

вирішення проблеми поліпшення стану водо забезпечення;

5) підведення підсумків: прийняття рішення на основі консенсусу щодо першочергових та віддалених шляхів, враховуючи вибори всіх груп (залежно від кількості присвоєних рангів першочерговому рішенню або ж віддаленому). Якщо відповіді не повторюються, то в результаті дискусії приходимо до консенсусу на основі зроблених групами виборів. Результати записуємо на дошці.

Висновки з дослідження і перспективи подальших розробок. Таким чином, інтерактивні технології уможливають створення навчального середовища, в якому теорія і практика щодо збереження довкілля засвоюється одночасно. Їх використання у процесі підготовки майбутнього вчителя дає змогу інтенсифікувати процес засвоєння і творче використання екологічної інформації, психологічно підготувати студентів до реальних ситуацій, набути досвіду такої діяльності, змінювати установки студентів на природо збереження.

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PHYSICAL TASKS OF MEDICAL DIRECTION AS A FACTOR FOR THE FORMATION OF PROFESSIONAL COMPETENCIES OF MEDICAL STUDENTS

Statement and substantiation of the relevance of the problem. After analyzing the sectoral standards of higher medical education to determine the place of medical and biological physics in the training of students in the direction of training 1201 «Medicine», we established that the ensure of training of medical personnel is based on such elements of standardization as the educational qualification characteristic of a specialist, educational and professional training program

of specialist [5] and means for diagnosing the quality of higher education [9]. According to the above-mentioned normative-legal documents, higher education institutions should ensure that graduates acquire a high level of knowledge that will enable them to solve certain typical tasks in the performance of certain production functions and to ensure a high level of preparation of basic knowledge of graduates [9]. According to the requirements of educational and

qualification characteristics, the ultimate objectives of training the discipline «Medical and Biological Physics» are: the formation of a system of knowledge of students about basic physical principles and approaches to the study of processes in Live nature, physical and technical principles of the functioning of medical devices, the use of mathematical methods in biomedical research, which forms the basis of subject competences in medical and biological physics, and is an integral part of the professional competence of the future specialist in the field of health care, as well as the basis for the study of professionally oriented natural and clinical disciplines in higher medical educational institutions of Ukraine [10].

Analysis of recent research and publications.

The problem of methods of teaching medical and biological physics and the use of medical tasks is carried out by scientists, teachers: Stadnichenko S.N., Chalyi A.V., Sukhovirska L.P., Kukurova E., Rubin A.B., Korovina L.D., Schellart Nico A.M. This question is relevant, especially in the area of formation of professional competence of future doctors.

The purposes of article. Therefore, the purpose of this article is to study the types of physical problems, the requirements for their content and presentation in classes on medical and biological physics.

Research methods. In the process of research we used theoretical methods (analysis and synthesis of scientific literature on the research problem), empirical (observation and systematic study: structures and updating of the content of scientific concepts on medical and biological physics, sectoral standards of higher medical education, textbooks and manuals on biophysics, factor analysis formation of professional competencies of medical students in biophysics classes.

Presentation of the main research material. The implementation of a competent approach requires the search for new approaches to the organization of the educational process. The competence paradigm is based on a functional approach, in which the doctor is competent not by itself, but in relation to the implementation of his professional functions, solving diagnostic and therapeutic tasks every day in accordance with the accepted domestic and international requirements that should take into account the transformation of medical standards, changes in diagnostic and therapeutic methods and also be flexible. In the content of the professional competence of the doctor we can distinguish certain components. Scientists I.V. Belous, N.V. Stuchinska, M.M. Tkachenko [3] points to the following components: informatics component (Bulakh I.E., Krivenko I.P.), technical component of the professional competence of the doctor (Nevmerzhitska A.V.), subject competencies from different educational disciplines (biology, physics, etc.). In accordance with the given classification in the process of solving physical problems of medical direction the basis of the physical and technical component of the professional competence of the future physician is formed. They envisage the presence of subject competences in general physics, medical and biological physics, computer science, medical

technology, and specialized training disciplines, and is a powerful means of integrating such competences and formation on their basis the professional competence of a health specialist.

