



Psychophysical Indicators of Schoolchildren in the Information School

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Abstract

Introduction: Informatization of modern society is an objective reality and has a significant impact on all areas of society, including the health and organization of the educational process. Numerous researchers note that with the spread of digital technologies, social shifts are occurring, including the deterioration of children's health.

Informatization of education becomes an independent condition of the learning and cognitive process and causes the transformation of the structure of education, changing its content, the introduction of new technologies and leads to a change in the intensity of educational work.

The purpose of the study is to establish the effect of the informatization of modern society on the process of teaching children at school using the method of assessing the "intensity of educational workload".

Methods: The intensity of the educational work of elementary schoolchildren was studied during the experiment to introduce the standards of the new generation (2011-2013), as well as students of 5-10 specialized secondary schools in the following subjects: Russian language, literature, mathematics, history, geography, foreign language (2014-2015). The intensity of educational work was studied in accordance with the method developed by the authors according to the following criteria: regime and monotony of educational work, intellectual, emotional and sensory loads. Were also studied intellectual development and mental performance in conditions of varying intensity of educational work, indicators of hyperactivity of children.

Results: It is revealed that educational work in the conditions of informatization with innovative forms of education can be attributed to the 3rd class of tension. Prolonged academic stress in this class of intense academic work negatively affects the intellectual development and mental performance of children. As a result, the number of hyperactive children increases (this trend is more pronounced in the group of boys).

Conclusion: Prolonged tension of the regulatory systems of the child's body leads to a decrease in intellectual development and mental performance. The increase in the number of hyperactive children can be associated with the intensification and informatization of modern education. Also revealed features of the intensity of educational work in specialized classes of secondary school.

Keywords: Schoolchildren; Intensity of Educational Work; Informatization of Education; Intensification of Education; Intellectual Development; Efficiency

Introduction

Informatization of modern society is an objective reality and has a significant impact on all areas of society [1], including health and organization of the educational process. Some authors believe that the biological evolution of humanity has ceased with the separation of man from nature, and at the moment humanity obeys social, not biological, laws. Informatization of education becomes an independent condition of the learning and cognitive process and causes the transformation of the structure of education, changing its content, the introduction of new technologies and leads to a change in the intensity of educational work [2,3].

The study of the intensity of academic work, its influence on the formation of health and the development of the intellectual potential of schoolchildren is a key issue. Of particular importance to this issue is the rapid deterioration in the health of modern schoolchildren in various countries [3,4]. Today in Russia, only 10% of students are considered healthy, 50% have disabilities in their health, and 40% have chronic diseases [5]. The health level of students has declined over the past decades, as confirmed by official medical statistics and research in the field of hygiene of children and teenagers [6,7]. An increase in the frequency of so-called "school diseases" has been noted: impaired formation of the musculoskeletal system, blurred vision, impaired digestive function, functional disorders of the central, autonomic and cardiovascular systems [8,9].

The research of the Institute of Age Physiology identifies priority factors of school risk: stressful pedagogical tactics, intensification of the educational process, the discrepancy between curricula and psychophysiological features of a child's body has been reported [10].

Legislatively approved requirements for the conditions of the organization of the educational process (p. 28 of the Federal Law No. 52-FZ "On the sanitary and epidemiological well-being of the population") do not take into account the features of the organization of the process of obtaining, processing, using and transmitting new knowledge in children.

Problem Statement

The authors developed a method of hygienic assessment of the intensity of educational work in order to understand the essence

of the phenomena that occur when the factors of the educational process influence the health of children [11].

The intensity of educational work determines the characteristics of the educational process, which reflects the load mainly on the central nervous system, the sensory organs and the emotional sphere of the child according to the criteria: intellectual, sensory, emotional loads, degree of monotony of loads, regime of operation [11].

The method of studying the intensity of educational work made it possible to compare the influence of various pedagogical technologies and innovative forms of education on children's health. The results of the assessment can be useful to substantiate targeted recommendations for improving the conditions of the organization of the educational process, which is necessary in the conditions of informatization and intensification of modern education.

