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WAYS OF STRENGTHENING INTEGRATIVE LINKS BETWEEN FUNDAMENTAL AND PROFESSIONAL DISCIPLINES OF MEDICAL EDUCATION

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It is known that ensuring the quality of medical education can only be achieved by observation of the principles of continuity and unity of education. The purpose of this work was to determine the role of fundamental disciplines in teaching professional disciplines and to find possible ways to improve interdisciplinary links. The main research methods were questionnaires, surveys, observations, and testing of students. Altogether 100 people who studied at the 6th (graduation) course of the specialty "Medicine" were examined and voluntarily agreed to answer questions about which basic knowledge and skills were useful for their professional training. The results of the work showed that the majority of respondents believed that fundamental disciplines are a necessary basis for the quality training of clinicians. Students highly appreciated the connection between different disciplines during their studies. According to the students, the basic disciplines were the most integrated among themselves, as indicated by 86% of the respondents. 72% of graduates assessed the existence of a connection between fundamental and clinical disciplines. Knowledge and skills in medical and biological physics were recognized as relevant and used in professional training by 64% of respondents. Among the topics of the discipline, the most useful for professional training were those that considered such modern, well-known clinical methods as electrocardiography, X-ray diagnostics, ultrasound, electrophysiotherapy, and electrical stimulation. The number of respondents who recognized the role of medical and biological physics for the subsequent study of these methods in senior courses ranged from 80 to 93%. Along with this, students used knowledge and skills from the other, more theoretical topics to study normal human physiology and pharmacology, i.e., the other fundamental disciplines which future doctors master immediately before professional training. In the process of research, we found that the main ways to maintain the interdisciplinary connections between fundamental and professional disciplines are the actualization of the study of topics by the teacher and the demonstration of the practical value of knowledge and skills, which can be realized in the first courses with the help of medical devices, when students study the principles of their application, and reviewing articles in the medical journals.

Key words: *fundamental and professional disciplines, integration links, medical and biological physics.*

Connection of the publication with planned research works.

The work is a fragment of the scientific topic of the department of medical physics, biophysics and higher mathematics of the Zaporizhzhia state medical and pharmaceutical university O119U101864: "Theory of increasing the efficiency of the formation of competence of students of higher medical educational institutions".

Introduction.

Numerous researches of Ukrainian and foreign scientists are dedicated to study the possibilities of improvement of the quality and integrity of medical education. One of them is the establishment of strong integration links between fundamental (natural science) and professional (clinical) educational disciplines.

Modern education recognizes the relevance of fundamental sciences as a defining knowledge base for doctors and support in solution of clinical problems [1]. "The concept of "cognitive integration" emphasizes the value of basic science in establishment of critical connections with clinical signs and symptoms" [2]. In terms of the importance of basic concepts mastering for understanding of biological processes in normality and pathology, as well as the need to provide in education the process of continuous use of fundamental knowledge throughout the entire course of study at a medical university and their integration with clinical application is emphasized by all researchers of this problem [2-8].

The need for connections between academic disciplines, which students must master during the period of study at the university, is accented in the work of [9], "since no academic discipline is able to form the professional competence of a future doctor." The authors discuss various types of interdisciplinary technologies, the use of which contributes to the implementation of "a systematic approach to understand the nature of human body, ways of diagnosis and treatment [9] and the conditions for successful solutions of the main tasks of interdisciplinary integration – "consistency and systematicity in the implementation of this approach when theoretical and clinical disciplines are studied". In addition, such conditions are the observance of unity in the definitions of scientific concepts, interpretations of laws, theories and provisions, the use of a similar system of designations of various quantities and units of measurement [10], which is established in the process of the study of fundamental academic disciplines with further use in medical education.

Thus, the fact that the study of natural sciences gives a firm foundation for further professional training is generally recognized. However, an actual scientific problem is the study of the longevity of the acquired basic knowledge, the ability to use them quickly, "spontaneously formulating fundamental scientific knowledge in clinical considerations" [2, 4]. There is a widespread among doctors and medical teachers opinion that a significant

part of the fundamental scientific information obtained in the traditional preclinical years at the medical school is lost, not used at the proper level [3]. The research of this problem is an urgent scientific task, its solution, feedback from the students who have gone through the path of learning from fundamental to clinical disciplines are important in our opinion.

