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WAYS TO IMPROVE THE EFFECTIVENESS OF BIOCHEMISTRY LESSONS BASED ON MODERN APPROACHES

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ABSTRACT

The article argues that the Biochemistry course, being necessary for the study of other disciplines, develops the competencies required in the teaching process, and at the same time is of great importance for the doctor in implementing interdisciplinary integration and professional integration necessary in his professional activities. Business games in the form of students' formulation of situational problems and test tasks, conducting lessons in the form of competitions, building logical-semantic systems develop students' cognitive abilities: independent thinking, creativity, problem-solving skills, assessment skills; increase students' creative independence, allow them to consolidate knowledge obtained as a result of studying different disciplines and establish interdisciplinary connections, strengthen their interest in science, scientific research, help connect scientific and theoretical principles with the clinic, and contribute to the development of practical work skills.

KEYWORDS

Problem-solving skills, creativity, conducting lessons in the form of competitions, scientific research.

INTRODUCTION

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One of the most important fundamental subjects for students of higher medical education institutions is biochemistry, during the study of which students acquire basic medical knowledge about the molecular basis of the functioning of the organism, the emergence and development of pathological processes, and the clinical thinking of a future doctor is formed.

The difficulty of teaching biochemistry is that the constantly updated and supplemented information requires a lot of independent preparation from students. Here, the quality of studying the subject directly depends on the cognitive abilities of students, which can be developed thanks to various active learning methods that help to form logical thinking and analyze information, as well as a creative approach to the problem. In turn, good cognitive abilities help to master the material and, ultimately, to develop the intellectual potential of a person to the maximum.

In order to increase the cognitive abilities of students, stimulate their creative activity and the desire to independently search for information, various forms of situational analysis have recently been used, which are the interaction of students' cognitive activity, interactivity within the group, initiative, and practical experience.

In the process of teaching biochemistry to second-year students of the directions of treatment work, pediatrics, medical prevention work and medical biology work at the Department of Biochemistry of the Bukhara State Medical Institute, the method of compiling situational problems and test tasks for students from biochemistry was used [1-3].

Competence in biochemistry increases the competitiveness of a future medical specialist in the labor market, provides an opportunity to work in the pharmaceutical industry, and in addition, the experience of applying the knowledge and skills acquired in professional work to solve practical problems and the mastery of modern biochemical methods of analysis will serve as a foundation for extensive scientific research.

A competency-based approach to teaching biochemistry

The main trend of modern education reform is, of course, the introduction of a competency-based approach, which is emphasized by life itself. Currently, it is impossible to become a full-fledged specialist by repeating and applying what you have learned only once. The scheme of the modern professional program provides for the listing of professional competencies in its introductory part, the formation of which should be directed from the initial stages of studying the subject. As you can see from Table 1, biochemistry helps to form the most important medical competencies, a significant part of which are competencies related to

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the ability to conduct a targeted search, collect and generalize scientific information.

Table 1
Professional competencies and their formation for studying biochemistry

№	Content of the competency
PC-2	Ability and willingness to identify the natural scientific nature of problems arising in the process of professional activity and to use appropriate physical, chemical and mathematical tools to solve them.
PC-3	Ability and willingness to develop a systematic approach to analyzing medical information based on the broad principles of evidence-based medicine, based on finding solutions using theoretical and practical skills to improve professional practice.
PC-5	Ability and willingness to interpret the results of modern laboratory and instrumental studies.
PC-15	Ability and willingness to make diagnoses based on the results of biochemical studies of biological fluids.
PC-17	The ability and readiness to identify the main pathological signs and syndromes of the disease in patients, taking into account the laws of the course of pathology in organs, systems and the body as a whole, using knowledge of the basics of medicine and biological sciences; analyze the laws of the functioning of various organs and systems in various diseases and pathological processes, and carry out basic diagnostic measures to identify urgent and life-threatening situations.
PC-18	Ability and willingness to analyze and interpret the results of modern diagnostic technologies for age and gender groups of patients, taking into account the physiological characteristics of the body, in order to implement successful treatment and preventive measures, identify physiological pregnancy, and participate in forensic examinations.
PC-27	Ability and willingness to use regulatory documents adopted in the healthcare sector (laws of the Republic of Uzbekistan, technical regulations, international and national standards, orders, recommendations, terms, international systems of units (SI), current international classifications, as well as documents for assessing the quality and efficiency of medical organizations).
PC-31	Ability and desire to study scientific and medical information, local and foreign experience.
PC-32	Ability and desire to participate in the development of modern theoretical and experimental research methods to create promising tools, and in organizing practical use and implementation of research results.

