Organization of the Educational Process at the Department of Normal Physiology of the Voronezh State Medical University Named after N.N. Burdenko in order to Ensure Sustainable Development

N.A. Nagibina[1], V.A. Semiletova[2], E.V. Dorokhov[3], A.P. Astashchenko[4] and M.S. Nechaeva[5]
Voronezh State Medical University, Voronezh, Russia
nagibina.natalya@yandex.ru

Keywords: Sustainable development, Learning process, Organization of the learning process and training of medical students.

Abstract: Ensuring sustainable development at the moment can be considered the main task of mankind, as the accumulating global problems threaten its existence. One of the options for solving them can be a scientific search, which makes the consideration of the process of education and training of specialists in higher education relevant. The paper highlights the essential aspects of teaching medical students at the Department of Normal Physiology of the VSMU on the example of training in the discipline Biophysics, among which are the predominance of active learning over passive, repeated study of the material, the use of acquired knowledge to solve more complex case problems, taking into account the specifics of medical workers in depending on the direction of study.

1 INTRODUCTION

Throughout human history, from ancient times to the present day, the transformational activity of man is clearly traced. Having learned to satisfy his needs, a person purposefully strives to improve the conditions of his existence. To do this, he, sometimes ruthlessly, intervenes in nature, trying to make it more convenient for his existence.

This uncontrolled and unlimited interference has by now led to a large number of global problems, the solution of which is of fundamental importance for the existence of future generations.

Historically, by studying various phenomena and objects, discovering their inherent patterns, a person got the opportunity to use the results obtained, directing them to solve pressing problems.

Modern higher education is aimed not only at the training of qualified personnel. Its important role is to create a research base and train scientific personnel who are constantly searching for objective patterns, the knowledge of which will reduce the impact on nature, use its resources consciously and carefully, achieving goals and preserving the planet for future generations.

Thus, modern higher education plays a fundamental role in ensuring the sustainable development of mankind, which makes consideration of its organization and essential aspects an urgent task.

2 MATERIALS AND METHODS

Consider the organization of the educational process at the Department of Normal Physiology of the VSMU named after N.N. Burdenko on the example of the discipline Biophysics.

This discipline, one might say, begins higher medical education, as it is implemented in the first

[1] http://orcid.org/0000-0001-5195-825X
[2] https://orcid.org/0000-0001-7802-6436
[3] https://orcid.org/0000-0002-2096-411X
[4] https://orcid.org/0000-0001-6416-6454
[5] https://orcid.org/0000-0003-4880-6751

semester of the first year for the Faculty of Medicine and in the second semester of the first year for the pediatric, dental, preventive and pharmaceutical faculties.

Of course, the teaching of this subject has its own characteristics for different faculties, but having considered the learning process for one faculty, it becomes possible to highlight its essential aspects as a whole. In this connection, we will consider in detail the learning process for students of the Faculty of Pharmacy.

The discipline Biophysics is studied by students of the Pharmaceutical Faculty of the Voronezh State Medical University named after N.N. Burdenko in the second semester of the first year.

Despite the fact that the student body lasts for more than a semester, the study of this subject often causes difficulties for the following reasons.

First, the biological and chemical components of the discipline of Biophysics do not change the fact that its main component is physics. Due to the fact that in preparing for Unified State Exam, the main attention was paid to specialized subjects, the study of physics either faded into the background, or stopped altogether.

Secondly, physics is significantly different from the subjects of chemical and biological profile that are familiar to medical students. When studying physics, the natural science component comes to the fore, based on mathematical formalism and the relationship of physical quantities.

Thus, if mathematics is also passed at the basic level when entering a university, then the gap between the physical-mathematical and chemical-biological components of the education of a first-year student of a medical university is only deepening.

3 RESULTS AND DISCUSSION

The ratio of theoretical and practical sections of the discipline "Biophysics" (fig.) contributes not only to the formation of the necessary competencies, but also to the development of independence, social responsibility, which is required for the formation of sustainable development of society as a whole.

