



KAPITEL 3 / CHAPTER 3 ⁴

DEVELOPMENT OF ELECTIVE COURSES FOR FOREIGN STUDENTS OF THE FACULTY OF PHARMACY

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Introduction

Higher pharmaceutical education is undergoing changes in accordance with the needs of the healthcare system and the requirements of international standards. The main goal of higher pharmaceutical education is to provide highly qualified training of pharmacists capable of critical thinking and making conscious and quality decisions in various practical situations of professional direction. In this regard, the style of pedagogical teaching of disciplines should also undergo changes and new modern approaches to the construction of the educational process are needed [1, 2].

The teacher should focus on the personal and professional individuality of each student, use a differentiated and creative approach, variable forms and training methods in the learning process. Among modern technologies and methods, a special place in the educational and training process is occupied by various interactive methods, because they allow one to focus on individual and group activities of students during the teaching educational disciplines, especially elective disciplines [3, 4].

According to the Law of Ukraine “On Higher Education” [5] students have the opportunity to choose elective courses. In Ukraine, the amount elective courses provided by the relevant educational program and curriculum is not less than 25% of the total number of ECTS credits, provided for this level of higher education. Elective courses realize an important role in students’ professional and personal development by integrating knowledge of many subjects and enriching their professional portfolio. They allow students to enhance their knowledge, skills, professional attitude and motivation, to activate their cognitive activity [6, 7].

The paper discusses the methods and approaches of teaching elective courses for foreign (English-speaking) pharmaceutical students at Department of Analytical, Physical and Colloidal Chemistry of Bogomolets National Medical University in conditions of distance learning, namely “Actual problems of pharmacy education”, “Fundamentals of patent law” and “Basics of chemical metrology”. More than three thousands foreign students from 64 countries are studying in Bogomolets National Medical University, in particular more than 2,500 English-speaking students from 48 countries [8]. So, the contingent of foreign citizens is heterogeneous in terms of national, social and religious characteristics, different levels of education and specific institutions in which foreigners received secondary education.

An important component of the teaching methodology of the elective disciplines at department of analytical, physical and colloid chemistry is the competency-based

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approach. A competency-based approach to teaching allows to provide students not only with certain knowledge and typical skills, but also to prepare them for a variety of practical situations that may arise in future professional activities [9].

Today, the Ukrainian pharmaceutical market is a fast-growing. The development of the pharmaceutical sector in Ukraine is characterized by an increasing the share of science-intensive, high-tech products regarding international standards. The current challenges facing the Ukrainian healthcare and pharmaceutical sector include ensuring a high level of quality and effectiveness of pharmacotherapy and disease prevention, developing human potential, increasing global competitiveness in the world market of pharmaceutical services. In view of this, the implementation of the competency-based approach in the teaching of future pharmacists in modern higher medical educational institutions is focused on formation of current set of specific competencies that relate to the qualitative professional performance. So, the main driver for adopting competency-based educational designs is the need to prepare pharmacists for their societal role, ultimately leading to improvement of health care and patient safety [10-13].

In the pharmacy literature, the “term” competency refers to a set of abilities, knowledge, attitudes, skills and beliefs gained by individuals from education, training and clinical experience, which enable them to practice effectively in the pharmacy profession. The traditional role of the pharmacist in supplying drugs needs to be expanded to a health care professional. The pharmacist should be capable of consolidating his solid scientific education with the practical integration of knowledge [10, 14-17].

It is also necessary to note the formation of a special communicative style between a teacher and a student – a student-centered model [18]. Due to following the student-centered approach, the student with his individual characteristics is the center of the educational process and its active participant, which allows him to develop the necessary special competencies and become a competitive professional. Active learning techniques are implemented: students solve certain practical and situational exercises, discuss, express their point of view, discuss problematic issues. In this process, the teacher provides full comprehensive support, as a consultant and organizer of activities, and not just as a carrier of information and knowledge [19].

Modern realities force teachers to look for more effective methods of working with students. The global pandemic is associated with quarantine measures that are forcing universities, schools and other educational institutions to switch to distance learning. Therefore, teachers of the department of analytical, physical and colloid chemistry analyzed the modern system of interactive techniques and related methods. Interactive learning is a set of pedagogical methods that include the use of social networks and various computer or online applications and programs during training sessions, which ensure effective learning of material and testing of knowledge [4].

Interactive methods such as brainstorming [20], case studies [21] and business



games [22] are used during the teaching proposed elective disciplines. In addition, the involvement of flipped classes [23] and the use of a spiral learning approach [24] helps to reveal the essence of the discipline as effectively as possible and to provide students with the necessary general and professional competencies [4].

