



**Iryna NIZHENKOVSKA,  
Olena KUZNETSOVA,  
Violetta NAROKHA**

## **Control of biological chemistry knowledge in the process of gaining the professional competences by future pharmacists**

The main goal of training of a professional pharmacist is to develop a system of professional skills and competencies that form the basis for future professional activities [17, 18]. Order No. 455 of the Ministry of Health of Ukraine of 30.05.2013 “On approval of Guidelines on Good Pharmaceutical Practice: Quality Standards of Pharmacy Services”, which is based on joint guidelines of the World Health Organization and the International Pharmaceutical Federation, defines major roles and functions of a pharmacist in the community and healthcare system [13]. A modern patient-centered approach in the provision of pharmaceutical care in Ukraine implies increased attention to the

quality of pharmaceutical education. Following the Law of Ukraine “On Higher Education”, the implementation of the European Credit Transfer System (ECTS) within the Bologna Process in the Higher Education of Ukraine is among the most important strategic goals of higher education in Ukraine [11, 12]. ECTS is a system for the accumulation and transfer of loans, focused on the student, based on the principles of transparency of learning, teaching and assessment [5]. The credits are awarded to the students upon completion of the required learning activities and the achievement of appropriate results, as evidenced by proper assessment. One of the benefits of the ECTS standard-based learning process is the introduction of a more flexible 7-point ECTS rating scale, which ranks students statistically [9]. Therefore, an important condition for the improvements in the quality of specialist training is the development and improvement of the forms and methods of quality control of students' academic achievements.

Modern pedagogical science defines the following didactic functions of control and evaluation of the students' educational and cognitive activities [2,6]:

- training - facilitating the repetition, refinement and systematization of educational materials, improvement of professional preparation of the student, providing feedback as a prerequisite for maintaining the efficiency and effectiveness of the learning process, which involves two subjects - the teacher and the student;
- diagnostic - identifying gaps in knowledge and skills, identifying the causes of difficulties encountered by the students, which allows the teacher to timely plan and adjust the methodology of teaching materials;
- assessment - determining the levels of knowledge, skills and competences of individual students and academic groups at a certain stage of discipline learning, as well as ensuring the accountability and openness of control results, which contributes to objective assessment and better learning;
- stimulating - stimulating the students' desire to improve the results of their activities, including learning, to encourage students to work systematically, to achieve better learning results and to overcome gaps in knowledge;
- developmental - promotion of students' motivation for learning, systematic work, better results of logical thinking and analysis of cognitive activity activation;

- educational - formation of several social and psychological qualities in students: time-management skills, discipline, honesty, diligence, care and neatness, independence, responsibility for the results of their work;
- prognostic - comparison of the identified levels of knowledge, abilities and skills with the requirements of the curriculum; determination of the ways to increase the effectiveness of the teacher's work and cognitive activities of the students;

Different types of periodic control are used to evaluate students' achievements and to establish the results after a specific topic, module or course completion - baseline, current, intermediate and final controls [3]. Depending on the specific type of control, there are certain forms of students' knowledge control, namely pass/fail examination, examination (discipline, module, final or graduation exam), OSPI (objective structured practical exam), standardized test, control work, report (on practice, students' research, etc.), coursework and diploma work, final qualification work, laboratory work, mini-projects, portfolio, presentation, abstract, situational tasks, simulation exercise, etc. [1, 4]. Modern didactics distinguishes the following methods of control by the method of student's competence evaluation: oral, written, test control, practical testing of skills, observation [16].

The content, methods and forms of knowledge control are determined following the didactic principles of control and evaluation of students' academic achievements. There are six basic didactic principles for student assessment and control [4]:

- thematic orientation;
- consistency;
- individual approach to each student;
- differentiation;
- objectivity;
- uniform requirements of the teachers of students' knowledge assessment;

The criteria for students' knowledge assessment in the discipline should reflect the student's achievement of the result in discipline's learning program, including knowledge levels, skills and competencies that are defined in the educational qualification characteristics of graduates of medical (pharmaceutical) higher education institution..

