Adaptation of students to distance learning during COVID-19 in terms of cardiovascular indicators

Anastasia Bashkireva¹, Tatyana Bashkireva¹, Alexander Morozov², Irina Osipenko³ and Natalia Abol'yanina⁴

¹Ryazan State University named after S.A. Yesenin, Svobody st., 46, 390000, Ryazan, Russia
²The Federal State Institution «Research Institute of the of the Federal penitentiary service of Russia», Narvskaya St., 15 A, b. 1, 125130, Moscow, Russia
³Smolensk state medical University, Krupskaya st., 28, 214019, Smolensk, Russia
⁴First Moscow state medical University named after I.M. Sechenov, Trubetskaya st., 8, b. 2, 119991, Moscow, Russia

E-mail: bashkireva32@gmail.com

Abstract. The spread and danger of coronavirus infection for public health led to the transition of educational organizations to distance learning. The article presents the results of studying the adaptation of the cardiovascular system of students to distance learning during the period of COVID-19. To determine the capabilities of bodies to the conditions of distance learning using ICT, we used the Belgian test. The results of the study showed that the health level of boys is undesirable, while that of girls is average.

1. Introduction

The world community connection with the pandemic that has gripped all countries of the world, the rapidly spreading and actively mutating coronavirus infection, has forced humanity to look differently at all its activities. Forced self-isolation has divided the life of society into two periods: before and after the pandemic [1]. Scientists, doctors, politicians emphasize that humanity will not return to the life that was before the pandemic covid-19. Foreign researchers called this stage of life «the era of the COVID-19 pandemic». Education also entered this era. We talked a lot about the need to integrate digital learning into the traditional education system. They argued about its dangers and benefits. In December 2019, the dispute resolved by the outbreak in China (COVID-19) and covering all countries of the world.

Due to the rapid spread and danger of coronavirus infection for public health, schools and universities have switched to distance learning [2]. In Russia, this transition took place on March 16, 2020. Participants of the global educational space faced the problems of homeschooling of students remotely and were actively involved in the search for their solutions. Working students and schoolchildren at home have become a challenge for universities and schools. Besides, many educational institutions lacked the infrastructure or resources to provide online learning [3, 4]. The question is about students who do not have access to laptops and the Internet at home. Can you teach hands-on, labs, music and art courses online? What will happen to those whose courses cannot teach online? The quality of online education is becoming a critical issue and requires due attention [5, 6].
The phenomenon of online learning remotely emerged during the crisis caused by the outbreak of COVID-19. Many schools have converted pupils to virtual learning as their primary tool for continuing education for the remainder of the school year. Previously, it revealed that teachers have a negative attitude toward online learning. They reject it because of the difficulties and challenges they face, especially the low technical availability for training [2].

The methods that teachers use traditionally, structuring teaching, do not allow them to implement in practice the transfer of knowledge to students [7]. However, given the constraints that teachers and students have faced in connection with the closure of schools, teachers had no choice but to use already known methodologies [8]. Without the possibility of personal learning, providing education has become more difficult. However, educators are now using materials focused on virtual learning, learning management systems and communication infrastructure.

We currently live in a world where Internet access is a basic need. Access to a computer is just as necessary to learning as having paper, pens and books. Teaching and learning processes adapted to the learning environment [9].

The growth of networks and the development of virtual settings, coupled with video conferencing, has created a continuous space in which pupils and teachers, students and teachers meet and work with conventional learning resources. Besides, these virtual settings seek to encourage and develop social interaction, presenting away can be designed collaborative learning patterns between teachers and students.

The need for professional development for the use and management of student information and communication technologies (ICT) education emphasized. We can look at this topic from different points of view. Such prospects include the exchange of best practices, investment in infrastructure, equipment and curriculum development to improve skills and encourage positive student attitudes towards ICT’s.

During the period of distance learning, teachers, who understand that there will be no return to traditional and pre-pandemic education, have accumulated positive and interestingly experience of working in a distance mode. They are ready to move to a new format of knowledge transfer and share their experience today, in the up-to-date conditions of using ICT. However, it should also emphasize that, unfortunately, the effectiveness of the development of digital education still constrained by the low quality of Internet resources associated with the speed and power of digital information transmission [10].

However, one of the most considerable problems is the need to study the health and adaptation of the body of participants in the educational process in the context of distance learning [11, 12, 13]. The optical analyzer and the cardiovascular system that most sensitive to the effects of information teaching aids.

