Advances in Economics, Business and Management Research, volume 156
2nd International Scientific and Practical Conference on Digital Economy (ISCDE 2020)

Conditions for Digitalization of Education and Related Health Problems of Students

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ABSTRACT
The article deals with the problems of the influence of mastering digitalization on the health of student youth in terms of spectral analysis using the method of heart rate variability. The study used the heart rate variability method. Measurements filmed in the classroom for 180 minutes. The results of the study found that with low muscle mobility and prolonged work in the digital space, hypodynamia occurs, which negatively affects the cardiorespiratory system of students. In this regard, it is necessary to develop guidelines and sanitary and hygienic standards for a productive educational process that is safe for health in the traditional conditions of mastering digital competencies.
Keywords: *digital competence, health, heart rate variability, digital divide, information and communication technology*

1. INTRODUCTION

Currently, the world has entered the era of "digitalization", which has affected all spheres of human life: from education to production [4]. The world began ruled by digital media, which people of different ages have yet to master. Some speciality replaced by new professions, the name of which humanity is just coming up [2].
Are the evolutionary mechanisms of adaptation of the human body ready to cope with the speed of numbers? How does the frequency of high-speed digital flickers affect the retina and human health in general? How will new technologies affect human health? Scientific and technological progress is rapidly developing, involving a person in it, but few people think about the need to study the capabilities of the human body to master them [3]. More and more, the question arises about the development of new sanitary and hygienic standards for professions. The question of professional selection arises.
As a result, it becomes necessary to develop methods of prenosological control in professional activity, as a condition for biological, socio-psychological adaptation that ensures human vitality, professional health and longevity, which has not yet sufficiently studied in the modern changing world from the position of an integrated approach and the principle of fractal determinism.
We rarely think about what price the human body pays for the rapid introduction of scientific and technological progress into our lives [5;7].
For example, a visual analyzer forced to accept such an amount of flickering frequency of colour information to which it is not yet adapted [6]. We already know about the unfavourable effects of the working monitor screen on vision, especially in children [9]. Physical inactivity develops. What else?
The purpose of our work is the necessity to study the mental state of a person who has been in conditions of information search for a long time in the development of digital competence [8]. For this, we used the indicators of the spectral analysis of the cardiorespiratory system.
We study the state of health of students in the traditional conditions of completing assignments online using Internet resources [10]. The essence of the work lies in the formation of digital competence through the solution of the following tasks [1]:

- completing assignments, students must develop the skill of critical analysis of information received from Internet resources;
- the analyzed knowledge should contribute to personal, intellectual and professional self-development.

2. METHOD

Certainly, that the cardiorespiratory system is the first to respond to any Exo- and endogenous influences exploration of the indicators of the cardiorespiratory system carried out in a state of physical rest with active mental work using information and communication technologies [11; 14].

We studied the health of students with using the method of heart rate variability. We are interested in spectral analysis or slow hemodynamic vibration analysis (PCA).
According to the literature data, the frequency ranges have a specific physiological content: HF - vago-insular, and LF - the sympathetic branch of the baroreceptive reflex, VLF - the response of the neurohumoral system to the stimulus; ULF is a subcortical response to a stimulus, as studies show, actively participating in the cognition process [13]. In our exploration, we established that the above HRV indicators are biological markers that affect human behaviour and adaptive responses [12].
In the research, we used the hardware-software complex "Varicard 6.0" in the statistical processing "ISCIM". Figures and statistical processing performed in the Statistica program.
It studied the parameters of the activity of the parasympathetic (RMSSD) and sympathetic (SDNN) links of the autonomic regulation of the circulatory system; the power of spectra of frequency ranges (HF, LF; VLF, ULF), having a lognormal distribution [15].
We investigate boys and girls (n = 57, boys - 27, girls - 30) who carried out active mental work on assignment for 180 minutes of continuous online and traditional training.