Our research [1; 2; 4; 11] showed that such tasks should meet the following requirements:

1. The physical phenomenon being studied should be widely used in the appropriate professional direction.
2. In the tasks, real data on medical devices, physical phenomena and processes in medicine, etc. should be used.
3. Tasks should include such issues as are encountered in professional activities.
4. The material of tasks should be directly related to the program material of classes on the subject «Medical and Biological Physics» or professional subjects.

We have investigated that tasks can be classified according to the following features:

1. By content: abstract and specific, with medical or medical and technical content.
2. By didactic purposes: training, control, creative.
3. By way of specifying the condition: text tasks, graphic tasks, task-drawings, research tasks.
4. By degree of complexity: simple (contain one to two actions), complex, combined.
5. By character and method of research: quantitative, qualitative, experimental [7].

We describe some types of tasks and give examples of tasks aimed at forming the appropriate professional competencies of future physicians.

In general, there are many definitions of the concept of «qualitative tasks». In our works we use the following definition: a qualitative task is a problem that is solved by concluding logical thinking with the help of induction and deduction, based on the corresponding laws [6]. But M.E. Tulchinsky introduced such an addition «solved tasks without using mathematical actions» [6]. In the process of solving such problems, attention is paid only to the qualitative aspect of the physical phenomenon in medicine. In the process of solving such problems, medical students learn to determine the physical and biological patterns, see their application in medicine. Solving the physical problems of medical direction requires developed intuition of students, contributes to the development of the ability to group and compare the physical phenomena in medical processes, indicators, conditions, determine the influence of physical factors on the functioning of medical equipment and bioorganisms, to allocate significant and insignificant influence.

We offer a short algorithm for solving qualitative physical problems of medical direction:

1. Familiarization with the content of tasks. Establishing the importance of the task in a professional direction.
2. To learn and consciously understand the content of the task.
3. Drawing up a plan for solving a qualitative problem.

4. Implementation of the solution of the medical and physical problem.

5. Check the answers. Analyze the effect of changing physical data of the problem content on the relevant medical and biological processes.

The choice of qualitative tasks for classes in medical and biological physics should be made in accordance with the study topic. It is especially important to take this fact into account when teaching foreign students, because the school curriculum for teaching physics vary in different countries. An important element in the formation of professional competencies is a systematic and planned solution of medical and physical problems; the task must have a specific didactic purpose, and it must be determined by the teacher in advance; it is necessary to show students the connection with professional subjects; for students the tasks should be interesting and understandable.

Qualitative physical tasks with medical content can be applied at any stage of the studying and the definition of its place directly depends on the skill of the teacher. Qualitative tasks can be widely used for new topics as problematic conditions, in the process of explaining new topics, in order to consolidate the past topic, to assess the knowledge and skills of students, to recall the material and repeat it.

When solving qualitative medical problems, we propose the use of a heuristic method. It consists in staging and solving a series of interrelated, focused, qualitative issues. Each of them has its own independent solution and at the same time is an element of solving the whole task. This method instills the students the skills of logical thinking, analysis of medical and biological phenomena, drawing up a plan for the task, teaches to connect the data of its conditions with the content of known physical laws, to summarize the facts, draw conclusions.

Quantitative (calculated) physical tasks of medical direction contain a number of quantitative regularities (the law of electromagnetic induction, laws of direct current, etc.), without them students will not be able to understand the deep enough physical content of these laws.

Graphic physical tasks of medical direction allow to visualize the most clearly and efficiently the functional relationship between the quantities characterizing the physical processes occurring in the body, medical equipment, environment. The graphical method of solving problems has broad prospects in the study of medical and biological processes. With the help of charts, processes can be presented, which can be expressed analytically only at later stages of teaching medical and biological physics or professional disciplines.

Physical tasks of medical direction with incomplete data are most often encountered in life, when the missing information has to be extracted from tables, directories, or by measurements. The solving of tasks of this type facilitates formation of skills of independent work with the reference medical literature.

Experimental tasks of medical direction in classes on biophysics are tasks for the solution of which data are obtained from the experience of demonstration, or when performing an independent experiment. When solving these problems, students find special activity and independence. The advantage of experimental tasks before text is that the former can not be solved formally, without sufficient understanding of the medical-physical process.