Bogomolets National Medical University has implemented the platform LIKAR_NMU [25] on the basis of Learning Management Systems Moodle for education. The using portal LIKAR_NMU allows creating a well-structured teacher-student interaction [26, 27].

Table 1 – Organizational structure of the seminar

Stages of the seminar	Time distribution	In-class activity
Preparatory stage	20 min.	
Organizational issues	5 min.	
Formation of motivation	5 min.	Discussion the actuality of the topic
Control of the initial level of students' knowledge	10 min.	Test questions, oral interview, interactive methods
Main stage	45 min.	
Study of the topic (according with the tasks of proposed elective courses)		Discussion the key questions according to the topic of seminar, answering the students' questions, consideration of calculated and situational problems, interactive methods, presentation of essays, simulated scenarios of different situations in real pharmacist work
Final stage	25 min.	
Control of the final level of students' knowledge (according with the tasks of proposed elective courses)	15 min.	Situational tasks, calculated problems, test questions, interactive methods
Overall results. Assigning marks	10 min.	

All useful materials for studying elective disciplines were posted on a learning platform LIKAR_NMU and available for students:

- block “general information about the course” includes pdf-files of curriculum of the course, syllabus of the course, regulations and criteria for evaluating the current control and differential credit;

- block “recommended literature” includes pdf-files of useful books and articles



for studying the course;

– block “lectures” includes PowerPoint presentations of lectures and pre-recorded video lectures;

– block “seminars” includes methodological instructions with complete information about the seminars and tasks for estimation the students’ knowledge.

Messengers Viber / Telegram were also used in educational process as an additional and effective element of the courses for the encouraging information sharing among students, increasing the motivation of the students about the course, information sharing the documents related to a subject, instant answers to questions [10, 26, 28]. Each lecture and seminar were occurred like videoconference via Zoom or Google Meet technology according to the class schedule.

Organizational structure of each seminar is presented in Table 1. Duration of each seminar is 90 minutes. Out-class activity of the students includes reading of recommended literature and articles, performing the tasks for individual work of students (according to the curriculum of discipline), studying the lectures’ material.

The authors would like to describe the structure of proposed elective courses and their role for future pharmacists.

3.1. The elective course “Actual problems of pharmacy education” [29-31]

The 3.2-credit hours elective course “Actual problems of pharmacy education” was created for first-year pharmacy foreign students. For the first time it was offered during the fall semester 2021/2022 academic year. There were eighteen students enrolled in the course “Actual problems of pharmacy education” in 2021/2022 academic year (Table 2).

Table 2 – Students’ demographic data (course “Actual problems of pharmacy education”)

Country	Female	Male
Republic of Turkey		4
Federal Republic of Nigeria	4	3
Republic of Lebanon	1	
Kingdom of Morocco	2	1
Islamic Republic of Iran	1	
People's Democratic Republic of Algeria		2

The aim of teaching the elective course “Actual problems of pharmacy education” is to provide students with relevant information on the development of pharmaceutical education in Ukraine, because, as usually, foreign students do not know anything about the Ukraine and its education system. The tasks of the elective course are:



- to reveal the current tasks of the development of pharmaceutical education at the present stage of the country's development in the context of European integration;
- to analyze the modern regulatory and legal support of the pharmaceutical health care sector of Ukraine, its compliance with international, in particular European legislation;
- to offer recommendations for improving the Code of Ethics for Pharmacists, taking into account the new policy of its development.

Studying the discipline “Actual problems of pharmacy education” provides the opportunity to acquire the following learning outcomes in accordance with the educational and professional program “Pharmacy”:

- to carry out professional activities in social interaction based on humanistic and ethical principles; to identify future professional activity as socially significant for human health;
- to apply knowledge from general and specialized disciplines in professional activity;
- to argue information for making decisions, be responsible for them in standard and non-standard professional situations; to adhere to the principles of deontology and ethics in professional activity.

The elective course consisted of ten lectures (ten hours), ten seminars (twenty hours) and independent work of students (sixty six hours). The information about the course topics and distribution of the hours between them is presented in Table 3.

Consider the using of flipped class methodology on example of studying the topic 5 “Education of a leader in the pharmaceutical industry”.

Questions for pre-class studying:

- what is leadership?
- leadership in pharmacy education;
- leadership in curriculum design;
- seven-star pharmacist concept and eight-star pharmacist concept;
- leadership competencies;
- process for effective leadership;
- Code of ethics for community pharmacists.