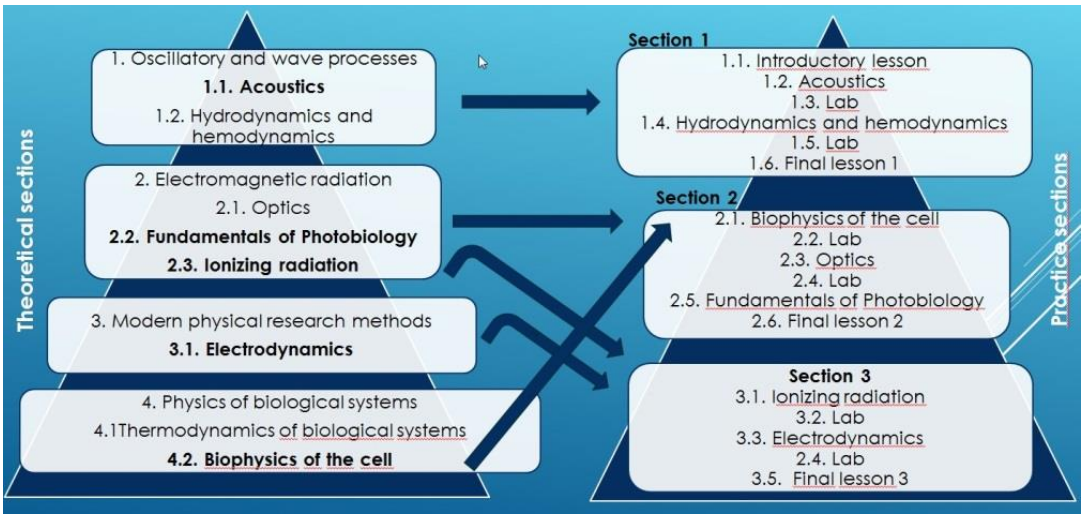

Figure 1: Correlation of theoretical and practical sections of the discipline Biophysics.

Mastering the subject involves the study of four main sections:

- Oscillatory and wave processes;
- Electromagnetic radiation;
- Modern physical research methods
- Physics of biological systems.

The first and fourth sections include two topics each, the second - three topics and the third - one.

Thus, the theoretical course of the Biophysics discipline provides for the study of eight topics, five of which will be covered in the lecture course. From each topic, seven to eight questions are submitted for offset, forming their total volume in the amount of 60 pieces.

The theoretical course is more than covered by the practical and laboratory classes provided for by the discipline. If the practical lessons are divided into three sections, in accordance with the number of final lessons, then the following is obvious. Theoretical section Oscillatory and wave processes are fully

considered in the first practical section. The second practical section provides for the analysis of two topics from the theoretical section Electromagnetic radiation and one from the section Physics of biological systems. The remaining three theoretical topics are covered in the last practical section.

Thus, it can be noted that instead of passive study through lectures, preference is given to active analysis of the material in a practical lesson.

Students independently prepare for a practical lesson by completing a certain set of tasks presented in the Workbook for independent work of students (Dorokhov, 2022).

Each topic can be accompanied by the following types of work.

1. A set of test tasks that allow you to prepare for both intermediate and final testing.

All courses taught to medical students are presented in the Moodle electronic educational environment, which includes an educational and methodological complex of the discipline, a test bank of tasks, both for preparing for individual topics and for completing final testing, the results of which are taken into account when assessing final classes, theoretical material and other auxiliary materials that contribute to the development of individual topics.

The following methodical recommendations are presented in the system:

– for students on the topics of practical or laboratory classes;

- for independent work of students in preparation for practical or laboratory classes;

– for teachers on the topics of lectures, practical or laboratory classes.

Mandatory are active references to the literature used to prepare for the classes. Also, a lecture notes have been created for students, allowing them to give an idea of all sections of the discipline (Dorokhov, 2019).

Thus, the work of students in mastering the disciplines of the program is carried out both in full-time format in the form of work in the classroom, and remotely in the Moodle electronic educational environment, where each interested user can evaluate the course of the discipline by the student, get an idea of his progress.

