# Improving the effectiveness of self-regulation and adaptation of students to stressful loads

*Lisova Nadezhda Alexandrovna*

*Candidate of Biological Sciences, Senior Lecturer*

*Krasnoyarsk State Pedagogical University named after V. P. Astafyev*

*Shilov Sergey Nikolaevich*

*Doctor of Medical Sciences, Full Professor*

*Krasnoyarsk State Pedagogical University named after V. P. Astafyev,*

*State University named after N.F. Katanov*

Abstract. The article presents the results of a study of the characteristics of psychophysiological self-regulation and adaptive capabilities of the central nervous system of students. A method is proposed for increasing the adaptive capabilities of students by optimizing the functional state and developing self-regulation skills in stressful situations.

**Keywords:** adaptive capabilities, students, self-regulation, functional state, biocontrol

It is known that students are one of the groups most at risk of developing maladaptive disorders, often lacking developed self-regulation skills and the ability to economically manage their psychophysiological resources [4].

The adaptive systems of the body, and especially the nervous system of young people, experience overloads under the influence of informational, emotional and physical influences, which often leads to the disruption of regulatory mechanisms and the development of a number of psychosomatic pathologies [5].

Correction of these problems is often carried out using methods aimed at reducing neuropsychic stress by teaching relaxation techniques, auto-training, breathing exercises, meditation, visualization, self-massage, group psychotherapy [3, 6]. The disadvantage of these methods is the high dependence on subjective factors, such as personal characteristics and motivation of the participants in therapy. In addition, they are not always effective due to the impossibility of an objective assessment by the student of his psychophysiological state and its dynamics.

A promising area related to teaching self-regulation skills is the technology of instrumental biocontrol based on the principles of biofeedback (BFB). Biofeedback is used to teach optimal psychoemotional self-regulation under conditions of current stress [1]. This technology has a number of advantages: the almost complete absence of contraindications and side effects, the absence of pharmacological and physiotherapeutic interventions, the comfort of the procedure for the patient, and the availability for use in an educational institution.

Despite the fact that there are quite a lot of studies devoted to the study of the functional states of students during adaptation to training loads in the literature, the inconsistency of some of the conclusions and the low degree of implementation of the results of such studies into practice draws attention. In connection with the above, **the purpose of the study** was to study the features of adaptive reactions and self-regulation of students and develop a method for their improvement using biocontrol technology.

The research was carried out on the basis of the research laboratory of Krasnoyarsk State Pedagogical University named after V. P. Astafyev. The study involved 100 students aged 18 to 21 years. The study was conducted with the informed consent of the participants. Determination of adaptive reserves was carried out using the method of cerebral omegametry, which included registration of the stable potential of the millivolt range (omega potential) in the projections of the frontal cortex of the right and left hemispheres of the brain [2, 7], as well as psychological testing with stress load simulation - game biocontrol under control of heart rate (HR).

According to omegametric data, in a state of calm wakefulness with a normal training load, 46% of the subjects had a normal level of brain activation, 20% had depression of activation influences and a low level of wakefulness, 7% had an excessively high level of activation of the frontal cortex, 27% of the omega potential of the left and the right hemisphere at different levels.

After a test session of biocontrol, high and medium levels of self-regulation were found in 41% of the participants, 59% had a low or below average level of self-regulation.

The most effective self-regulation was achieved by subjects with an average level of activation (20-40 mV) and dominance of the left hemisphere of the brain, although individuals with a low level of activation were characterized by a moderate increase in HR with a significantly lower ($p<0.001$) average heart rate in comparison with the rest of the subjects.

Thus, it was found that the level of brain activation, which ensures a functional state, affects the success of self-regulation under conditions of emotional stress, and therefore a normal level of activity of the nervous system is necessary to ensure effective adaptation, including to training loads. We used this fact to develop a way to increase the adaptive reserves of students. The essence

of the method consists in teaching techniques and techniques of self-regulation, individually selected for each student, depending on his functional state and aimed at its optimization:

- With a low level of activation, neuropsychological exercises are used to activate and increase the tone of the nervous system: movements of the eyes in all directions and in a circle; finger gymnastics; self-massage of earlobes and fingers; search for numbers in Schulte tables; frequent deep breathing, etc.);
- High level of activation: techniques are used to relax and reduce emotional stress: diaphragmatic breathing; breathing with delayed exhalation; breathing with the account of inhalation and exhalation; progressive muscle relaxation; visualization of pleasant memories; elements of autogenous training and meditation.
- High asymmetry of activation: tasks are used to improve interhemispheric interaction: drawing with 2 hands at the same time simple geometric shapes; breathing alternately through the right and left nostril; cross movements with the intersection of the center of the body.

The fixation of the most effective methods was carried out using biofeedback (game biofeedback).