Experimental part

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The introduction of a competency-based approach requires restructuring the entire educational process and the entire list of educational technologies used. Taking into account modern trends in the educational process, not traditional reproductive methods, but teaching technologies that activate the student's creative activity and form an active approach to studying science should prevail. In relation to biochemistry, such interactive technologies involve students not only solving, but also creating test and situational problems, defending abstracts, conducting roundtable discussions, group conferences, creating multimedia atlases and presentations, conducting research on the search for pathological components of gastric juice, urine, determining vitamin supply, etc. Biochemical practice, biochemical experience are an important element in the development of the natural scientific thinking of the future doctor. Modern computer technologies allow, along with traditional in vitro experiments, to introduce schemes called smart maps into the educational process. Computer modeling of molecular processes, presentation of computer simulations of modern biochemical methods, molecular analysis methods can significantly bring the institute's biochemistry course closer to the achievements and capabilities of modern science. Computer animations and videos are also an excellent tool for visualizing complex molecular processes - protein-ligand interactions, conformational changes, the work of supramolecular complexes, proteomes, matrix synthesis, intracellular signaling.

Implementing a competency-based approach to teaching biochemistry

The competency-based approach in higher education institutions ensures the integration of traditional effective teaching technologies with innovative technologies, the formation of specialists with the necessary level of training and the necessary professional competencies.

Competence, which is the ability of a specialist to perform his professional functions qualitatively and to improve himself as a result of training, is achieved primarily through the student's mastery of fundamental knowledge, without which practical activity is unthinkable. On the basis of this fundamental knowledge, special knowledge is developed with the gradual formation of practical skills.

At the current stage of education development, the increase in the number of credits due to the increase in classroom hours and extracurricular (TMI) hours allows solving problems arising in the study of biochemistry. An important place is occupied by self-regulating educational technologies and technologies for the development of professional education.

In our opinion, the most effective is active learning, which consists in constant interaction between the

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teacher and the student, ensuring the implementation of the internal mechanism of self-development of students, which increases the quality of teaching and provides constant monitoring of students' independent work. Active learning includes the cognitive activity of students; we will not be mistaken if we define it as intra-group and intergroup interactivity of students and the interaction of the teacher and the student with initiative, practical experience. Such forms as debates and discussions, seminars, practical exercises, round tables have long become traditional. Recently, trainings, business and role-playing games, test-training systems, situation analysis and brainstorming, stimulating cognitive activity, intellectual creativity, and motivating students to acquire independent knowledge have been widely used to increase the level of student activity in the learning process.

Similar innovative technologies are being introduced at the Department of Biochemistry of the Bukhara State Medical Institute. Identifying a problem to overcome a simulated situation, as well as developing methods for solving this problem, is an example of a more complex, higher form of educational activity than the form that involves solving ready-made problems. In this regard, the active form of teaching creates certain difficulties for students, the elimination of which requires integrative knowledge and allows you to connect the knowledge gained with clinical sciences, which creates additional motivation for educational activities and in the future independently appeal to the sources of fundamental sciences.

Developing students' cognitive abilities in the process of teaching biochemistry

The quality of teaching biochemistry directly depends on the cognitive abilities of students, which can be developed through various active teaching methods that help to form logical thinking and analysis of information, as well as a creative approach to the problem. In turn, good cognitive abilities contribute to better assimilation of the material and, ultimately, the maximum development of the intellectual potential of the individual.

In order to increase the cognitive abilities of students, stimulate their creative activity and the desire to independently search for information, various forms of situational analysis have recently been used, including the cognitive activity of students, interactivity within the group, the initiative of students and interaction with practical experience.

In the process of teaching biochemistry to 2nd-year students of the medical faculty of the Bukhara State Medical Institute, a method was used that included the formulation of situational problems and test tasks in biochemistry by students.

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Analysis and solution of situational problems formulated by teachers and students in the lesson on the topic "Interrelation of carbohydrate, fat, amino acid metabolism" took place in the form of an active non-traditional form of education - quizzes. The questions were structured in such a way that students could answer at least partially correctly. The main goal of the quiz was to interest participants in the issues raised in the problems and to show that the most complex biochemical problems are often very simple, based on standard general biological principles.

