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## FORMATION OF GENERAL SUBJECT COMPETENCES IN STUDY OF BIOCHEMICAL STUDENTS OF NATURAL SPECIALTIES

### Abstract

**Introduction.** An important task of modern education is to provide a high level of general and vocational training specialists who possess knowledge and skills system, can think logically and problem, are able to combine theoretical and practical knowledge. Therefore, the biochemistry course study is necessary to organize the learning process in a way that is combined regulatory fundamental part and skills with professional orientation.

**Methods.** Usage of scientific and methodical publications, the educational research methods, and also agro-chemistry department practical material, chemical and general biological sciences of Podilskyi State Agrarian and Engineering University. In the process of writing the article, methods of analysis, systematization of scientific and methodological literature sources, generalization of theoretical data were used.

**Results.** In this article it is proved the proper use importance and combination of different forms and methods of biochemistry course teaching for veterinary medicine students. One of the important approaches that transforms the higher education system is the competency approach, which requires the formation of skills to create the conditions for mastering the competency complex. The competency approach is aimed at forming a person capable of further vocational education, social and professional mobility. Compulsory components of any competence are relevant knowledge and skills. In studying the course of biochemistry students of natural sciences develop general competences, which allow them to acquire the necessary knowledge and skills, to apply them in practical work to solve problems related to the future profession. The formation of general subject competences is based on the content of the subject, connected with the use of various pedagogical methods and teaching methods. This article proposes methods, forms and means of forming general subject competences in studying the course of biochemistry for students of natural sciences as a necessary condition for qualitative training of future specialists. The result of their implementation is active learning, the use of new forms of interaction between teacher and student, which improves the quality of learning.

**Discussion.** In order to optimize the learning process is an important combination of different forms and methods as the methodological basis for teaching biochemistry.

**Keywords:** biochemistry, educational process, teaching methods, practical orientation of the course, interdisciplinary communication, chemical experiment, self-study, professional training.

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### Introduction

In recent years, higher education has been widely used by a competent approach to training professionals, the main idea of which is that the main result of education is not the individual knowledge, skills and abilities, but the ability and willingness of the future employee to an effective and productive professional activity (competence). A

competent approach in the system of modern education is possible if two interdependent units are combined — competent teacher, competent student. A competent teacher is a teacher with a high level of professional, pedagogical, psychological and social qualities. The system of

competences of the student includes: ability to learn, general cultural (communicative), social-labor, informational.

Competence — the general ability of a person to act rationally in various situations, effectively solve current problems in different areas of life. Competence is the end result of learning, the purpose of which is the formation and development of the student's personality, the disclosure of his abilities and talents.

Competence is formed in the process of learning and gaining practical experience. Competence is ensured by a combination of components — knowledge, activity, and personal qualities. All of these components are closely interconnected.

Knowledge is an important element of competence. They must be scientific, deep, strong, systematic, versatile. General subject competences are defined for each subject and developed throughout the period of its study.

In view of this, students should have at the high level appropriate competences, which, first and foremost, relate to their future professional activity when studying at a higher education institution [7].

The relevance of this topic is determined by the need for proper organization of the educational process of studying the course "Biochemistry of animals with the basics of physical and colloidal chemistry", which will provide students with mastering various ways of cognitive and practical activity. This will help them absorb the necessary knowledge, prepare them for future professional activity in their chosen field.

#### **Analysis of recent researches and publications.**

The analysis of literary sources shows that the problem of implementation of the competence approach in education is at the center of modern pedagogical thought, actively developed by domestic and foreign scholars. According to the works of O. Lebedev, competence in education is the level of education [4]. Other scholars [6] view competence as a special way of generalizing a set of knowledge, skills, abilities, and attitudes that allow a future specialist to identify and solve problems that are specific to a particular area of professional activity. Among the basic competencies of a graduate of a higher education institution are the development of basic professional skills, practical skills in the professional field [5].

Despite the considerable achievements of scientists in the development of methodology for the introduction of the competence approach in the educational process, the list and the content of the general subject compe-

tences in biochemistry, which will be formed in students of natural sciences, are not yet sufficiently defined.