Research statement

An important criterion for the organization of the educational process is its hygienic assessment. To develop recommendations for the introduction of health-friendly educational methods and technologies, a study was conducted on the intensity of students' academic work.

In this study, we studied the intensity of the educational work of primary schoolchildren during the experiment to introduce the standards of the new generation (2011-2013). This made it possible to compare the intensity of academic work in the innovative school (working according to the new standard) and the traditional school (using the methods of the traditional system of education). At this stage of the study, the methodology revealed the main problems in shaping the health of children during the period of changing of paradigms of education.

Further study (2014-2015) of academic labor was conducted in specialized secondary school classes in the following subjects: Russian language, literature, mathematics, history, geography, and a foreign language in grades 5-10.

Purpose of the Study

The purpose of the study is to establish the effect of the informatization of modern society on the process of teaching children at

school using the method of assessing the «intensity of educational workload.

Research methods

The studies were conducted in primary classes (1-3 year of study) and in the classes of the middle and upper levels of education.

In primary school, 465 children aged 7-10 were examined. The traditional school (1 group of students) amounted to 141 children and the innovative school (2 group of students) - was a total of 324 children. The studies were conducted with between 2011 and 2013.

The study of labor intensity among students in grades 5-10 was conducted in specialized classes in the following subjects: Russian, literature, mathematics, history, geography, and a foreign language. Examined - 820 children 11-17 years.

The intensity of academic work was investigated by means of observation, the timing of study time and questioning. The assessment was based on the study of the educational activities of the child and its structure.

Intellectual development of younger students was assessed using the Raven test. Diagnosis of hyperactivity syndrome was carried out using the rating scale on hyperactivity [11], by interviewing parents and teachers, observing the daily routine and the nature and behavior of schoolchildren. The mental performance of children was studied using V.Y. Anfimova.

From the medical record of the child (f. No. 26 00) the average annual sickness rate was copied. Parents of the examined children confirmed their consent to the study. The results were communicated to the parents. The research protocol was approved by the decisions of the ethics committee of the East-Siberian Institute for Medical and Ecological Research.

Statistical processing of the results was carried out using the program Statistica Base 10 for Windows Ru. Statistical processing was carried out according to standard indicators of the arithmetic average (M). The results of the study were verified using the error of the arithmetic mean (m) and standard deviation (S). The indicators were analyzed for normality. The significance of the indica-

tors was checked using t-test for differences in quantitative traits with a normal distribution. In this case, the confidence interval was adopted more than 95%. With an abnormal distribution of the variation series, the statistical significance of the differences was determined using the Mann-Whitney test. The χ^2 criteria were used to assess the significance of differences in the study of qualitative traits. To assess the relationship between the two variables, the Spearman correlation coefficient was used. The critical level of significance of statistical hypotheses was assumed to be 0.05.

Findings

Statistically significant intensity of academic work in the innovative school was higher in the following indicators: regime of operation, sensory, intellectual loads and emotional loads ($p < 0.05$). Next, we analyzed the classes of tension of educational work. It was revealed that the class of intensity of educational work was higher in children who were engaged in thematic circles of additional education or using information systems and gadgets when performing homework.

In the innovative school, the indicator of the intensity of academic work showed the third class of tension in terms of monotony, intellectual exertion, and also the regime of the educational process. Emotional and sensory loads in the innovative school identified the 2nd grade of educational work intensity. The overall level of tension in school of innovation was classified as 3rd grade. The intensity of academic work in a traditional school was defined as 2nd grade.

The features of the intensity of educational work in specialized classes of secondary school are revealed. According to the indicators of monotony of studies and sensory loads, the density of informational messages reached maximum values in the lessons: 10th grade - Russian language; 9th grade - math and history; 5th grade - Russian language, history and geography; in the 6th grade - in geography; in the 7th, in geography and Russian language; 8th grade - history and geography; The highest values of the loads corresponded to class 2 of the intensity of educational work.