The main principles of the quiz were: the originality of the tasks, the realization of the creative potential of the majority of participants, and the simultaneous control of the level of knowledge and creative thinking. The technology of its conduct was as follows: a group of students was divided into two teams, each of which received 20 tasks. All tasks were original, educational in nature and based on the biochemistry curriculum. The condition for setting the problems was that the participants had to apply their knowledge in some medical aspect, and every student with any level of knowledge could find at least a partial answer. The teacher acted as a judge, the winners were determined by the sum of the points scored, on this basis each student was assessed at the end of the lesson.

During such lessons, the educational activity of not only successful students, but also lagging behind students was stimulated, which led to an increase in the assimilation of the educational material, which was later determined in colloquiums on these sections.

The effectiveness of teaching biochemistry can be significantly increased if students build logical semantic models (LSM) proposed by V.E. Steinberg for multidimensional description and analysis of knowledge. We used this method in the process of studying such complex sections of biochemistry as the metabolism of carbohydrates, proteins and nucleic acids. The construction of MSM by students under the supervision of a teacher allowed them to deeply understand and assimilate the information, draw conclusions and generalize the material being studied. At the same time, this type of reporting for the teacher significantly reduced the amount of controlled material. The results of using MSM also led to an increase in the quality of knowledge and teaching.

Analysis and solution of situational problems formulated by teachers and students in the lesson on the topic "Metabolism Control and Its Disorders" took place in the form of an active non-traditional form of education - quizzes. The questions were structured in such a way that students could answer at least partially correctly. The main goal of the quiz was to interest participants in the issues raised in the problems and to show that the most complex biochemical problems are often based on very simple, standard general biological principles [4].

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Thus, in the process of teaching biochemistry, students' formulation of situational problems, conducting exercises in the form of quizzes and building MSM, develop students' cognitive abilities, initiative, active response to problem situations and intellectual creativity, increase interest in science, increase learning efficiency and contribute to the acquisition of competencies for the future professional activity of a doctor.

The organization of the transmission of cultural heritage from generation to generation is the most important task of education. It is clear that synergism, which claims to be a new scientific paradigm of thinking, cannot ignore this area of human activity. Two aspects can be noted in relation to the topic under consideration: synergism in education and synergism of education.

The first is more traditional and is associated with the introduction of relevant disciplines into medical higher

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education, holding various training seminars and conferences [5]. Finally, this is the publication of popular science literature, the organization of educational television programs, etc.

The second side includes teaching methods and techniques based on the concepts of synergetics, the creation of a fundamentally new learning environment, new approaches to managing educational structures.

On the one hand, everything is clear: work in this area is being carried out very actively. At the same time, there is no need to radically revise the concept of education, since the problem is fully solved within the framework of the traditional educational paradigm. On the other hand, such a radical revision cannot be avoided;

Synergetics studies open systems, in which the main point is the interaction and exchange of energy and information between objects and subsystems, and the pedagogical process is a specially organized interaction between the teacher and the student. Such basic rules of synergetics are the concepts: self-organization, synergy, nonlinearity and chaos. Let us use these rules to show how we can describe a new educational concept that we call the synergistic paradigm.

In relation to education, self-organization means self-education. In self-education, the emphasis shifts from the transfer (translation) of knowledge and skills from the teacher to the student to the teaching of methods for independently searching for and mastering the necessary information and interpreting this information in its own context.

The second key word in the educational aspect, synergy (coordinated interaction), takes on the characteristics of a dialogue or even a "polylogue" rather than a monologue, as in the traditional scientific and technical paradigm of education. In this case, the educational environment is formed not according to the type of "object-subject", but according to the type of "subject-subject". In such conditions, the teacher does not transmit certain examples of "objective" knowledge or ready-made truth, as in the traditional paradigm, but together with the student develops the forms of educational activity, its content and assessment criteria. The latter is very important, because in such an educational environment the field of assessment criteria moves mainly into the sphere of personal relations between the teacher and the student, which are in a state of cooperation and even co-creation. Thus, the teacher's task is to organize the student's self-learning process, which, according to E.N. Knyazeva and S.P. Kurdyumov, is more like "... a joint educational adventure" [6].