The methods of students' knowledge control in the discipline significantly affect final control results, the possibility of their analysis

and the statistical reliability of assessments. Control results of the students' educational achievements are used to evaluate the effectiveness of learning [14].

The purpose of this paper is to highlight the methodological approaches in the control of students' academic achievements and principles of assessment of students' knowledge and skills in discipline "Biological Chemistry", which are aimed at the optimization of educational process and improvement of professional training of the specialists in the pharmaceutical industry.

As a basic discipline, biological chemistry is focused on the training of highly qualified pharmacists and is one of the most important subjects in the system of medical and pharmaceutical education. The ultimate goal of mastering Biological Chemistry is to create a background of ideas about the molecular level of the human body development and functioning, biochemical mechanisms for the development of pathological conditions in the body and their necessary correction with drugs. Biological chemistry lays the foundation for studies of professional disciplines - pharmacology, clinical pharmacy, pharmacotherapy, drug toxicology, toxicology, forensic chemistry, etc.

The main goal of the Department of Pharmaceutical, Biological and Toxicological Chemistry of O.O. Bogomolets National Medical University (NMU) is the training of specialists competent in biochemical mechanisms of metabolism and energy regulation and ways to ensure normal cell, organ and system functions in living organisms, development of pathological processes in living organisms and principles of their correction using pharmaceutical preparations, which is of key importance for a future specialist in medicine.

The curriculum of Biological Chemistry for the students of the Faculty of Pharmacy, specialty "Pharmacy, Industrial Pharmacy", is consistent with the working curriculum for training specialists of the second (master) level of higher education, knowledge area 22 "Health Care" at O. O. Bogomolets NMU, specialty 226 "Pharmacy, Industrial Pharmacy", qualification "Master of Pharmacy", taking into account the educational and qualification curriculum for the training of specialists of the second (master) higher education level, Discipline 22 "Healthcare", qualification "Master of Pharmacy", approved by Academic Council of O. O. Bogomolets NMU. According to the working curriculum, discipline "Biological Chemistry" is studied during semesters IV-V for 180 hours (70 hours of practical work, 30 hours of lectures and 80 hours of independent work).

The curriculum includes baseline, current, intermediate and final controls of students' knowledge and skills throughout the course of discipline "Biological Chemistry". The list of the types and methods of control, means of diagnostics of students' knowledge, criteria for evaluation of individual forms of knowledge control and a scheme of point calculation and distribution are presented in the relevant sections of the curriculum of discipline "Biological Chemistry".

The Department of Pharmaceutical, Biological and Toxicological Chemistry of O.O. Bogomolets NMU has developed different educational and methodical materials to facilitate the controls of the academic performance of the students of the Faculty of Pharmacy: a list of theoretical questions in the discipline, tests of different levels of mastering, structured writing tasks, situational tasks, a list of practical skills that a student must complete upon graduation. The website of the Department presents most of the above-mentioned materials and methodological considerations for preparation for practical classes in biological chemistry for the students of the Faculty of Pharmacy, which contain tasks for independent work and self-control of knowledge on the topic of the classes. At the same time, the tests for the control of the baseline knowledge, which are constantly updated and complemented, are not in open access. To deepen the theoretical knowledge of students in the course of Biological Chemistry and prepare for the Unified State Qualification Exam (USQE) in specialty "Pharmacy, Industrial Pharmacy" "Step 1. Pharmacy", current and final control of knowledge of biological chemistry, the staff of the Department of Biological Chemistry have prepared a manual, "Biological Chemistry. Test tasks with explanations for students of the Faculty of Pharmacy".

Baseline (zero) knowledge control is used at the beginning of the practical training in biological chemistry to check the level of knowledge of the students in related disciplines necessary for mastering the discipline that the student is studying. Normally it is carried out in the form of a test paper. The results of the baseline control are not taken into account in the student's current learning as they are only for the teacher.

Current control is a means to detect a degree of mastering of learning materials. It is carried out at each practical session according to the specific objectives of the topic to check the degree and quality of the mastering of the material being studied. Students' current learning activities are monitored using such tools as computer-based testing, oral questioning, structured written paper, situational tasks, laboratory studies and interpretation of the results, and control of practical skills.