In the work of [3], they studied students' perception of the content, necessity, and use of basic science disciplines in the process of their study at clinical departments. In general, the opinion of students about the learning of basic disciplines turned out to be positive, which, according to the ideas of modern pedagogical science, is very important – therefore, for the acquired knowledge not to become inert and inaccessible, future specialists must be sufficiently motivated to obtain them, including through the positive attitude of students to study.

In the research [5] among senior students, it was found, in general, an understanding of the relevance and value of disciplines included in the block of natural and scientific training. Along with this, most respondents noted that the information learned in accordance with educational programs is very detailed to be clinically useful. According to the students, the way to strengthen the link between basic and professional disciplines can be improvement of the actualization of knowledge on the topics of fundamental sciences. In the research [8], students indicated joint learning as an effective way of their integration with special medical disciplines, i.e., the one where the knowledge and skills on related topics are acquired in classes with the help of teachers of two profiles at the same time. According to [8], the condition for the success of such an approach is “commitment of all participants in the educational process to the appropriate teaching tool, careful planning and cooperation between teachers”, which can be difficult, but effective.

The above-mentioned problem of strengthening integral connections is relevant in the educational process of all fundamental disciplines, and in particular, medical and biological physics, which students study in the first year, in addition to basic knowledge, mainly for human physiology and pharmacology, as well as some specialized disciplines, “forms a type of thinking that allows you to master the essence of the problem quickly, to make the optimal decision in any field of knowledge.” [11].

The aim of the study.

To determine the ways to strengthen integral connections in the process of study of medical and biological physics, based on the research of the subjective attitude of sixth-year students of the medical faculty to fundamental training and analysis of the formation of the integration link “fundamental – clinical disciplines”.

Object and research methods.

The research was conducted with the participation of 100 6th year volunteer students of the specialty “Medicine”.

Theoretical methods: study, analysis and generalization of psychological-pedagogical, scientific-methodological literature; empirical methods: questionnaires, surveys, observations, testing, self-assessment to determine the level of formation of integration links between the fundamental and professional disciplines of the cur-

riculum of the specialty “Medicine” among the students of the 6th year of medical faculty.

Research results and their discussion.

According to the results of the survey, 83% of students agreed with the proposed statement: “To be a good clinician, one must master fundamental, basic disciplines well.” Students recognized human anatomy – 97%, normal human physiology – 93%, microbiology – 70% as relevant and most important for study of professional disciplines. The respondents noted that they easily used the acquired solid basic knowledge from the mentioned fundamental subjects when they studied clinical disciplines. Future graduates noted that in the first courses they were particularly interested in studying human anatomy, normal physiology, microbiology, medical and biological physics, and medical biology. At the same time, the interviewees determined that, in their opinion, the educational material for human anatomy and biochemistry was too detailed in terms of volume.

The majority of students who took part in the survey agreed with the statement that the relevance of knowledge from fundamental disciplines and the motivation to gain this knowledge increased significantly if the connection with the future profession of a doctor was systematically emphasized, i.e., when the practical significance of the studied topic was accented, whether the relationship between fundamental and clinical disciplines was established in the process of the students studies at the university, they noted that during the entire period of study they observed the maintenance of interdisciplinary integration links at all levels: between basic disciplines (86%), between professional disciplines (78%), as well as between fundamental and clinical disciplines (72%). The survey participants also noted that the disciplines they learnt in the first and second year of university were integrated with the disciplines they studied at school, for example biology, chemistry, physics (73%).

The next step of our research was the study of the relevance of the discipline “Medical and biological physics”, the use of knowledge obtained at lectures, practical classes in the process of mastering of professional disciplines, the level of integration of the discipline with other fundamental, as well as clinical disciplines. As you know, the subject of “Medical and biological physics” is the physical and physical and chemical basis of life processes in the human body, also the effect of physical factors of the environment on human body, which are also used in diagnostic and therapeutic medical equipment. It provides ample opportunities for integration with a wide range of educational disciplines, included in the block of medical and biological training (human physiology, pharmacology, biochemistry, pathological physiology, etc.), and also professional training: internal medicine, surgery, physiotherapy, radiation medicine (radiology diagnostics and radiation therapy), hygiene and ecology, ophthalmology, otorhinolaryngology, etc. [12, 13].