From a mathematical point of view, nonlinearity means, in particular, the presence of several solutions to a problem under the same initial conditions, as well as the presence of various branches (bifurcations) in the solution space. In a broader sense, this concept

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includes multivariance, alternative choices of paths for the evolution of complex systems. In the pedagogical process, nonlinearity should be manifested in the form of a joint search for a solution to the problem between the teacher and the student, the outcome of which cannot be accurately predicted, since creative activity is fundamentally uncertain in nature. Finally, chaos is the most complex of the concepts of synergetic. Chaos in the new paradigm sets before the teacher the task of transforming the unorganized and spontaneous space of the student's aspirations and capabilities into a creative field, in which the new reveals the features of the already learned and familiar, or, conversely, the new reveals the features of the already known and familiar. It should be noted that chaos should not be overcome, but it should not be expelled from teaching, because with such expulsion, unorganized creative energy itself is largely expelled, and creativity risks becoming a formal operation of ready-made clichés and categories. Chaos should be transformed into a space of joint creativity between the teacher and the student, who, gathering the fruits of their labors, travel in common mental spaces.

The specific features of a synergistic creative environment in comparison with a traditional environment are more clearly shown in Table 2.

Table 2
Comparing the characteristics of two learning environments

Signs	Traditional learning environment	Creative learning environment
Motivation	Gaining knowledge for further adaptation in society	Self-awareness, self-knowledge
Nature of information	Manipulating other people's ideas, ready-made templates, and standard solutions	Information is received independently and interpreted in its own context
The process of knowing	Mastering patterns like "Do as I do"	Self-organization, change, discovery
Relationship	Subject-object: person - object of study	Subject-subject: man is the subject of knowledge and creativity
Results	Planned, known	Probable, unknown
Technologies	Imitative, reproductive	Creative, problematic
Teacher functions	Influence, dominance	Interaction, support, co-creation
The next effect	Academic knowledge base, algorithms, templates, libraries	Motivation for self-expression, reflection, perspective, and exploration

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Thus, theoretically, the features of the new synergistic paradigm of education are very clearly manifested. The situation with the development of specific methods of such education is not so clear: the literature on this topic is very scarce. This is understandable: we are, in fact, talking about a radical change in one of the most conservative stereotypes of thinking [7].

At the first stage of the implementation of this program, along with the presence of new elements in the spirit of the principles of synergism, there will be traditional, well-proven methods that do not clearly contradict the ideas of synergism. The methodology of teaching using associations (the "Zig-zag" method), described in the collection "Synergistic Paradigm", is an example of this approach. In this technology, the main conceptual cluster is obtained through individual associations that are connected in one way or another with its central logical core.

The basis of this technology is repetition in classes of a three-phase cycle, the stages of which are called, respectively, "challenge", "understanding" and "reflection". At the first stage of the selection, the following tasks are set: to arouse interest in the topic under discussion, to activate the student in such a way that he is ready for critical perception of new information. At this stage, the student remembers what he knows on the issue being studied, systematizes this information, makes assumptions and asks questions to which he wants to get answers.

The main tasks of the second stage of comprehension are: to maintain the interest and inertia of action created in the first stage, as well as the students' desire to monitor their understanding and gradually move from "old" knowledge to "new". The student reads (listens) to the text using the active reading methods recommended by the teacher, noting new information with understanding. The reflection stage is often overlooked in the teaching process, although it is no less important than the others. At this stage, the teacher returns students to their initial tentative notes for changes and additions. Students should try to express new information in their own words (in their own context), for which the teacher gives them creative, research or practical tasks. The second goal of this stage is to organize an active exchange of ideas between students, which will give them the opportunity to expand their ideas by considering other possible answers and solutions. Each stage uses its own techniques and methods.

At the call stage, methods such as "discussion question", "brainstorming", "advanced lecture" have proven themselves well. At the second stage, conceptual clustering, KnWKn tables ("I know" - "I want to know" - "I knew"), all kinds of notes, as well as methods of keeping diaries and marking the text can be used. At this stage, methods of working in small groups and modules with fewer classroom hours are very effective.

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At the reflection stage, methods such as jointly creating a "final cluster", talking with a "council of experts" (formed from the same group of students), "scientific report", as well as creative works can be used. A very interesting method is "sync wine" - a creative work with a strictly defined linguistic form (similar to the Japanese poetic style "Hokku"), containing exactly ten words in five lines with a clearly defined semantic content. Moreover, these ten words should not only describe the topic of discussion, but also express the author's personal assessment, which, as can be seen, requires not only a good understanding of the essence of the topic being presented, but also the ability to present it concisely and clearly at a very high level.