Intermediate control is the evaluation of the student's knowledge of the content module program material, obtained during the implementation of certain types of work in practical classes in biological chemistry and independent work during the semester. It is conducted in the form of an intermediate certification based on the result of the current training in the last practical class in the semester.

The final control is carried out upon completion of the study of the discipline to assess students' knowledge, skills and competences in biological chemistry and is conducted in the form of an exam. The purpose of the exam is to check the students' level of knowledge by the volume, quality and depth of the subject of the discipline, and the ability to apply them in practice.

When monitoring and evaluating students' academic achievement at the Department of Pharmaceutical, Biological and Toxicological Chemistry, standardized test control is preferred, using a variety of test tasks: multiple-choice recognition, compliance, sequence, design, classification, and other tests. Test control has become one of the priority means of the formal control of knowledge in the modern educational process, it is widely used at various stages of education, and is a leading method in the assessment of the quality of knowledge in higher medical (pharmaceutical) educational institutions [10].

The following functions are performed as a form of control tests [14]:

- diagnostic - reveal the level of knowledge;
- educational - stimulate the cognitive activity of students;
- disciplinary - discipline students, help to identify and overcome learning gaps.

Standardized test control has significant advantages over traditional control methods [7, 8]:

- quality of knowledge and skills of students of the whole group can be checked for a limited time;
- control of knowledge, competencies, and skills is performed at the necessary, pre-planned level;
- knowledge and skills of students are evaluated objectively;
- student's attention is fixed not on the formulation of the answer, but on the understanding of its essence;
- students' self-control of their own educational and cognitive activity.

However, test knowledge is known to have drawbacks [7, 8]:

- probability of random choice of correct answer;

- the ability to evaluate only the final result (right-wrong) in closed-type tests, and the process that led to this result is not disclosed;
- standardization of thinking;
- lack of speech development;
- a large amount of time to complete the required number of tests.

When developing test tasks, we meet the general requirements [15]:

- the content of the test and the number of test tasks should be consistent with the purpose of the test;
- formulate tasks clearly and briefly;
- avoid the use of expressions and words that are unintelligible for students;
- follow the rules of grammar and punctuation;
- avoid interrelated tasks where the content of one task prompts the answer to another;
- avoid inadvertent prompts in tasks and answers.

Another important form of students' knowledge and skill control at the Department of Pharmaceutical, Biological and Toxicological Chemistry is written answers to situational tasks. Certain situations serve as certain examples of ideas and generalizations for students, provide a basis for a high level of abstraction and thinking, interest and admire, help link learning to real-life experience, and provide a basis for the effective use of knowledge and skills in the practice of future pharmacists. This exercise teaches students to ask questions, to distinguish facts from opinions, to identify important and minor circumstances, to analyse and make decisions. Equally important is that reviewing, discussing and solving situational problems are the best way to prepare students for the Unified State Qualification Exam (USQE) and the "Step 1. Pharmacy" license exam.

According to the normative documents, the student should develop certain competencies and skills necessary for further professional activity, to learn to transform the received information into their own professional competences, i.e. a set of practical skills, methods of activity, personal-psychological abilities to know the necessary range of subjects and phenomena necessary for the implementation of the productive professional activity in the field of pharmacy. The most important link in the educational process at the department of pharmaceutical, biological and toxicological chemistry is the acquisition of practical skills (methods of qualitative and quantitative analysis of the content of bio-organic compounds in biological fluids and tissues) and gradual formation, professional skills in students, spectrometry,

chromatography, etc. In the course of the laboratory examination, the student should demonstrate the necessary knowledge of laboratory ware, equipment and competence to work with them to assay-specific samples, the skill to register and analyse the data obtained, and the skill to interpret the results of the practical work.

The training achievements of students in biological chemistry are assessed following the criteria developed by the department for the evaluation of the results of students' current activity, taking into account all stages of practical training:

- evaluation of the solution of test problems;
- evaluation of the student's oral response;
- assessment of the solution of situational problems;
- assessment of the implementation of a practical skill or knowledge.

For each training stage the student receives a score of "5-4-3-2", from which the teacher determines the arithmetic average score, which is translated into points according to the distribution, which was conducted by the department at the beginning of the discipline study. If the mean arithmetic score is 2 for the class, this equals to 0 points.