Knowledge and skills on medical and biological physics were recognized as relevant and used in professional training by 64% of the surveyed graduates. However, a certain proportion of respondents (22%) noted that the application of the acquired knowledge was complicated by the fact that it was acquired in the first year,

and the study of clinical disciplines began in the fourth year. Only 10% of the surveyed students noted that they did not understand why they should study “Medical and Biological physics”, it was boring and difficult for them to study. But many future graduates who took part in the survey, namely 68%, noted that during the “Medical and Biological Physics” classes, knowledge were always updated in order to emphasize the practical significance of each topic.

Among all the topics of discipline, the interviewed students accentuated those, knowledge and skills about which they used to the greatest extent in the next study of clinical disciplines, such as “Physical foundations of electrocardiography” (92% of respondents), “Electrical stimulation of organs. Basics of low-frequency and high-frequency electrophysiotherapy” (83%), “Physical basics of X-ray diagnostics and X-ray therapy” (83%), “Ultrasound and its use in medicine” (81%). This result did not surprise us, because in the process of study of these topics, students deal directly with medicine already in the 1st year. In addition, the actualization of the specified topics in classes is a simple task, since all students repeatedly encountered the relevant methods in their everyday life, that is, the students were motivated to find out the principles of their implementation even before the beginning of studies.

It is necessary to note that the mechanisms of electrocardiography, electrical stimulation, and electrophysiotherapy cannot be studied without prior consideration of such topics as biopotentials, biophysics of muscle contraction, which, in turn, are based on ideas about biological membranes and the transport of substances in them. However, surveyed students accented the role of these topics for further study of normal human physiology (82%) and pharmacology (78%), and only 53% of graduates for clinical disciplines, which indicates the need to strengthen actualization in the latter case. It is possible to say the same about such fundamental topics as “Thermodynamics of biological processes”, “Physical basis of hemodynamics”, “Biophysics of hearing” and “Biophysics of vision”, which importance students mainly assessed for the subsequent study of normal human physiology. In this regard, it was interesting to identify factors, in addition to actualization, contributed to the greatest recognition of some topics in the assimilation of clinical disciplines by analyzing the methodology of conducting the relevant classes.

One of such topics, as indicated above, is “Physical basis of electrocardiography (ECG)”. In accordance with the requirements of the master level standard, after study of this topic students should understand the propagation of excitation in the heart, the dipole Einthoven’s theory of ECG, the shape of a normal electrocardiogram, be able to interpret the origin of its waves, segments, complexes, have a concept of the electrical axis of the heart, be able to find it and characterize its direction. In addition, at the ECG class, professional competences are formed, they contribute to the maintenance of integration links with clinical disciplines. One of these competencies is the ability to analyze and explain current information on a given topic. For the formation of relevant skills, we use the results of research published in the Zaporizhzhia Medical Journal. In particular, students receive from the teachers the pictures of recorded electrocardiograms [14] for analysis and also get the

task to evaluate the shape and direction of the waves, the duration of segments, intervals, find the heart axis and characterize its direction, students in the practical part of the class not only master the questions about the mechanisms of formation of a normal electrocardiogram, but also make sure that the knowledge they acquire are necessary in order to assess how the corresponding processes occur in some pathological states.