Tasks for in-class discussions:

- propose the best definition for term “leadership” according to your own opinion.

Argue your answer;

- why leadership is important for pharmacy education?
- seven-star pharmacist concept and eight-star pharmacist concept. Explain each attribute of these concepts;
- is an additional eighth attribute (researcher) important for pharmacy education?

Explain your answer;



Table 3 – Structure of the discipline “Actual problems of pharmacy education”

Name of topic	Number of hours		
	lectures	seminars	students' independent work
Topic 1. Bologna process and quality of education.	1	2	7
Topic 2. Restructuring of the higher education in Ukraine according to the “Law on Higher Education”, International Standard Classification of Education (ISCED-2013) and National Qualification Framework (NQFs).	1	2	7
Topic 3. Organization and control of independent work of students.	1	2	7
Topic 4. Current trends in the development of higher pharmacy education.	1	2	7
Topic 5. Education of a leader in the pharmaceutical industry.	1	2	7
Topic 6. Pharmacy education in Ukraine and abroad, stages of its development.	1	2	7
Topic 7. Innovative technologies of teaching disciplines.	1	2	6
Topic 8. Research work of students.	1	2	6
Topic 9. Today's and problems of higher education in Ukraine.	1	2	6
Topic 10. The role of chemical and humanities in the education of pharmacists.	1	2	6
Total hours	10	20	66

– explain the role of curriculum design for education of a leader in pharmacy education;

– name leadership competencies. Which are the most important for future pharmacists according to your own opinion?

– discuss the main points of Code of ethics for community pharmacists.

Flipped classes will provide an opportunity for active learning and student engagement in a variety of hands-on activities such as individual assignments, discussion, debate and critical thinking [23].



3.2. The elective course “Fundamentals of patent law” [4, 32, 33]

The 2.0-credit hours elective course “Fundamentals of patent law” was created for second-year pharmacy foreign students. For the first time it was offered during the fall semester 2021/2022 academic year. There were seven students enrolled in the course “Fundamentals of patent law” in 2021/2022 academic year and ten students in 2022/2023 academic year (Table 4).

Table 4 – Students’ demographic data (course “Fundamentals of patent law”)

Country	Female	Male
Republic of Turkey	1	4
Federal Republic of Nigeria	4	3
State of Palestine		1
Kingdom of Morocco	2	
Islamic Republic of Iran	1	1

The purpose of teaching the optional course “Fundamentals of patent law” is to acquire the students the skills to identify potential patentable objects, prepare a description for an application for an object of industrial property (invention, utility model, industrial design, mark for goods and services) and work with databases of scientific and patent information.

The main tasks of studying the elective course “Fundamentals of patent law” are:

- to master the general principles of legal protection of intellectual property objects;
- to disclose the practical possibilities of using industrial property objects in pharmacy and medicine;
- to develop the ability to abstract thinking, analysis and synthesis;
- to apply knowledge in practical situations and make informed decisions;
- to use the modern information search technologies for professional activities.

Studying the discipline “Fundamentals of patent law” provides the opportunity to acquire the following learning outcomes in accordance with the educational and professional program “Pharmacy”:

- to apply knowledge from general and specialized disciplines in professional activity;
- to use the results of independent search, analysis and synthesis of information from various sources to solve typical tasks of professional activity;
- to argue information for decision-making, bear responsibility for them in standard and non-standard professional situations; to adhere to the principles of deontology and ethics in professional activity;
- to carry out professional activities using information technologies, “Information databases”, navigation systems, Internet resources, software and other



information and communication technologies;

The elective course consisted of ten lectures (ten hours), five seminars (ten hours) and independent work of students (forty hours). The information about the course topics and distribution of the hours between them is presented in Table 5.

Table 5 – Structure of the discipline “Fundamentals of patent law”

Name of topic	Number of hours		
	lectures	seminars	students' independent work
Topic 1. General information about the intellectual property system.	1	1	4
Topic 2. Copyright and related rights. Legal protection of inventions and utility models.	1	1	4
Topic 3. Legal protection of industrial designs, trademarks, patent application.	1	1	4
Topic 4. Legal protection of medicines and their manufacturing process, trade dress protection, protection of names and brand names and other intellectual property items.	1	1	4
Topic 5. Role of patent information and patent documentation in the development and creation of industrial property in pharmacy.	1	1	4
Topic 6. Peculiarities of patent research in pharmacy.	1	1	4
Topic 7. Intellectual property agreements.	1	1	4
Topic 8. Commercialization of intellectual property.	1	1	4
Topic 9. International cooperation in the field of intellectual property.	1	1	4
Topic 10. International system of industrial property protection.	1	1	4
Total hours	10	10	40