The load on the hearing aid was greatest in literature, history, and geography for 5th graders; at the lessons of literature, geography, foreign language for 6th graders; at the lessons of literature and foreign language for 7th graders; in literature, history and geogra-

phy classes for 8th and 9th grades; on geography, literature and Russian language for 10th grade.

During the lessons of geography, literature, and history in 5-10 classes, the load on the hearing organs was almost 2 times higher than on the glottis. Duration of concentration (in minutes) increased from middle classes to senior ones in the following subjects: literature ($7.0 \pm 1.1 - 21.7 \pm 2.4$), Russian language ($5.0 \pm 1.9 - 10.7 \pm 1.3$), mathematics ($3.2 \pm 1.9 - 12.2 \pm 1.5$), history ($15.5 \pm 3.5 - 19.7 \pm 3.9$), geography ($19.5 \pm 6, 5 - 27.3 \pm 4.6$), foreign language ($6.7 \pm 2.4 - 17.0 \pm 1.8$). The greatest number of simultaneously observable learning objects is marked on the lessons of history, geography, and a foreign language.

Based on the greater sensitivity of children in primary school, their psychophysical features were investigated depending on the intensity of educational workload. The mental performance of children (in terms of productivity) did not have statistically significant differences, while the number of scanned lines and the number of errors in an innovative school were twice as high, indicating an increase in speed and a decrease in the quality of information processing.

The average level of intelligence in the innovative school was in 85.7% of children, in traditional school in 89.9% of children. Intellect below average is found in 10.1% of students in a traditional school. In an innovative school, 14.3% of children had lower than average intelligence. Gender and age differences of intelligence in children were not in this study. Children with an average level of intelligence among girls made up 89.6% of the traditional school. Among the boys of the traditional school, 90.3% of boys with an average level of intelligence were identified. The same level of intelligence in the innovative school was noted in 85.1% of girls and 86.1% of boys.

Children of the traditional school performed more tasks in the Raven test than children of the innovative school: $30.1 \pm 0.65\%$ (innovative) and $35.2 \pm 0.65\%$ (traditional) ($p < 0.05$). An examination of the Raven test in series showed statistically significant differences in series A and B.

Indicators of series A of the Raven test, which reveal the "principle of interrelation in the structure of matrices" and depend on the level of attentiveness, imagination and level of visual difference

in children in a traditional school - these indicators were statistically higher than in children in an innovative school ($8.1 \pm 0, 5$ vs. 5.6 ± 0.4 ; $p < 0.05$), which indicates a higher level of attention and visual difference.

When interviewing and quizzing parents, attention deficit disorder was higher in the innovation school (especially among boys). There were no statistically significant differences between the groups. Teachers in the survey also noted a greater number of children with hyperactivity syndrome in the innovative school. Significant differences were observed among girls and amounted to 8.09 points - among girls of the innovative school and 5.4 points among girls of the traditional school and ($p < 0.05$).

Assessment of the intensity of the educational process according to the "regime of the day" revealed in: Grades 5-8 - permissible level of tension (Grade 2); at 9-10 - hard work of 1 degree. Additional education significantly increased the intensity of academic work. The situation was worsened by improper scheduling, insufficient duration of breaks or their lack of learning process.

Conclusion

Studies have shown that the overall indicator of the intensity of academic work in an innovative school is significantly higher and amounted to 2.5 ± 0.1 . The traditional school is characterized by a lower overall indicator of academic work intensity (1.7 ± 0.1). It is shown that the significant factors of educational activity intensity are the regime of operation and intellectual loads [11]. This is most relevant for the innovation school, where the intensity of learning activities is attributed to the 3rd class. It is also proved that an increase in the intensity of academic labor does not contribute to the intellectual development of children.

Intensification of education leads to chronic stress during mental stress, which leads to the activation of the sympathoadrenal element of the autonomic nervous system and causes a functional strain of the cardiovascular system, which depletes the body's reserve abilities to learn [12]. Prolonged tension of the regulatory systems of the child's body reduces intellectual development and mental performance. The intensification and informatization of modern education leads to an increase in the number of hyperactive children.

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