The next topic, which, according to the students, integrates to the greatest extent with clinical disciplines is “Electrostimulation of organs. Basics of low-frequency and high-frequency electrophysiotherapy”. Students do not doubt the relevance of studying these issues, since electronic devices are widely used for therapeutic purposes. Special importance in medicine has the creation of electronic stimulators that support the functional activity of internal organs in the case of their complete or partial loss, they contribute to save the lives of many patients (for example, application of pacemakers, defibrillators), improve the quality of life of other patients (cochlear prosthesis, etc.). The methods of electrophysiotherapy are additional to the main methods of treatment, but, according to the students, their study was interesting from the point of view that various factors of electromagnetic nature affect biological tissues almost equally, and the main factor of the therapeutic effect is the frequency of pulses. The students noted that during the classes they understood the mechanisms of low-frequency and high-frequency methods, gained the knowledge about the main characteristics of physical factors which have an influence on organism in each case, and this knowledge were in demand in various educational disciplines. But the most impressive for students in the process of study of the topic was the demonstration of an electro-neurophysiological installation for electrical stimulation and recording of biopotentials of nerves and muscles, i.e., it is used not only for therapeutic, but also for diagnostic purposes in the clinic, and, especially, the device for magnetic stimulation. The last one was accented because the teachers demonstrated the absolute painlessness, safety, and effectiveness of the procedure by stimulation of their own muscle, because of which it was contracted, without contact and through clothes. Students read the instructions for the device in class and made sure that magnetic stimulation is applied for the treatment of many pathological states in various excitable tissues and organs. In addition, the consideration of the historical context of this method allows students to get acquainted with its diagnostic value, in particular with transcranial magnetic stimulation, which allows to do non-invasive and painless research of the central part of the neuromuscular system.

Thus, the results of our research showed that the main ways of strengthening the integration links between the fundamental discipline of medical and biological physics and professional disciplines are the actualization and successful demonstration of the practical value of knowledge and skills acquired by students when they study various topics. It confirms the results of numerous research, which show that basic scientific knowledge gained in a clinical context are assimilated by the students better and applied easier.

Since the integration of fundamental and clinical scientific knowledge is increasingly recognized as important for the practice of medical professions, it is

necessary to revise all topics of various fundamental disciplines to find optimal ways to implement interdisciplinary educational tasks. It is not necessary to have appropriate equipment, which role in the educational process is great, but not absolute for this purpose. Reviewing articles in medical journals is another way to demonstrate the practical significance of the knowledge and skills acquired in the classes [14, 15].

At present moment we have not tested yet such a way of interdisciplinary integration as joint learning, but its idea is clear and has already been repeatedly discussed by the central methodical commission for natural and medical disciplines of the university. It is proposed to conduct joint classes of medical and biological physics and normal human physiology, pharmacology. There are many reasons to believe that such an approach has good prospects for the formation of integration links of medical and biological physics with other fundamental disciplines that students study immediately before professional training. At the same time, the inclusion of

fundamental laws and achievements of physics will undoubtedly contribute to the successful solution of complex medical problems.

Conclusions.

1. Majority of the 6th year students of medical faculty, who had training in clinical disciplines, recognize the need to study fundamental disciplines, positively assess the level of formation of integration links between various disciplines of the curriculum.

2. Students consider knowledge and skills of medical and biological physics as relevant and use them in study of the following fundamental and professional disciplines.

3. The analysis of the most relevant topics named by the students and the methods of conducting the relevant classes showed that the strengthening integration links between fundamental and professional disciplines can be achieved by updating knowledge and skills and demonstrations of their practical significance with the help of medical scientific publications and equipment.

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ШЛЯХИ ЗМІЦНЕННЯ ІНТЕГРАЦІЙНИХ ЗВ'ЯЗКІВ МІЖ ФУНДАМЕНТАЛЬНИМИ ТА ФАХОВИМИ НАВЧАЛЬНИМИ ДИСЦИПЛІНАМИ МЕДИЧНОЇ ОСВІТИ