In order for students to successfully acquire knowledge, skills and competences, the teacher needs to organize the educational process in accordance with current principles of motivation and personality needs. The main factors that motivate students to highly productive educational and creative activity are: the importance of the subject for professional training and awareness of the theoretical and practical importance of the topic of the classes; the student's awareness of the immediate and final learning goals; high pedagogical mastery of teaching discipline personal relationships with the teacher of the subject, etc. [7].

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Combining chemical and biological knowledge together enables us to form a scientific worldview, a scientific picture of the world that comprehensively reflects the objective reality. This pooling of knowledge around theoretical generalizations makes it possible to recognize the priorities of the educational process of forming the scientific picture of wildlife, which is a component of the scientific picture of the world, the highest and special form of systematization of knowledge from the basic sciences, the highest form of knowledge integration [2].

**Purpose.** The purpose of the article is to reveal the content, tasks, methodical approaches to the implementation of the study of the subject "Biochemistry of animals with the basics of physical and colloidal chemistry" for students of natural specialties of agricultural institutions of higher education. The subject of this study is the tools and teaching methods used in studying the course "Biochemistry of Animals with Fundamentals of Physical and Colloidal Chemistry" for students of natural sciences. The subject of the study is the professional training of future veterinarians. The methodological ba-

sis of the work is the study of education in the study of biochemistry, as well as the latest technology training.

**Methods:** In the process of writing the article, methods of analysis, systematization of scientific and methodological literature sources, generalization of theoretical data were used.

**Results.** One of the subjects taught to students of natural sciences is biological chemistry. This course plays an integral role. It summarizes all the previously studied facts that are subject to the basic laws of the organic world. Biological chemistry is the basis for many disciplines of biological profile, such as genetics, physiology, immunology, microbiology, pharmacology, cytology, etc. The role of biochemistry in understanding the nature of pathological processes in the body, the molecular mechanisms of action of drugs and biologically active impurities, which are widely used for both humans and animals, is extremely important [4].

The teacher should take into account the students' knowledge about organic substances obtained during the study of biological courses, skillfully gather information about the chemistry of biologically important substances with specific examples, to consider the chemistry of their action.

Modern methods of teaching biological chemistry require a combination of theory and chemical experiment, since biochemistry is an experimental science that requires constant visualization at lectures and laboratory classes. The ultimate goal of biochemistry is the complete description of all chemical reactions occurring in living systems.

In vocational guidance, the discipline reads like the biochemistry of an animal organism, so students need to learn it as a tool that studies the structure and functioning of the animal organism and gives the opportunity to find ways to intensify agriculture. In addition, this subject is the theoretical basis for the following specialized disciplines.

The objectives of the discipline are to study the basic laws of physical and colloidal chemistry; structure, properties, biological role of major classes of organic compounds, as well as individual representatives and their practical use; the relationship between the main classes of organic compounds, the ways of their transformation; mechanisms of reactions of metabolism of proteins, lipids, carbohydrates, water, minerals in the animal body; structure and biochemical transformations in separate tissues and organs.

The structure and content of the course are subordinated to the achievement of the stated goal, so the educational material is constructed so that in theoretical terms it allows to consider in a unity static and dynamics of processes, and in practical terms — reveals the value of the acquired knowledge for their use in animal husbandry.

Practical orientation of the discipline "Biochemistry with the basics of physical and colloidal chemistry" is that in laboratory classes students acquire the skills necessary for their future work: determine the pH and buffer properties of solutions; prepare artificial solutions of carbohydrates, macro- and micro-elements, vitamins, proteins, amino acids and other substances; determine the activity of enzymes of different tissues that characterize the functional state of organs and systems of organs of animals; determine the content of vitamins in feeds, biological fluids, vitamin preparations, and calculate their need for the prevention of hypovitaminosis; determine the concentration of glycogen, glucose, fructose, lactate and pyruvate in tissues as indicators of the physiological state of the animals and control their feeding; determine the qualitative and quantitative composition of amino acids and the concentration of protein and protein metabolism products in biological samples to control amino acid and protein metabolism, the physiological state of animals, and the needs of animals in these substances; determine the chemical composition and physico-chemical properties of milk, ensuring the quality of dairy products and characterizing the physiological state of the mammary gland and the quality of feeding animals; determine the parameters of carbohydrate, mineral and lipid metabolism, activity of farmers; determine the chemical composition and physical and chemical properties of the muscles, as well as the qualitative and quantitative composition of the meat of animals of different species [6].