2. Filling in a table containing the basic physical laws on the topic under consideration. As already noted, the operation of physical formulas causes difficulties for medical students. However, no one requires to reproduce patterns by heart. It is only necessary to formulate this or that law or indicate the meaning of the physical quantity, determined by this or that expression.

3. Next, there are tasks to determine the structural elements of physical devices and the principles of their operation.

4. Reproduction of various graphic dependencies related to the issue under consideration.

5. In each topic, tasks are required for the use of the studied physical aspects of the issue under consideration in medical practice.

Practical classes in the discipline of Biophysics usually proceed as follows.

Each topic in the workbook (Dorokhov, 2022) is accompanied by a set of theoretical questions for self-preparation of students for the lesson.

These questions are detailed elements of the material to be taken out for credit. Therefore, the practical lesson is devoted to a joint discussion of the material that is submitted for consideration on a particular topic.

Thus, as a result of work in a practical lesson, each student has the opportunity to:

· answer the questions presented in the workbook or asked by the teacher in order to clarify the essence of the process or phenomenon under consideration;

· supplement the answers of their classmates, demonstrating their immersion in the topic under consideration;

· sort out all the tasks provided for on the topic under study in the workbook.

That is, conducting each practical lesson as an element of problem-based learning, involving the performance and discussion of a certain set of tasks, allows the entire group to be involved in the discussion process. Some answer, others complete, others draw on the board, graphically explaining patterns, or write down formulas.

Such an organization of work makes students speak out on the issue under discussion, which is extremely important in the light of the specifics of modern education, where the ability to express one's thoughts or defend one's point of view is practically not in demand.

Finally, students solve the tasks together under the guidance of a teacher, which makes the acquired knowledge more valuable than the material that is presented in the form of lectures.

This is the first essential aspect of teaching the discipline of Biophysics to medical students.

When studying the discipline of Biophysics, medical students perform a number of the following laboratory work on the topics studied.

Topic 1.2. Hydro- and hemodynamics

Laboratory work 1. Determination of the viscosity of a liquid with a capillary viscometer.

Laboratory work 3. Determination of the coefficient of surface tension by the method of drop separation

Laboratory work 4. Determination of the dynamic viscosity of a liquid using the Stokes method

Topic 2.1. Optics

Laboratory work 18. Determining the wavelength of light using a diffraction grating

Laboratory work 19. Light polarization. Determining the concentration of sugar in a solution using a saccharimeter.

Topic 2.3. Ionizing radiation. dosimetry

Laboratory work 28. Radioactive radiation. Studies of the protective properties of materials.

Laboratory work 30. Studying the basic law of radioactive decay.

Topic 3.1. Electrodynamics

Laboratory work 9. Determination of the threshold of sensation and resistance of a part of the body to direct current using the Potok-1 galvanization apparatus

Laboratory work 15. Studying the physical foundations of the ECG method

Self-preparation of a student for laboratory work is carried out in workbooks (Dorokhov, 2022) and provides for the following main stages.

I Test control of the initial level of knowledge

II Answers to questions for self-preparation for the lesson

III Filling in the table of basic formulas used in laboratory work

Thus, preparation for laboratory work, obtaining admission to its implementation and protection of the results obtained also involves a more detailed consideration and repetition of individual topics of the discipline.

This can be singled out as the second aspect that determines the teaching of the discipline of Biophysics to medical students.

In addition to the above, the discipline of Biophysics provides for work on the implementation of case tasks collected in a separate workbook (Dorokhov, 2022).

These tasks are distributed by the topics of the discipline and are formulated as follows. The task begins with the formulation of a biophysical concept, phenomenon or process, to which five questions are formulated with the following goals:

– explanation of a biophysical concept, phenomenon or process;

- allocation of physical quantities and regularities between them, used to describe the concept, phenomenon or process under consideration;

- consideration of the dynamics of a phenomenon or process with a certain change in the quantities that determine it;

– determination of the medical application of the considered biophysical concept, phenomenon or process.