3. RESULTS AND DISCUSSION

The results of the study showed that the vegetative status of young men characterized by general vagotonia. The heart rate controlled by the dominance of the vago-insular (HF) branch of the baroreceptive reflex (t = 0.83; P, 0.001). During 180 minutes of work in digital space, young men have difficulty breathing, sweating, rumbling in the abdomen, which they felt like a reaction to hunger, a feeling of thirst, darkening of the eyes, fatigue, and a desire to take a break. These signs correspond to a vago-insular crisis. Observations of the condition of young men during the long-term work on the development of digital competencies online revealed signs of a vagoinsular attack. The feature of vegetative-vascular dystonia found in 42%.
In our study, we found that the vegetative status in girls characterized by partial sympathicotonia. The heart rate controlled by the dominance of the sympathetic LF branch of the baroreceptive reflex (t = 0.87; P <0.001). During classes in conditions of prolonged exposure to the digital space, the girls showed increased excitability, anxiety due to the search for the correct information. After classes, complaints of headache and polyuria noted. Blood pressure above normal found in 13.6% - below normal, girls, 36.4% - tachycardia. Figure 1-2 shows the individual indicators of heart rate variability in a boy and a girl in the classroom in terms of mastering digitalization.

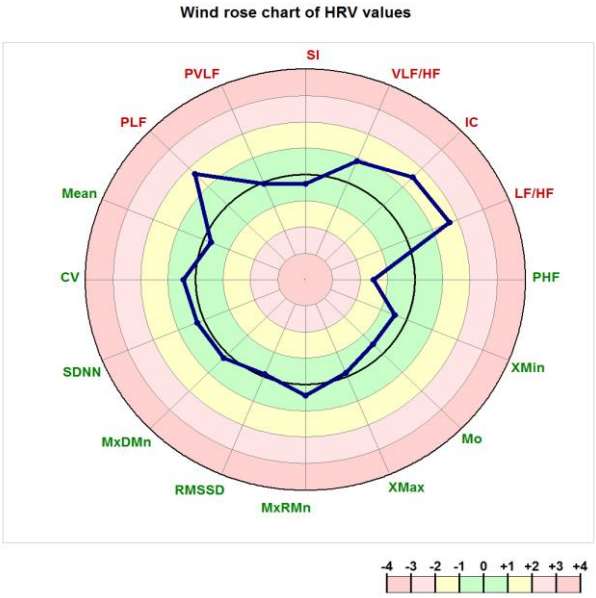

Figure 1 An example of individual indicators of heart rate variability in a young man in class under digitalization conditions

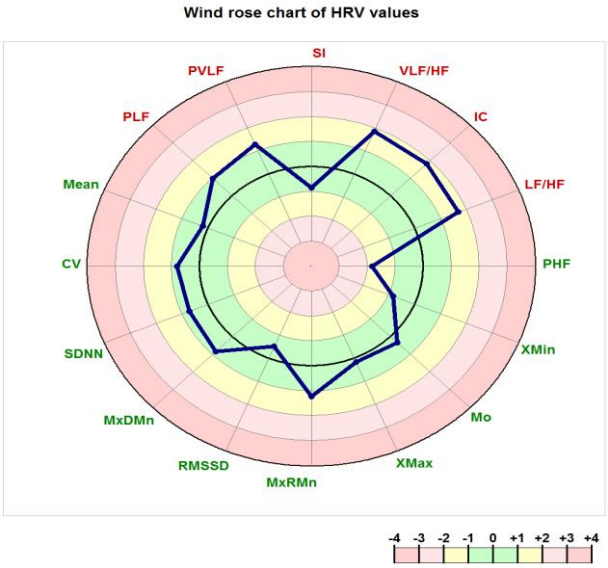

Figure 2 An example of individual indicators of heart rate variability in a girl in class under digitalization conditions

Some researchers think that there is an interrelationship between cognitive processes and emotional states in the development of technical skills in information and communication technologies. We carried out a correlation analysis between the spectral indices VLF and ULF (Fig. 3).

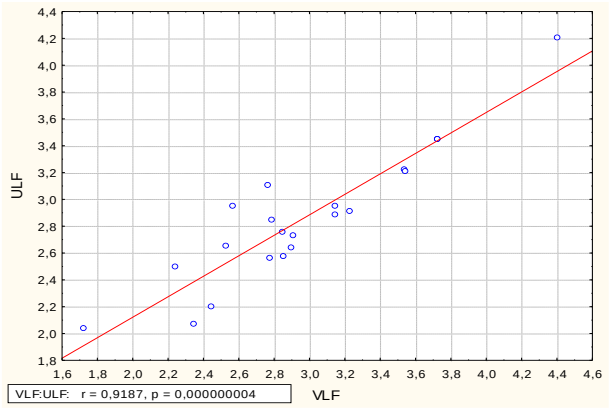

Figure 3 The relationship between VLF and ULF among students (in terms of digital competence formation)

In our exploration, a reliably high relationship established between the VLF and ULF data (t = 0.92; P <0.001), which confirms the literature data on the participation of emotions in cognitive activity by the example of mastering digital competencies. The higher the level of emotion, the higher the level of gnostic action. The price of such gnostic occupation depends on individual characteristics, human health and the capabilities of his body.