General competences in biological chemistry are that students are introduced to the structure, chemical and biological properties of substances from which living organisms are built, the biochemical processes that flow into them, and the biochemical foundations of their life, and the effects and processes that flow in these organisms. Also important is the formation of special competencies — to perform chemical experiments, that is, the experimental and practical skills required for the job.

When preparing for biochemistry classes, the teacher first faces the task of selecting the most necessary information from all the information available. Another

equally important task is to process scientific information pedagogically; highlight the main material, think of the logic of presentation, choose the most appropriate methods.

Construction of classes in biological chemistry is determined by the nature of the content of the course, which should cover the most important problems of modern science. In this regard, the teacher has a number of problems related to the restructuring of the educational process. One of them is to organize effective forms and use innovative technologies that are most appropriate for this discipline. Depending on the topic, purpose and content, we use certain forms of organization of lectures and workshops. An important role is attached to the implementation of didactic principles and innovative approaches to learning, including personality-oriented, developmental, differentiated, competency, which not only shape knowledge, skills and skills, but also create conditions for future specialists to develop the ability to self-acceptance decisions, solving atypical problems of high professionalism, that is, aimed at the formation of substantive competence.

The course is based on cross-curricular links. The teacher should take into account the knowledge of students gained in the study of biological courses, as well as skillfully pick up information about the chemistry of biologically important substances, while limiting the generalized description of them without delving into chemistry, but with specific examples. Carbohydrates can be found on the examples of glucose, glycogen, fiber, starch, already known to students in organic chemistry. You can use their knowledge of inorganic chemistry — this will help to understand the chemistry of the cell. For example, the structure of a nucleic acid (NK) molecule is perceived more readily because students are aware of Carbon and phosphoric acid from inorganic chemistry. The concept of the third component of the NK molecule — the nitrogenous base — is developed using knowledge of the basics. The concept of amino acids and their ability to detect the reactions of acids and bases is developed on the basis of knowledge of organic chemistry about the amine group and the carboxyl group, and is facilitated by the knowledge that their students acquire from anatomy and physiology courses.

One of the means of achieving academic success is cross-curricular integration, whose purpose is to activate previously acquired knowledge, skills and competencies when studying a particular topic. This allows you to or-

ganically combine the subject studied with the previous and subsequent topics, to logically link the different disciplines into one, to determine their place in the future profession. Therefore, the knowledge gained in the study of natural sciences, is the basis of professional orientation and form a holistic picture of the student. Therefore, cross-curricular tasks should be used in the educational process. They may be problematic and searchable and may include problematic questions. These tasks should take into account the level of cognitive activity and the students' ability to work independently. All kinds of tasks should be designed in such a way that they develop a creative approach to the topic being studied, promote the development of skills and competences, rationally solve the set tasks. [1].

The construction of classes is determined by the nature of the content of the course, which should cover the most important problems of modern science. Numerous and varied facts are explored to unravel these problems. It is important to build a study of each topic in such a logical sequence: statement of the problem, consideration of the problem and conclusions from the topic. If the class is problematic, the teacher asks the students questions — a problem that should be solved in the class. Preparing for the class, the teacher breaks down the main question into separate, logically related questions, provides conclusions from them and summarizes the findings, and concludes — a short answer to the main question of the class — a problem. The method of preparation for the problematic lecture requires careful selection of the topic, as not every topic of the discipline can be problematic. It is advisable to carefully elaborate theoretical, practical, illustrative and other educational material, structure it and identify the components of problematic nature [8].

In the process of studying the course of biochemistry for the formation of general subject competencies use the following methods: verbal, visual and practical. Using verbal methods, the teacher transmits knowledge through lectures, stories, conversations. The main source of knowledge is the word of the teacher. Verbal methods play an important integrative role in relation to the learning material.

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ods play an important integrative role in relation to the learning material. By using visual methods — demonstration and observation — the teacher directs and refines students' perceptions. The main source of knowledge is the observation of demonstrated objects, experiments, images, not the word of the teacher, although he always plays a leading role in the whole cognitive process.

