.2% for girls in N1, and by 29% for girls in N2 ($p < .05$). For boys in N1 it has increased by 26%, and for boys in N2 it has increased by 34.2%. The level of strength endurance has increased by 8% for girls in N1, and by 33% for girls in N2 ($p < .05$). For boys in N1 it has increased by 17%, and for boys in N2 it has increased by 47% ($p < .05$). The level of coordination endurance hasn't changed for girls in N1, and it has increased by 34% for girls in N2 ($p < .05$). For boys in N1 it slightly decreased, and for boys in N2 it has increased by 30% ($p < .05$) (Table 3).

Table 3. The results of physical fitness after the experiment.

Type of exercise	**Sex**	**Control group (N1)**	**Experimental group (N2)**	**t**	**p**
		m1 ± m1	m2 ± m2		
Plank position (sec)	F	54.3 ± 4.78	67.2 ± 2.01	2.48	p < .5
	M	96.5 ± 2.31	108.64 ± 1.13	4.7	p < .05
Squats (score)	F	7.43 ± 1.09	10.22 ± 0.7	2.15	p < .05
	M	8.75 ± 0.83	13.78 ± 1.49	2.958	p < .05
Throwing a stuffed ball (number)	F	5.23 ± 1.05	8.84 ± 0.7	2.86	p < .05
	M	5.05 ± 1.24	9.12 ± 1.43	2.176	p < .05

DISCUSSION

The research can be viewed as an addition to a list of scientific studies (Bartnovskaya et al., 2014; Egorycheva, 2014; Skurikhina et al., 2016) concerning the improvement of physical education for students with weak health.

The submitted material has a right to state that physical lessons involving the means of fitness based on unit, person-centred, and systematic approaches have a positive influence on students. It is clear that N2 have shown better results in most studied parameters than N1. Taking into account the preferences of students and the characteristics of studying and intellectual labour, blocks (module) from the system of fitness, fitness-sets which take into account the underlying medical condition and the specifics of labour were designed. Additional exercise tests which allowed to assess the level of development of professionally important physical qualities: static, strength, and coordination endurance, were included. Throughout the entire experiment, the assessment of physiological parameters and physical fitness, as well as counting the number of steps walked every day had been taking place. With the help of students, electronic educational resources in the format of sets of special physical exercises were created and put into practice. All the following components influenced the formation of the competence of students. A significant increase in learning motivation and an improvement in self-assessment culture had been noted. In the work of Carr et al. (2018) similar results were found, and it was shown that the involvement of students in new activities increases their motivation. The way of teaching in question was studied and proved to be effective in education and can therefore be considered by physical education professors (Gillette, 2017).

In the researches of Rumba (2011), Kondakov (2013), Bartnovskaya et al. (2014) the techniques of applying the means of recreational physical education in lessons for students in special study group should be noted. There was a rational approach to planning the contents and the organisation of learning and training process for physical education in a university. It is necessary to remember that the majority of the researches are focused on increasing of the efficiency of the learning process only. In our research, an accent was made on increasing the amount of physical activity during the day. Autonomous physical activity of students included prolonged walking with the counting of the number of steps (fitness bracelet). As the result of the research, it was proved that the teacher's control of autonomous physical activity can be effectively performed using a fitness bracelet. It lets the teacher control the received activity during a necessary period of time and motivates the owner to be more active.

In the works of Ovsyannikova (2015), Titov (2013) methods of using different types of recreational gymnastics in the process of physical education are demonstrated, but only for female students. However, the material and technical facilities and the organisation of the learning process in universities usually don't provide the possibility of forming study groups based on gender and physical ability. The method offered by the authors of this article allows to put girls and boys with different levels of physical fitness in one group.

The study of ways of correction of body posture for female university students by the means of recreational gymnastics (Ponyrko, 2013) is of interest. A sequence of dynamic and statodynamic exercises was explored with the aim of frontal posture correction. Bogoeva (2011) developed a process of physical education for students in the special medical group with cardiovascular system disorders with the application of respiratory exercises. Let's note that the percentage of students with various health disorders varies greatly. Therefore, grouping the students based on medical entity is difficult in the process of physical education in universities. The advantage of the method described by the authors of this article is in the ability to use it in physical education for students with weak health without grouping them based on their type of health disorder.

In the work of Kh. M. Lyashenko (2013), a differentiated approach to physical education for students in the special medical group is described, but only for students with cardiovascular diseases, especially for those with unstable arterial blood pressure. The experimental programme of physical education is characterised by:

- A higher amount of physical activity of aerobic type;
- Its gradual increase;
- Exercises performed on the treadmill or the ergometric bicycle with background music;
- Increase in the amount of exercises aimed at the development of strength endurance of the muscles of the shoulder girdle and the upper limbs;
- Increase in the amount of exercises aimed at the development of coordination skills;
- Inclusion of autogenic training at the end of the lesson.

The increase in the amount of exercises aimed at the development of strength endurance only for the muscles of the shoulder girdle and the upper limbs can be discussed. In the experiment described in this article, exercises with integrated effect are suggested.

In the work of Zykov (2012) about adaptive physical education in accordance with the type of adaptation to physical exercise, a new method is suggested. It is based on differentiated and personalised usage of ways and methods of lesson teaching. A positive influence of the programme on the functional and intellectual performance and physical fitness was demonstrated. Unit, person-centred and systematic approaches which were used in the experiment correspond well with the specific principles of adaptive physical education. Our research also includes the teacher's control over the autonomous physical activity of students with various health disorders.

The received data is interesting because it allows objective assessment of improving of physical education for students with weak health by the means of fitness based on unit, person-centred, and systematic approaches.

CONCLUSION

The research allowed to ensure a positive dynamic in the functional state of the students and in the results of the exercise tests based on fitness. Significant differences were found in the level of physical fitness, the lung capacity parameters, and the circulatory reaction to physical exercise. The unit approach optimised the applied means of physical education on the base of artistic athletic gymnastics, water fitness and aerobics. For each unit, goals and ways to achieve them were set. Electronic educational resources with video sets of special exercises taking in account the types of health disorders, personal level functional status and physical fitness were created at experimentally tested. Person-centred approach led to the increase of physical activity of the students throughout the day, and the method of step counting ensured it. The systematic approach ensured an optimal organisation and recreational character of the whole process of physical education.

CONFLICT OF INTEREST

Authors state that there is no conflict of interest.

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