This is the most time-consuming and complex type of work, which allows the acquired knowledge to be applied in practice to explain the features of the flow of physical processes and phenomena and to the fullest extent contributes to the understanding of their essence, specifics and features.

One case task is necessarily included in the ticket for passing the test in the discipline.

This can be singled out as the third aspect that distinguishes the teaching of the discipline of Biophysics in a medical university.

Finally, the program of the discipline under consideration necessarily includes certain topics that are essential for the assimilation of students of a particular faculty. For example, for students of the Faculty of Pharmacy, topics such as Fundamentals of Photobiology and Thermodynamics of Biological Systems are specifically included.

On the one hand, the property of atoms and molecules to absorb light of certain wavelengths characteristic of a given substance is widely used in medicine and pharmacy for qualitative and quantitative research.

On the other hand, any living organism is an open biological system, which is characterized by such thermodynamic parameters as internal energy, enthalpy, entropy, Gibbs energy. When external conditions change, the process of transition of systems from one state to another takes place, which is described by the variation of the given thermodynamic quantities.

This can also be considered as an essential aspect of teaching the discipline of Biophysics, which allows preparing students of individual faculties both for further education and for future professional activities.

Also, at the Department of Normal Physiology, a permanent scientific work of students is organized, which allows not only to study in more depth certain physiological and biophysical aspects of the functioning of the human body, but also to be included in scientific work on a selected topic.

The results of scientific research of students are presented in the work of the student scientific circle and at various student conferences [5].

4 CONCLUSION

That is, during the time of study at a medical university, a student gets the opportunity to try himself in various aspects of his future activity - to gain knowledge, skills and abilities for the qualitative performance of his professional duties and (or) to engage in scientific research, devoting himself to teaching, constantly improving his qualifications and working on solutions to the many medical problems facing humanity [6, 7].

Thus, in the process of teaching the discipline of Biophysics for medical students, the following significant aspects can be identified to achieve sustainable development:

1. the predominance of active problem-based learning in practical classes over passive learning in the form of lectures;
2. repeated study of the material in practical and laboratory classes, allowing you to freely navigate in certain aspects of the material;
3. use of acquired knowledge for solving complex case problems, contributing to a more complete assimilation of the essence, features and specifics of physical phenomena and processes and their application in medicine;
4. inclusion in the material of the discipline of topics that are in demand in practical activities by future specialists, which determines the focus of education on achieving the maximum result from the beginning of training while preserving the environment and resources, that is, without compromising the ability of future generations to satisfy their own needs.

REFERENCES

Dorokhov, E.V., 2022. Biophysics: Workbook for independent work of students. Voronezh: Publishing house XXI century. 131 p.

Dorokhov, E.V., 2019. A course of lectures on medical physics: a textbook for independent work of students. 131 p.

Dorokhov, E.V., 2022. Laboratory workshop on the discipline Biophysics: Workbook for independent work of students. 118 p.

Dorokhov, E.V., 2022. Biophysics: control materials on the discipline. 94 p.

Yakovlev, V. N., Esaulenko, I. E., Dorokhov, E. V., 2020. Centenary of the Voronezh School of Physiology. 312 p.

Nagibina, N. A., Semiletova, V. A., 2022. Comparative evaluation of the current monitoring of progress and intermediate certification of students of two Voronezh universities. Medical physics, physiology and related disciplines in academic and university science: Collection of abstracts of the conference with international participation, dedicated to the 100th anniversary of MGMSU named after A.I. A.I. Evdokimova, Moscow, November 17–18, 2022. - Moscow: Moscow State University of Medicine and Dentistry. A.I. Evdokimova. pages 336-339.

Semiletova, V. A., Astashchenko, A. P., Komissarova, O. V., Dorokhov, E. V., 2020. The system of remote examinations using the Moodle platform at VSMU. N.N. Burdenko: Teaching aid. 15 p.