As an interactive component, tests created using the Quizizz [34] platform were used in the classes. Interactive methods function as follows: in accordance with the plan of seminar, the teacher “turns on” interactive elements (tests, games, videos, etc.) at the scheduled time, students must perform certain actions in accordance with the task protocol. The execution of these actions, as well as the transition from one task to another, is coordinated and controlled by the teacher. Each action of each interactive element is aimed at obtaining a planned result. For example, about ten interactive tests and games were held in each lesson of this discipline. The topic of the questions and



the choice of the structure of the game forms fully corresponded to the educational requirements and was based on the basic concepts, terms, and concepts presented in the academic subject curriculum of the course [4].

3.3. The elective course “Basics of chemical metrology” [35-37]

The 2.0-credit hours elective course “Basics of chemical metrology” was created for second-year pharmacy foreign students. For the first time it was offered during the spring semester 2021/2022 academic year. There were four students enrolled in the course “Basics of chemical metrology” in 2021/2022 academic year and eighteen students in 2022/2023 academic year (Table 6).

Table 6 – Students’ demographic data (course “Basics of chemical metrology”)

Country	Female	Male
Republic of Turkey	1	6
State of Palestine		1
Kingdom of Morocco	2	
Federal Republic of Nigeria	4	3
Republic of Lebanon	1	
Islamic Republic of Iran	1	1
People's Democratic Republic of Algeria		2

The aim of the course “Basics of Chemical Metrology” is to acquire the practical skills of statistical processing of the results of chemical experiment, interpretation and evaluation of the results of medicines analysis in accordance with the requirements of the State Pharmacopoeia of Ukraine.

The main tasks of studying the discipline “Basics of Chemical Metrology” are:

- to form of students’ knowledge and skills regarding the assessment of metrological characteristics of chemical analysis methods, validation of analytical methods and tests;
- to acquire of statistical processing skills and presentation of measurements results.

Studying the discipline “Basics of Chemical Metrology” provides the opportunity to acquire the following learning outcomes in accordance with the educational and professional program “Pharmacy”:

- to apply knowledge from general and specialized disciplines in professional activity;
- to analyze information obtained as a result of scientific research, generalize, systematize and use it in professional activities;



- to plan and implement professional activities on the basis of normative legal acts of Ukraine and recommendations of proper pharmaceutical practices;
- to determine the main organoleptic, physico-chemical, chemical and pharmaco-technological indicators of medicines, substantiate and choose methods for standardization, carry out statistical processing of the results in accordance with the requirements of the State Pharmacopoeia of Ukraine.

The elective course consisted of ten lectures (ten hours), five seminars (ten hours) and independent work of students (forty hours). The information about the course topics and distribution of the hours between them is presented in Table 7.

Table 7 – Structure of the discipline “Basics of Chemical Metrology”

Name of content parts and topics	Number of hours		
	lectures	seminars	students' independent work
Topic 1. Basics of metrology.	1	–	6
Topic 2. Errors of measurements.	1	2	7
Topic 3. Statistical analysis of results of chemical experiments in accordance with the requirements of State Pharmacopoeia of Ukraine.	3	4	8
Topic 4. Validation criteria for analytical procedures in accordance with the requirements of State Pharmacopoeia of Ukraine.	1	2	7
Topic 5. Mathematical statistics and theory of probability.	2	–	8
Topic 6. Chemometrics and chemometric methods in chemistry.	2	2	4
Total hours	10	10	40

The case studies were used for teaching the course “Basics of chemical metrology”. The general aim for using case studies is to illustrate the importance of processing of results of chemical analysis in solving different tasks in pharmaceutical analysis. Also, using this method provides the increasing of interest among students in chemical metrology and as the result most of the students were involved in the case studies solving process.

Let us demonstrate some case study examples:

Case study 1

Results of standardization of potassium permanganate solution using oxalic acid solution as primary standard (mole/dm³) are: 0.1250; 0.1255; 0.1265; 0.1260; 0.1245. Process the data, namely: verify the homogeneity of the results; determine the



confidence interval (95% confidence level); determine the quantity of significant numbers in the final result.