The student has the opportunity to get acquainted with the control results, to analyse the accomplishment of tasks and mistakes. The teacher should explain why a particular score is given. A student considers a score objective only upon adequate argumentation.

The educational topics that are assigned by the discipline curriculum as students' independent work in the extra-curricular time should also be assessed.

The department also credits the students with additional points for participating and receiving prizes in the All-Ukrainian Olympiad and other Olympiads in academic disciplines.

The assessment of student achievement in the discipline "Biological Chemistry" is rating and is ranked using a multi-scale score as the sum of points for current activity and examination and is determined according to USQE and the scale adopted in Ukraine [9].

The results of the study course "Biological Chemistry" include special (professional, subject) competencies: the ability to explain the biochemical mechanisms of pathological processes in living organisms and the principles of their correction by pharmaceuticals, to plan and perform biochemical laboratory tests; to interpret results of biochemical laboratory tests to assess the physiological state of the human body; to use reference and methodological literature.



Thus, the method of control of students' knowledge, skills and competences in biological chemistry at O.O. Bogomolets NMU Department of Pharmaceutical, Biological and Toxicological Chemistry is adapted to the modern pharmaceutical education conditions and is aimed at the development of professional competence and further professional activity of future specialists in the pharmaceutical field. To evaluate students' preparation adequately, complex, diverse methods of control and assessment should be used with an optimal and creative approach to their use depending on the didactic purpose, the content of the educational material, the level of students' awareness and their intellectual development. To increase the efficiency of the educational process, more attention should be paid to internal monitoring at the level of the higher education institution, and not only to rely on the results of the USQE and "Step1. Pharmacy" license exam.

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*Authors*

Nizhenkovska Iryna Volodymyrivna  
*MD, Professor,  
Head of the Department  
of Pharmaceutical, Biological and  
Toxicological Chemistry,  
O.O. Bogomolets National Medical University,  
Kyiv, Ukraine  
E-mail: dekan-farm@ukr.net*

Kuznetsova Olena Volodymyrivna  
*PhD in Biochemical Sciences,  
Associate Professor,  
Department of Pharmaceutical, Biological and  
Toxicological Chemistry,  
O.O. Bogomolets National Medical University,  
Kyiv, Ukraine  
E-mail: kuznetsova.lena9@gmail.com*

Narokha Violetta Petrivna  
*PhD in Pharmacology,  
Associate Professor, Department of Pharmaceutical,  
Biological and  
Toxicological Chemistry,  
Bogomolets National Medical University,  
Kyiv, Ukraine  
E-mail: v.narokha.nmu@gmail.com*

*Abstracts*

НИЖЕНКОВСЬКА ІРИНА, КУЗНЕЦОВА ОЛЕНА, НАРОХА ВІОЛЕТТА. **Контроль якості знань біологічної хімії у процесі формування професійної компетентності майбутнього провізора.** Провідною метою професійної підготовки фармацевтичного працівника є формування системи професійних умінь та навичок, що складають основу майбутньої професійної діяльності. У зв'язку з цим, важливою умовою підвищення якості підготовки спеціалістів є розвиток і вдосконалення форм і методів контролю якості навчальних досягнень студентів. В статті досліджені дидактичні принципи контролю якості знань, висвітлені методичні підходи до контролю навчальних досягнень студентів та принципи оцінювання знань, вмінь і навичок студентів з дисципліни «Біологічна хімія», які спрямовані на оптимізацію навчального процесу і підвищення ефективності професійної підготовки фахівців фармацевтичної галузі. Для об'єктивної оцінки знань, вмінь і навичок студентів необхідно застосовувати комплексні, різноманітні методи контролю й оцінювання, адекватно і творчо підходити до їх використання залежно від дидактичної мети, змісту навчального матеріалу, рівня компетенції і інтелектуального розвитку студентів. Для підвищення ефективності навчального процесу потрібно більше уваги приділяти моніторингу знань студентів на рівні вищого навчального закладу.