Even in a brief description of the essence of the project on the development of critical thinking technology through reading and writing, it is not difficult to see the implementation of the main ideas of synergism in education: interpretation of information in its context, self-study using dialogue or "polylogue", non-linearity, which is expressed in the organization of discussions, "brainstorming", "expert advice", the results of which neither students nor the teacher can predict. And, perhaps most importantly, the complete absence of the teacher's dominance, his role is reduced to launching the initial impulse, gently controlling the course of the self-education process and summarizing the results together with the students.

The synergetic approach is one of the main directions in the educational (and upbringing) systems of Sh. Amonashvili, Davydov-Elkonin, V. Shatalov and others.

A number of authors believe that the possibilities of information technologies can be used in the design of a creative educational environment. This applies, first of all, to the development of various types of virtual laboratories, multimedia educational and methodological complexes, and the use of Internet technologies (blogs, forums, chats, etc.).

There is no doubt that with the growing interest in synergetic in education, new methods and technologies will appear that partially or fully implement the principles of synergetic.

RESULTS

In connection with the above, the following question seems appropriate: in which educational structures and for which educational contingent will it be easiest to use the new synergistic paradigm technique? There is no consensus on this issue in biochemistry. On the one hand, a number of authors believe that the new model of teaching should be introduced as early as possible: from the first grade, and better, from preschool institutions. Indeed, children of this age perceive any innovation very well. Others believe that the most effective training at the moment will be for a contingent that is motivated for such training and has previously accumulated information and methods of

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working with it. In this case, we are talking about second higher education for adults and additional education for secondary school students and students. There is also no unity in defining the areas of study: the concept of synergistic education was developed in connection with the teaching of the cycle of medical sciences. However, the experience of working within the framework of the project on the development of critical thinking through reading and writing, which includes many aspects of this concept, shows that this methodology has proven itself even better in teaching purely exact sciences: chemistry, biochemistry, physics and biophysics.

It is worth noting that there is a group of authors who warn against the overly zealous implementation of the new paradigm in higher education, and their arguments deserve the most serious study.

However, one way or another, the ideas of synergism will inevitably penetrate education and leave their mark both in new methods and educational technologies and in the educational process itself.

Biochemistry is intended to create a basis, a foundation for the study of clinical sciences as a mandatory subject before clinical sciences in medical higher educational institutions. At the same time, biochemistry, physical and chemical chemistry and molecular biology are among the most actively developing areas of biomedical science. The widespread introduction of biochemical, biotechnological and molecular methods in the diagnosis and treatment of diseases even led to the emergence of the new term "molecular medicine". Consequently, in-depth knowledge of biochemical processes should be present in the work of modern doctors and used by them in solving professional problems.

CONCLUSION

The pronounced fundamental-applied dualism creates certain difficulties in teaching biochemistry. The biochemistry course is studied in the lower grades and, in essence, requires mastering the language (if not the alphabet) of this interesting science. Memorizing complex chemical formulas, multi-stage chains of metabolic pathways - all this requires a lot of effort from first-and second-year students. There is a point of view on the need to somewhat "lighten" the course by reducing the requirements for knowledge of the part of formulas and the chemistry of metabolic pathways. Such proposals, in our opinion, essentially deprive biochemistry of its fundamentality, its logical basis as a science that describes biological processes in chemical language. At the same time, neither the level of knowledge of primary school students for medical studies, nor the number of hours allocated for studying the subject, allow teachers to fully convey and students to understand and appreciate the importance of biochemistry for the medical field. Almost outside the basic course, a lot of information has been

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preserved in the field of clinical biochemistry, and the clinical biochemistry course is included only in the curriculum of the fourth (graduate) year of medical biology, the rest of the course is not included in the curriculum, its inclusion in higher courses has been widely discussed.

The developed system of teaching biochemistry to students is based on a rational combination of traditional forms of teaching and the capabilities of modern information technologies. The main emphasis is on ensuring that the training of specialists meets the requirements of their future professional activities, and on activating the cognitive activity of students in order to create a solid foundation of primary biological knowledge as a basis for further study of special disciplines. The use of the considered forms of organizing the educational process in the subject of "biochemistry" among students encourages students to devote more time to independent work with information sources, directs them to independently search and solve assigned problems, which, of course, arouses additional interest in the subject being studied. The work introduced in mini-groups allows for mutual learning between students with different levels of knowledge.

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