Case study 2

Quality control of drug “A” (active substance of metoprolol tartrate) includes the spectrophotometric determination of metoprolol tartrate. According to the regulatory documentation, the content of the active substance should vary from 95.0 to 105.0 mg. The following results were obtained from the five parallel determinations, mg: 96.74; 96.88; 97.0; 97.36; 98.43. Perform the statistical analysis of the given results at the 95% confidence level and estimate their repeatability.

Case study 3

According to the regulatory documentation, the content of metamizole sodium in drug “A” is carried out by iodometric titration. For metrological certification of a new titrimetric method for the metamizole sodium determination in the drug “B”, a sample containing 503.00 mg of metamizole sodium was analyzed. The following results were obtained from the ten parallel determinations, mg: 498.73; 505.23; 509.42; 509.52; 513.12; 523.84; 524.41; 525.31; 534.89; 537.30. Check the presence of the significant systematic error of the titrimetric method at the 95% confidence level.

Case study 4

It is known that one of the pharmacopoeia criteria of drug quality is the indicator of dosage uniformity. Traditionally, the drugs analysis of the dosage uniformity is carried out by high-performance liquid chromatography, gas chromatography and ultraviolet-visible spectrophotometry, etc. Near-infrared spectroscopy is an alternative, fast, convenient method of analysis of dosage uniformity, but its implementation requires a validation procedure. In order to assess the reproducibility and correctness of the new method of near-infrared spectrometry, the analysis of some drug “A” for dosage uniformity is carried out by two methods: ultraviolet-visible spectrophotometry (method I) and near-infrared spectrometry (method II). It is known that the method of ultraviolet-visible spectrophotometry is metrological certified, so does not contain systematic errors. The results of determination of chloropyramine hydrochloride content in tablets “A” by two methods are, mg/tablet:

- 1) 26.22; 26.49; 26.55; 26.55; 26.65; 26.76; 26.83; 26.85; 27.08; 27.60;
- 2) 26.15; 26.40; 26.56; 26.56; 26.67; 26.68; 26.72; 26.77; 26.95; 27.43.

Compare of two methods of analysis by reproducibility at the 95% confidence level.

Conclusion

In conclusion, it should be noted that interactive learning methods play an important role in the education system. By alternating various interactive methods or applying them simultaneously, it is possible to achieve a high efficiency of assimilation of educational material and to form competences in future pharmacists. Modern education should be aimed at the development of a person's personality, the disclosure



of his capabilities, talents, self-awareness, and self-realization. The application of these technologies in the educational process enriches the structure of knowledge and approaches to learning. The student understands the depth of knowledge and the effectiveness of his abilities.

The course “Actual problems of pharmacy education” is the opportunity for foreign pharmacy students to learn about education system of Ukraine and development of pharmacy education (for instance, Bologna Process, the “Law of Ukraine on Higher Education”, National Qualification Framework and International Standard Classification of Education) and to learn a lot of useful points for better understanding profession of the pharmacist (for instance, Code of ethics for community pharmacists, seven-star pharmacist concept and eight-star pharmacist concept, leadership competencies, role of chemical and humanities). The responses to survey questions revealed an overall positive attitude of students to the organizing the course and its quality. Students described the course as enlightening, useful and informative [29].

The introduction of the optional discipline “Fundamentals of Patent Law” into the initial plan of training future pharmacists was logical and correct, because thanks to it, students acquire the necessary knowledge of fundamentals of patent law, intellectual property, and technology transfer. After completing the discipline, the students noted that the course was essential for the formation of a qualified personality of a future pharmacist. The students especially noted such necessary acquired skills and knowledge as the Patent Laws of Ukraine and the main resolutions of the Cabinet of Ministers, which regulate the issue of industrial property; rules for drawing up and submitting applications for inventions, utility models, industrial designs and trademarks for goods and services; patent search in databases of Ukraine and other countries; rights and obligations of authors and patent owners of industrial property in Ukraine [4].

The relevance of chemical metrology to pharmacy practice is not apparent to most pharmacy students. The pharmacy case studies presented in this work illustrated that the chemical metrology is the important section of analytical chemistry, and metrological control and processing of results of chemical analysis is a necessary step in solving any quantitative analysis task and so the same time very important for pharmaceutical analysis of drugs and substances. These case studies gave the pharmacy students an insight into the different roles of the chemical metrology in pharmacy industry [35]. Overall, students felt that the course “Basics of chemical metrology” was educational, engaging, and well organized with effective delivery of material.

So, the elective courses “Actual problems of pharmacy education”, “Fundamentals of Patent Law” and “Basics of chemical metrology” were successfully conducted achieving the desired learning outcomes and were well received by the students.