**Ключові слова:** контроль якості знань, оцінювання знань, професійні компетентності.

НИЖЕНКОВСКАЯ ИРИНА, КУЗНЕЦОВА ЕЛЕНА, НАРОХА ВІОЛЕТТА. **Контроль качества знаний биологической химии в процессе формирования профессиональной компетентности будущего провизора.** Ведущей целью профессиональной подготовки фармацевтического работника является формирование системы профессиональных умений и навыков, составляющих основу будущей профессиональной деятельности. В связи с этим, важным условием повышения качества подготовки специалистов является развитие и совершенствование форм и методов контроля качества знаний студентов. В статье исследованы дидактические принципы контроля качества знаний,

*освещены методические подходы к контролю знаний студентов и принципы оценивания знаний, умений и навыков студентов по дисциплине «Биологическая химия», направленные на оптимизацию учебного процесса и повышения эффективности профессиональной подготовки специалистов фармацевтической отрасли. Для объективной оценки знаний, умений и навыков студентов необходимо применять комплексные, разнообразные методы контроля и оценивания, адекватно и творчески подходить к их использованию в зависимости от дидактической цели, содержания учебного материала, уровня компетенции и интеллектуального развития студентов. Для повышения эффективности учебного процесса нужно уделять больше внимания мониторингу знаний студентов на уровне высшего учебного заведения.*

**Ключевые слова:** контроль знаний, оценивание знаний, профессиональные компетентности.

**NIZHENKOVSKA IRYNA, KUZNETSOVA OLENA, NAROKHA VIOLETTA. Control of biological chemistry knowledge in the process of gaining the professional competences by future pharmacists.** *The main goal of training a professional pharmacist is to develop a system of professional skills and competencies that form the basis for future professional activities. Therefore, in order to raise the quality of specialist training, an important condition is to develop and improve the forms and methods of quality control of students' academic achievements. The article explores the didactic principles of knowledge quality control, highlights the methodological approaches in the control of students' academic achievements and principles of assessment of students' knowledge and skills in discipline "Biological Chemistry", which are focused on the optimization of educational process and improvement of professional training of the specialists in the pharmaceutical industry. For sake of the unbiased assessment of students' knowledge and skills, the complex and diverse methods of control should be used with an adequate and creative approach to their applications, depending on the didactic purpose, the content of the educational material, the level of students' competencies and their intellectual developments. In order to increase the efficiency of the educational process, more attention should be paid to internal monitoring at the level of the higher education institution.*

**Keywords:** knowledge control, knowledge assessment, professional competencies.



NIŻENKOWSKA IRYNA, KUZNECOWA OLENA, NAROCHA WIOLETTA. **Kontrola jakości znajomości chemii biologicznej w procesie formowania profesjonalnej kompetencji przyszłego farmaceuty.** *Głównym celem szkolenia zawodowego pracownika farmaceutycznego jest kształtowanie systemu umiejętności zawodowych, które stanowią podstawę przyszłej działalności zawodowej. W związku z tym ważnym warunkiem poprawy jakości kształcenia specjalistów jest rozwój i doskonalenie form i metod kontroli jakości osiągnięć akademickich studentów. Artykuł bada zasady dydaktyczne kontroli jakości wiedzy, wyjaśnia metodyczne podejścia do kontroli osiągnięć edukacyjnych studentów oraz zasady oceniania wiedzy, znajomości studentów dyscypliny „Chemia biologiczna”, której celem jest optymalizacja procesu edukacyjnego i doskonalenie szkolenia zawodowego specjalistów z branży farmaceutycznej. Aby obiektywnie ocenić wiedzę, umiejętności i kompetencje studentów, należy zastosować złożone, różnorodne metody kontroli i oceniania, odpowiednio i kreatywnie je wykorzystać w zależności od celu dydaktycznego, treści materiałów edukacyjnych, poziomu kompetencji i rozwoju intelektualnego studentów. W celu zwiększenia efektywności procesu edukacyjnego należy zwrócić większą uwagę na monitorowanie wiedzy studentów na poziomie szkolnictwa wyższego.*

**Słowa kluczowe:** kontrola jakości wiedzy, ocena wiedzy, kompetencje zawodowe