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Резюме. Серед засобів покращення якості і цілісності медичної освіти важливу роль відіграє встановлення міцних інтеграційних зв'язків між фундаментальними та фаховими навчальними дисциплінами. Метою предствленої роботи було проаналізувати суб'єктивне ставлення випускників до фундаментальної підготовки, оцінку ними сформованості інтеграційного зв'язку «фундаментальні – клінічні дисципліни» і визначити можливі шляхи його зміцнення при вивченні медичної та біологічної фізики. Дослідження проведено за участю 100 студентів-добровольців, які навчаються на 6 курсі за спеціальністю «Медицина», тобто мають знання і вміння з усіх дисциплін навчального плану підготовки лікаря за фахом. Використовували анкетування, опитування, спостереження, тестування, само оцінювання студентів. Результати показали, що 83% опитуваних вважали фундаментальні дисципліни необхідною ланкою підготовки клініцистів. Підтримання міждисциплінарних інтеграційних зв'язків було оцінене студентами наступним чином: між базовими дисциплінами (86% опитуваних), між фаховими дисциплінами (78%), між фундаментальними і клінічними дисциплінами (72%). Знання і вміння з медичної та біологічної фізики визнали актуальними і використовували в фаховій підготовці 64% опитаних. Серед тем, які в найбільшій мірі були корисними для клінічної підготовки були «Фі-

зичні основи електрокардіографії» (92% опитаних), «Електростимуляція органів. Основи низькочастотної та високочастотної електрофізіотерапії» (83%) та інші, в яких були представлені загальновідомі клінічні методи діагностики і терапії. Знання і вміння з більш фундаментальних тем студенти використовували для наступного вивчення нормальної фізіології людини (82%) і фармакології (78%), а для клінічних дисциплін тільки 53% опитуваних. Основним фактором підтримання міждисциплінарних інтеграційних зв'язків випускники відзначили актуалізацію вивчення різних тем викладачем, рівень якої на заняттях з медичної та біологічної фізики опитані визнали високим. Аналіз методики проведення занять, які були визнані студентами найбільш корисними у засвоєнні клінічних дисциплін, показав, що іншим шляхом зміцнення інтеграційних зв'язків між фундаментальними і клінічними дисциплінами може служити демонстрація практичного значення знань і вмінь, яка може бути здійснена через розгляд статей у медичних фахових журналах та за допомогою відповідних медичних приладів.

Ключові слова: фундаментальні і фахові дисципліни, інтеграційні зв'язки, медична та біологічна фізика.

WAYS OF STRENGTHENING INTEGRATIVE LINKS BETWEEN FUNDAMENTAL AND PROFESSIONAL DISCIPLINES OF MEDICAL EDUCATION

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Abstract. Among the tools for improvement of the quality and integrity of medical education, the establishment of strong integration links between fundamental and professional educational disciplines plays an important role. The purpose of the presented work was to analyze the subjective attitude of graduates to fundamental training, their assessment of the formation of the integration connection “fundamental-clinical disciplines” and to determine possible ways of strengthening it when they study medical and biological physics. The research was conducted with the participation of 100 6th year volunteer students of the specialty “Medicine”, i.e. they have knowledge and skills in all disciplines of the curriculum of specialty “doctor”. Questionnaires, surveys, observations, testing, self-assessment of students were used. The results showed that 83% of the respondents considered fundamental disciplines as a necessary part of the preparation of clinicians. Maintenance of interdisciplinary integration links was evaluated by students as follows: between basic disciplines (86% of respondents), between specialized disciplines (78%), between fundamental and clinical disciplines (72%). Knowledge and skills in medical and biological physics were recognized as relevant and used in professional preparation by 64% of respondents. Among the topics that were most useful for clinical preparation were “Physical basis of electrocardiography” (92% of respondents), “Electrostimulation of organs. Basics of low-frequency and high-frequency electrophysiotherapy” (83%) and others, where well-known clinical methods of diagnosis and therapy were presented. Knowledge and skills from more fundamental topics were used by students for the next study of normal human physiology (82%) and pharmacology (78%), and only 53% of respondents used it for clinical disciplines. As the main factor in maintaining interdisciplinary integration ties, the graduates noted the actualization of the study of various topics by the teacher, which level in medical and biological physics classes was considered high by the interviewees. The analysis of the methods of conducting classes, which were recognized by students as the most useful in learning the clinical disciplines, showed that another way of strengthening the integration connections between fundamental and clinical disciplines can be the demonstration of the practical value of knowledge and skills, it can be realized through the review of articles in medical specialties magazines and with the help of appropriate medical devices.

Key words: fundamental and professional disciplines, integration links, medical and biological physics.

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Conflict of interest:

The authors of the article confirm the absence of conflict of interests.

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