The third group of methods is practical. Here the main source of knowledge is the results obtained by students during laboratory work. All methods, when used properly in accordance with the content of the material, enrich knowledge, develop scientific outlook, thinking, practical skills.

The problematic construction of a lesson does not mean, however, that it should be built deductively. Classes can be different: some are deductively constructed, others are inductive, and the third are with a combination of deduction and induction, regardless of the order in which the textbook is presented. In the construction of the lesson should not follow any standard scheme: polls, explaining new material, fixing the explained. Sometimes the survey is included in the explanation process and sometimes it is brought to the end of the class. Fixing new material is often done in the course of explanation, summarizing parts of the content of the lesson and eventually summarizing it. In many classes, it is advisable to use generic schemes. Problem lectures are recognized by scientists as a means of providing high mental development, stimulating students' independent thinking, developing cognitive and professional interests, needs. They contribute to the deep intrinsic motivation of learning and developing a chosen profession, which manifests itself in a positive attitude towards the process of cognition, search activities and generate interest in their future profession.

An important point is the expansion of the role of chemical experimentation, which is an effective means of forming and developing concepts about organic matter. The experiments included in the content of the course syllabus relate to the determination of biologically important organic substances in animal objects. The use of experiment makes the study of the subject visible and accessible; helps to show students the static and dynamic aspects of learning in unity. Properly placed experiments and observations make it possible to acquaint students with some methods and techniques of research work; develop the ability to work independently. Being able to plan an experiment on a task, scientifically correct it and

record the results, analyze and draw conclusions — is very important and useful.

In conducting classes, preference should be given to different types of independent work [5]: solving problematic issues in the form of situational problems of practical orientation; creation of metabolic schemes of separate biochemical processes; filling in specially designed tables; using the project method, etc. These forms of independent work are effective as they include problematic and professional orientation, activation of students' creative abilities, presence of logical sequence of all stages of work and mandatory reporting of results, use of modern information technologies.

Repetition is included in the methodology of all topics. To properly organize repetitions, the teacher must be well aware of the logical connections in the course, clearly understand what material is based on the study of each topic, to learn what material it prepares in the future — that is, to know the development (movement) of concepts in the course. From these methodological positions should be chosen to repeat the main content of the sections and topics, releasing a minor. It is necessary to associate new material with the passed, developing concepts. This can, of course, be done by resorting to, for example, comparisons (theories, phenomena, signs, stages, etc.). It is during the comparison that students learn to think, analyze, summarize. It is also necessary to include an element of the new to the seemingly known: the selection of new facts, objects, the use of material that has passed in a new problem, new content and formulation of the question, etc.

Testing and accounting can be done using a variety of forms, but the main role is the questions of the teacher. Thanks to them, the student compares, compares, relates phenomena, looks for causal relationships, draws conclusions, summarizes the material. With the help of skillfully asked questions, the teacher not only checks that retained the student's memory from the read in the book, but also penetrates into the very process of mastering the knowledge that takes place in the student's mind.

In order to activate cognitive interest, it is necessary to systematically use scientific information of an applied nature. This information should be collected not only by the teacher but also by the students. A factor in stimulating students' cognitive interest in learning the course is to support their life experiences. Therefore, training should be based on knowledge of the role of nutrients in animal organisms, the importance of balanced feeding of

animals, the failure of which leads to impaired metabolic processes and the development of diseases (acidosis, alkalosis, ketosis, etc.).

In recent years, the share of students' independent work in the overall structure of the educational process has steadily increased, reflecting the tendency to ensure an active, objective role of the learner in the educational process [3]. It is the final stage of solving the educational and cognitive tasks, which were discussed at lectures, seminars, practical and laboratory classes. After all, knowledge can be considered as a student's property only if he has put their mental and practical efforts to obtain them.

The purpose of students' independent work is to form independence as a personality trait, the essence of which is the ability to systematize, plan, control and implement their activities without the help and control of the teacher.

The tasks of independent work can be the acquisition of certain skills, skills, consolidation and systematization of acquired knowledge, their application to solve practical tasks and perform creative work. The main requirements of controlling the independent work of students is the systematic and massive achievements of student learning [2].