4. CONCLUSION

The results we received allow us to assert that working at a computer using Internet resources for 180 minutes in traditional learning conditions negatively affects the cardi-respiratory system of students. In an up-to-date condition of mastering the technical skills of lease information and communication technologies, the surveyed established the relationship between cognitive processes and emotional states. The assimilation of digital technologies accompanied by the influence of emotions on cognition. The boys had general vagotonia, and the girls had partial sympathicotonia. Mastering professional and educational digitalization depends on the individual characteristics of the human body and gender differences. Our research shows that a long time of active mental work at a computer using modern digital technologies leads to a breakdown of adaptation systems and harms the functional state of students.
Particular attention devotes to the age and characteristics of the students. They are already intensively involved in the digital space at school. Mastering digitalization in traditional learning conditions requires the development of methodological recommendations and sanitary and hygienic standards that regulate the time of working at a computer that is safe for the health of students.

REFERENCES

[1] F. Cahen, F. Mendes Borini, International Digital Competence, J. of Int. Management, 26(1) (2020) 100691. DOI: https://doi.org/10.1016/j.intman.2019.100691

[2] L.M. Brevik. G.B. Gudmundsdottir, A. Lund, T.A. Strømme, Transformative agency in teacher education: Fostering professional digital competence. Teaching and Teacher Education, 86 (2019) 102875. DOI: 10.1016/j.tate.2019.07.005

[3] N.E. Coviello, The network dynamics of international new ventures, J. Int. Bus. Stud. 37(5) (2006) 713731.

[4] McKinsey Global Institute, Digital Globalization: The New Era of Global Flows. MGI, New York, 2016. https://www.mckinsey.com/business-functions/ digital-mckinsey/our-insights/digital-globalization-the-new-era-of-global-flows.

[5] A. Hidalgo, S. Gabaly, Gustavo Morales-Alonso, Alberto Urueña, The digital divide in light of sustainable development: An approach through advanced machine learning techniques. Technological Forecasting and Social Change, 150 (2020) 119754.

[6] J. Castaño-Muñoz, J.M. Duart, T. Sancho-Vinuesa, The internet in face-to-face higher education: can interactive learning improve academic achievement? Br. J. Educ. Technol. 45(1) (2014) 149-159.

[7] A. Scheerder, A.J. van Deursen, J.A. van Dijk, Determinants of Internet skills, uses and outcomes. A systematic review of the second-and third-level digital divide, Telemat. Inform. 34(8) (2017) 1607-1624.

[8] H. Santos, J. Batista, R. Pedro Marques, Digital transformation in higher education: the use of communication technologies by students. Procedia Computer Science, 164 (2019) 123-130.

[9] V. Moreno, F. Cavazotte, I. Alves, Explaining university students' effective use of e-learning platforms, Br. J. Educ. Technol. 48(4) (2017) 995-1009.

[10] B.de K. Björn, R. Gertjan, F. Paas, Effects of spatial distance on the effectiveness of mental and physical integration strategies in learning from splitattention examples, Computers in Human Behavior, 110 (2020) 106379. DOI: 10.1016/j.chb.2020.106379

[11] S. Chibisov, G. Cornélissen, F. Halberg, Longitudinal monitoring of blood pressure and heart rate, Proc. Int. Symposium, Problems of ecological and physiological adaptation, People's Friendship University of Russia, Moscow, 2007, 510514.

[12] C. Herbert, A. Quay, Handbook of disruptive behavior disorders. New York, 1999.

[13] A. Petsakou, T.P. Sapsis, J. Blau, Circadian Rhythms in Rho1 Activity Regulate Neuronal Plasticity and Network Hierarchy, Cell, 162 (2015) 823835, DOI: 10.1016/j.cell.2015.07.010

[14] J.L. Fleg, F. O'Connor, G. Gerstenblith, L.C. Becker, J. Clulow, S.P.,Schulman, et al., 1998, Impact of age on the cardiovascular response to dynamic upright exercise in healthy men and women, J. Appl. Physiol, 78, 890900.

[15] S. Akselrod, D. Gordon, F.A. Ubel, Power spectrum analysis of heat rate fluctuation a quantitative probe of beat-to-beat cardiovascular control, 213 (1981) 220222.