Since when working at a computer, there is, a sharp decrease in motor activity and hypodynamia occurs with all the ensuing consequences for health [14]. The flickering screen irritates the retina of the eye, tearfulness, pain, which negatively affects the visual analyzer, the effect of which not yet traceable. It is since there are no instrumental techniques to detect the negative impact of a monitor screen glowing for a long time on the visual analyzer. We understand that it harms, but it is not yet possible to measure it.

Scientifically based methods for studying the state of the cardiovascular system, including tests, exist and must to recommend for use [13, 15-18].

2. Materials and method
During the period of self-isolation, students taught remotely. How did the body of students adapt to the conditions of distance learning using ICT at the level of physiological indicators? It was interesting to know the students' opinion on this form of education. What difficulties did they face?

The study used the well-known Belgian test "Reaction of the cardiovascular system to load in the form of torso bending." This test is easy and convenient to conduct research does not take much time. Exercises are available to perform and include torso bends with the arms down and the torso up. Such a
change in body position causes a corresponding change in the flow of blood to the heart the pulse increases. The faster the pulse restored by the methodology, the higher the level of adaptation, despite the low level of physical activity, for example, during prolonged work at the computer.

The research took place within a month, from the moment of entering distance learning (from March to April). Students took the readings four times during the day (8.00; 12.00: 16.00; 21 hours).

Students of 3-4 courses (n = 25, boys - 11, girls - 14) at the age of 20-22, studying in various areas of training, were examined.

The article presents the average indicators of the reaction of the cardiovascular system of students.

3. Results and discussion

The study of parameters of the cardiovascular system was a three-week cycle (20 ± 3 days).

At first (R² = 0.8; P <0.001) and third (R² = 0.69; P <0.01) weeks, the girls showed significant synchronization of the state of the cardiovascular system according to the Belgian test (figure 1).

![Figure 1. Belgian cardiovascular test scores in girls (weeks 1 to 3) amid the COVID-19 pandemic and distance learning (April 2020).](image)

Note: Case - adaptation cost (1-3); Var - measurements (1-3 weeks).

The learning process proceeded most favourably in the second week (in the middle of the month) of the survey. Overstrain of functional systems detected in 7.1% of the examined. During the study, the girls studied at the computer for 66.9 hours. Individual indicators of computer work ranged from one hour to 10 hours.

In young men, the indicators of the cardiovascular system corresponded, according to the method, to the undesirable result. The significant stress of the cardiovascular system during the training period was a note in the first week and gradually decreased to the average by the third week (figure 2).

During the study, the young men did more work at the computer than the girls did, and in total, it was 100 hours. Individual indicators ranged from five to seven hours.

It is interesting to note that young men, in addition to studying, also actively participated as volunteers: they bought and delivered food to the elderly.

The girls tried to organize rationally their learning process at a distance. One student-written: «Throughout the days, I observed a tendency for the heart rate to rise from the beginning of the day to the end. On average, the state of the cardiovascular system is satisfactory (average). On average, the state of the cardiovascular system is satisfactory (average). The highest rates were on the days when I spent 10 to 15 hours at the computer. The lowest rates were on the day of rest and on days when the
number of hours at the computer did not exceed 8 hours. The level of health (HZ) in conditions of
distance education did not have changed. I have seen an improvement when comparing the score (1.6)
I measured under training conditions. It may be because good home conditions, nutrition, work and rest
hours have improved. There was more time for an active lifestyle: I did exercises, did various physical
activities, and often walked outside. With traditional training, you had to get up early. There was no
time for exercise and breakfast. I spent much time on the road. I got tired after my studies».

![Figure 2. Belgian cardiovascular test scores in boys (weeks 1 to 3) in the context of the
COVID-19 pandemic and distance learning (April 2020).](image)

Among the problems of distance learning, students indicated difficulties in finding and analyzing
information, communicative dissatisfaction, and the need for approval.

4. Conclusion
Thus, a study conducted over three weeks revealed the levels of adaptation of students in the context of
self-isolation of the COVID-19 pandemic to distance learning. In young men, the health level of the
cardiovascular system corresponded to the undesirable level in the first week and the average level by
the end of the third week. Throughout the entire study period, the health level of girls responded to the
mesial level. It is necessary to note that young men actively participated in the social life of society,
providing volunteer assistance to those in need during the period of dynamic growth of the coronavirus
infection. Students noted that they had trouble in organizing an individual style of learning activity in
distance learning conditions. The time they determined for independent work using information and
communication technologies not effective. During the period of study of students at the university,
attention paid to supporting the individual style of activity and its formation both in traditional and
distance learning.

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