In the experimental substantiation of the proposed method was attended by 32 students aged 18 to 21 years, who were divided into experimental and control groups. In the experimental group, a course of biofeedback with biofeedback sessions was conducted depending on the level of brain activation with the selection of individual techniques and exercises, in the control group there were no special training and education. The results of the experiment are shown in the table.

Table

Physiological indicators after a course of biofeedback in individuals with different levels of voluntary self-regulation success (N = 32)

| **Indicator** | **Group** | | | |
|---|---|---|---|---|
| | Experimental (n=16) | | Control (n=16) | |
| | Before the course | After the course | Before the course | After the course |
| OP of the left hemisphere, mV | 19.2 ± 2.4 | 26.6 ± 2.2* | 11.3 ±3.1 | 15.6±2.9* # |
| OP of the right hemisphere, mV | 31.2 ± 2.7 | 25.92 ± 2.5 * | 23.7±2.7 | 18.3±3.5* # |
| Interhemispheric asymmetry, mV | -12.0 ± 1.2 | 0.7 ± 0.5* | -12.4±1.3 | -5.7 ± 1.1* # |
| Interhemispheric | -5 ± 2.12 | 1 ± 1.12 | -7 ± 3.12 | -3 ± 2.12 |

| | | | | |
|---|---|---|---|---|
| asymmetry, mV | | | | |
| Time to reach the "plateau", sec | 204 ± 50 | 89 ± 36 | 253 ± 59 | 131 ± 51 |
| Maximum potential amplitude, mV | 25.1 ± 5.2 | 7.6 ± 4.0 | 20.4 ± 5.1 | 15.1 ± 3.4 |
| HR, bpm | 86.2±2.7 | 72.1±2.2* | 84.7 ± 2.5 | 79.4±2.3* # |

*Note: * - reliability of differences between groups according to the Mann-Whitney test, # - reliability of differences within the group according to the Wilcoxon test*

Comparison of the initial parameters before the biofeedback course in the selected groups did not reveal significant differences, which indicates their homogeneity. At the same time, after the end of the course in the experimental and control groups, there were significant changes in the characteristics of the omega potential. There was a decrease in interhemispheric asymmetry, normalization of OP parameters and heart rate. However, in the control group, fewer positive shifts were observed, which was expressed in non-optimal values of the omega potential, large values of the wave amplitude and slower stabilization of oscillatory processes.

After the course of correction, a significant decrease in the representation of insufficient and asymmetric activation of the central nervous system was noted in the absence of a state of hyperactivation in the experimental group. In 90% of the subjects, the omega potential corresponded to the optimal level. At the same time, 75% showed a decrease in interhemispheric asymmetry, which averaged 1.6 mV. In the control group, there was a shift towards a decrease in the level of activation while maintaining a high interhemispheric asymmetry, 40% had a low level of activation, 32% had an asymmetric level, which can be considered as a sign of a suboptimal state of the brain and the body as a whole.

Comparison of the coefficient of efficiency of heart rate control showed that in the experimental group, the success of mastering the skills of self-regulation was on average 35-40% higher than in the control group.

Thus, the proposed method solves the problem of increasing the adaptive reserves of students, which contributes to the improvement of the functional state and performance through the development of productive strategies for self-regulation and normalization of the functional state of the brain of students.

## References

1. Jafarova O. A. Biofeedback in pedagogy and psychology // Materials of the scientific-practical

conference "Modern problems of psychology and education in the context of work with various categories of children and youth". 2018. V. 26. P. 39-43.

2. Ilyukhina V.A. Ultraslow information-control systems in the integration of vital processes of the brain and the body // Human Physiology. 2013. V. 39, № 3. P. 114.
3. Karjakina T.N., Golub O.V. Methods of self-regulation of functional states of the individual // Logos et Praxis. 2006. №. 5. P.71-73.
4. Kirsanov V.M., Shibkova D.Z.Psychophysiological characteristics of the personality of students in the period of adaptation to training at the university // Siberian Pedagogical Journal. – 2012. №. 9. P. 127-132.
5. Lisova N.A., Shilov S.N. The effectiveness of energy supply of adaptive reactions among female students depending on the typological properties of temperament // Journ. of med.-biol. research. 2020. V. 8, № 3. P. 314–318.
6. Malkov A.P. Improving the performance of students with the use of methods of psychological self-regulation // Promoting the professional development of the personality and employment of young specialists in modern conditions. 2016. P. 82-87.
7. Murik S. E. Omegaelectroencephalography: formation history and diagnostic capabilities of the new method in electrophysiology // The bulletin of Irkutsk State University. «Geoarchaeology, Ethnology, and Anthropology Series». 2018. №. 26. P. 69-85.