An integrated approach to content planning and the implementation of experimental tasks in medical and biological physics classes should include the following steps: work with test tasks (with the choice of the same correct answer, on the determination of physical quantity, on the determination of various quantities according to one formula, etc.); experimental tasks (use of identical objects, studying of a medical-biological object or device and formation of the skill of its use (not torn off in time with the study of theoretical foundations); fulfillment of frontal laboratory work or physical practice.

The following are variants of practical and experimental tasks according to the stages of the study of the section of hydrodynamics [11].

1. Test tasks for forming an understanding of the physical phenomena of hydrodynamics.

1.1. *Why blood flows from the capillaries in the vein:*

- A) veins have special valves;
- B) the area of transverse veins is smaller;
- C) blood pressure in the capillaries is higher than in the veins;
- D) the flow rate of blood in the veins is greater;
- E) veins have thinner walls.

1.2. *How the volume flow rate of a fluid changes at the output of the tube if the cross-sectional area of the tube at the outlet is twice that of the input:*

- A) 2 times increase;
- B) 4 times increase;
- C) will decrease in 2 times;
- D) will be the same as at the input;
- E) will decrease 4 times.

1.3. *Why is the linear velocity of blood flow in the capillaries less than in the arteries:*

- A) their radius is smaller than the radius of arteries;
- B) the amount of their cross-sectional area is larger than the arteries;
- C) blood pressure in them is lower than in arteries;
- D) their hydrodynamic resistance is greater than in the arteries;
- E) their number is much larger than the number of arteries.

2. Tasks for the formation of individual skills for solving tasks (middle level).

2.1. To estimate the minimum allowable arterial pressure in a giraffe, below which the blood supply of the brain becomes impossible. The giraffe's brain is located 3 m above the heart.

2.2. The pictures (Fig.1.1 – 1.3) show various instruments for measuring blood pressure. Analyze the readings of these devices.

3. Tasks for the formation of separate skills of solving tasks (sufficient level).

3.1. What should be the pressures difference ΔP at the ends of a capillary of radius $r=1$ mm and length $L=10$ cm so that a volume $V=1$ cm³ of water (viscosity coefficient $\eta_1=10^{-3}$ Pa·s) can be passed through it during a time $t=5$ s? Calculate and for glycerin. Compare Results.



Fig. 1.

3.2. The pressure drop in a blood vessel of length $L = 55$ mm and radius $r=1.5$ mm is 365 Pa. Determine how many milliliters of blood flow through the vessel in 1 minute. Blood viscosity coefficient $\eta=4.5$ mPa.

The variants of frontal and individual laboratory work are presented by us in the printed edition «Physical bases of physiotherapeutic equipment: methodical instructions for laboratory work in the discipline «Medical and Biological Physics» [8].

Conclusions from research and prospects for further studying. Thus, the physical tasks of the medical direction are an important part of the process of teaching medical and biological physics, and, as a consequence, the formation of professional competencies of medical students. Throughout the study, we were convinced that solving the physical tasks of the medical direction contributed to a more expressive formation of the concepts of physics, more versatile and deep understanding, and strong development of the content of learning. Due to the appropriate selection of material for medical and physical tasks you can familiarize students with the new material, expand their professional knowledge, prepare students for the studying of professional subjects, realize the unity of theory and practice. There is a filling of physical formulas with specific medical and biological content. The solution of physical tasks of medical direction is one of the effective ways of establishing inter-subject relationships.

Physical-medical competence, which is decisively forming in the process of solving various types of the above-mentioned tasks, is a basic component of the professional competence of a future health specialist.

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АНАЛІЗ ЗМІСТОВИХ ПІДХОДІВ ДО ПІДГОТОВКИ ФАХІВЦІВ З КОМП'ЮТЕРНИХ НАУК

Постановка та обґрунтування актуальності проблеми. Одним з найважливіших завдань сучасної вищої освіти є професійна підготовка майбутніх фахівців, здатних самостійно здобувати

нові знання, логічно і творчо мислити, об'єктивно оцінювати свою діяльність, спираючись на аналіз прийнятих професійних рішень. Питання професійної підготовки фахівців з комп'ютерних