Organizing students' independent work is one of the important tasks. Complete methodological support of all types of independent work of students allows to effectively manage this important type of educational activity. Independent work at the university involves the gradual assimilation of new material, repetition and consolidation, its application in practice. The effectiveness of independent work depends on its organization, content, interconnection and the nature of the tasks.

The teacher determines the volume and content of independent work, coordinates it with other types of educational activities, develops methodological means of conducting current and final control, analyzes the results of independent educational work of each student. The teacher should work to improve the methods of teaching, taking into account effective forms and methods of teaching. The teacher's skill is to have a proficient knowledge of teaching and upbringing methods, creative application of modern pedagogical technologies; rational management of students' cognitive and practical activity, their intellectual development.

The teacher must know thoroughly the theoretical material on the problem that he is working on, which

will enable him to choose the forms and methods of work correctly, to use them at certain stages of the class. In order to intensify the training, it is advisable to hold discussions that develop the skills of practical analysis, substantiated argumentation and scientific proof of the propositions put forward, promote the penetration into the essence of processes and phenomena, create an emotionally saturated atmosphere in the classes.

Taking into account the types of general and subject competences, which should be formed in students during the study of biological chemistry, and the fact that the object of assessment is knowledge, skills, experience, activity, emotional value of the subject, developed [8] system of diagnostics of the level of their formation by the following criteria and indicators: the level of mastery of subject knowledge: knowledge of theoretical material, correctness of performance of various types of tasks; ability to apply the acquired knowledge in practice: the ability to analyze, make generalizations, systematize theoretical material, find the necessary information and use it in practice; technique of performing the experiment and preparation of reporting documentation, ability and skills of working with chemical reagents and biochemical equipment, ability to observe the course of processes and their results, to make the correct reasoned conclusions, to make appropriate calculations, the ability to properly prepare reporting documentation (protocols) laboratory; personal qualities: readiness for employment, timeliness of tasks, independence, organization, responsibility, communication skills and skills (ability to work in a pair or group, skills of oral and written communication, ability to use biochemical language as a means of communication) and others.

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their results, to make the correct reasoned conclusions, to make appropriate calculations, the ability to properly prepare reporting documentation (protocols) laboratory; personal qualities: readiness for employment, timeliness of tasks, independence, organization, responsibility, communication skills and skills (ability to work in a pair or group, skills of oral and written communication, ability to use biochemical language as a means of communication) and others [8]:

- on the results of the current control: this type of control is carried out during laboratory, practical and seminar classes and involves the verification, assessment and correction of the acquired competences of students;
- by results of thematic control: this type of control is a generalization of each course topic (content module) in accordance with the work and study programs, its purpose is to diagnose the level of mastering of systemic, thematic knowledge, skills and skills;

- on the results of final control (exam): this type of control is a generalization (final) of the entire course of the discipline and is used to assess the final level of formation of all types of subject competences in the subject.

Assessment of the level of formation of general and subject competences is carried out during training sessions and according to the results of final control.

### Conclusions and Prospects

1. The content of the course allows to use various forms of organization of training: lectures, seminars,

educational researches, laboratory classes. The learning process involves the use of individual learning activities. In order to carry out the control of knowledge, it is advisable to conduct surveys in the classroom, perform test tasks, evaluate the laboratory tests.

2. The content of the course should be professionally oriented in order to formulate relevant competences. Each topic should combine information and tasks of fundamental content in parallel with professionally oriented material.

3. All methods, if properly applied to the content of the material, enrich the knowledge, develop scientific worldview, thinking, practical skills, and therefore, activity.

4. The peculiarity of the method of teaching the course “Biochemistry of Animals Fundamentals of Physical and Colloidal Chemistry” is the use of problem training, organization of student research activities. In order to intensify the training, it is advisable to hold discussions that develop the skills of practical analysis, substantiated argumentation and scientific proof of the propositions put forward, promote the penetration into the essence of processes and phenomena, create an emotionally saturated atmosphere in the classes.

5. The predicted results of the use of various forms and methods of teaching are the formation of the system of knowledge, skills and skills of students, as well as the achievement of the planned learning outcomes.

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