

ACTUAL ISSUES OF FORMATION OF PROFESSIONAL COMPETENCES OF FUTURE PROFESSIONALS WHEN STUDING GOOD PHARMACEUTICAL PRACTICES

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INTRODUCTION

The formation of competencies of future professionals for the pharmaceutical field, taking into account the relevance and expectations of potential employers, is an important component in the development of educational-and-professional (EPP) and educational-and-scientific programs (ESP) at all cycles of higher education (HE).

For this reason, the meetings of professors and students with employers, among which “Arterium” Corporation – the leading pharmaceutical enterprise in the region, are held systematically at the Lviv Polytechnic National University.

At one of such meetings, in 2016, precisely the employers of “Arterium” Corporation paid attention to the insufficient knowledge level of the Good Pharmaceutical Practices (GPP) complex in the professional training of pharmacy specialists. Employers noted, first of all, it is necessary to carry out the advanced training the newly hired specialists on this topic. For this purpose, the annual cycles of lectures of leading specialists of the enterprise for senior year’s students were organized within the framework of the cooperation. The trainees received appropriate certificates, which were taken into account by the employer when considering applications for internships at the corporation, and this, in turn, fostered future employment.

The Scientific and Methodological Commission of the specialty “Pharmacy, Industrial Pharmacy” conducted the all-round analysis of this problem and as results, the revision and updating of existing EPP and ESP of the three cycles system of HE have been conducted.

It should be noted that according to the Cabinet of Ministers of Ukraine (CMU) Resolution No. 266 of 29.04.2015 “On Approval of the list of branches of study and specialties, for the training of higher education applicants” (with amended), the Order of Ministry of Education and Science of Ukraine No. 1151 of 06.11.2015 “On the features of introduction of the list of branches of study and specialties for the training of higher education applicants”, a specialty 15.00.01 “Technology of drugs, organization of

pharmaceutical business and forensic pharmacy” was renamed to specialty 226 “Pharmacy, Industrial Pharmacy” (branch of study 22 “Healthcare”).

The new specialty was considered related to the specialty 15.00.01 “Technology of drugs, organization of pharmaceutical business and forensic pharmacy”. It was licensed in 2016 and implemented at the Department of Technology of Biologically Active Substances, Pharmacy and Biotechnology of Lviv Polytechnic National University for the training of HE applicants by the third (educational-and-scientific) cycle.

Admission for specialty 226 “Pharmacy” (since 2017 – “Pharmacy, Industrial Pharmacy” following amendments to the list of specialties) at the third (educational-and-scientific) cycle study is based on the diploma of HE by the chemical and pharmaceutical specialties and entrance exam results. Accordingly, since 2016, students’ admission for the first and second cycles study was carried out by the specialty 226 “Pharmacy” (similarly, since 2017 – “Pharmacy, Industrial pharmacy”). Therefore, these prerequisites have allowed the Lviv Polytechnic National University to develop new EPPs and ESPs for all three cycles of HE and to take into account the expectations of employers.

Our research aimed to summarize the experience on revision the EPP and ESP for the specialty 226 “Pharmacy, Industrial Pharmacy” in Lviv Polytechnic National University and to make the comparative analysis of corresponding educational programs (EP) in Danylo Halytsky Lviv National Medical University concerning the teaching of the GPP complex, that provides formation of certain competencies of future specialists for pharmacy branch.

1. The principles of creation of educational-and-professional programs and the system of learning outcomes assessment at the Lviv Polytechnic National University

The unified List of the branch of study, elaborated in Ukraine in 2016, allowed combining the different Lists of branches of study and science. It was based on ISCED-2013 (International Standard Classification of Education) and necessitated the creation of new EPPs for specialties that previously had other names¹. Such an approach to the implementation of international standards is justified since the classification of education based on ISCED is harmonized with the Standard Industrial Classification of All Economic Activities (SIC), which has become an important condition for

¹ ISCED Fields of Education and Training 2013 (ISCED-F 2013), UNESCO Institute for Statistics, Montreal. URL: <http://www.uis.unesco.org/Education/Documents/isced-fields-of-education-training-2013.pdf>

appropriate training of specialists in relation to labor market needs. The National Standard Classification of Education² is a tool for transparency of HE in Ukraine, which is towards integration into the European and international educational space.

The Law of Ukraine “On Higher Education”³ also provided for a change in the concept of the organization of education: from a teacher-oriented to a student-centered approach, from a process-centered to learning outcomes (LO) approach. It was necessary to standardize not the list of normative disciplines, but the list of graduate competencies and the normative content of training, which are defined as “learning outcomes”⁴. The reform in HE in Ukraine has led to the development of the student-centered learning conception aimed the forming a qualified competitive specialist, capable of the research-and-innovative type of thinking, who needs continuous professional development and has the appropriate skills. The student-centered approach requires direct, meaningful discussion between students, professors, and the administration of the HE institution regarding the design and organization of the training program. The program should provide students with an opportunity to choose courses, create individual educational paths, elective classes. Therefore, it is extremely important that this program should have a flexible structure. The flexible organization of learning, teaching and self-assessment activities, including schedule flexibility, are also important. It is necessary to introduce interactive learning systems into the educational process, to provide the participants of this process with the possibility of self-improvement, self-control of knowledge, independent work with educational materials in the mode and volume that satisfies them, as well as the choice of a rich information base, various ways of communication, including interactive, for solving educational problems and forming the specialists competencies⁵.

Implementation of the Law of Ukraine “On Higher Education” at Lviv Polytechnic National University is carrying out by the development and

² Національна стандартна класифікація освіти. Національна академія педагогічних наук України. URL: <http://naps.gov.ua/uploads/files/sod/NSKO.pdf>

³ Про вищу освіту: Закон України від 01.07.2014 р. № 1556-VII. Дата оновлення: 16.01.2020. URL: <https://zakon.rada.gov.ua/laws/show/1556-18>

⁴ Koster A., Schalekamp T., Meijerman I. Implementation of Competency-Based Pharmacy Education (CBPE). *Pharmacy*. 2017. Vol. 5(1). 10–26. DOI 10.3390/pharmacy5010010.

⁵ Zubin A. Competency and its many meanings. *Pharmacy*. 2019. Vol. 7(2). P. 37. DOI 10.3390/pharmacy7020037.

Parson L., Childs B., Elzie P. Using competency-based curriculum design to create a health professions education certificate program that meets the needs of students, administrators, faculty, and patients. *Health Prof. Educ.* 2018, Vol. 4, P. 207–217. DOI 10.1016/j.hpe.2018.03.008

approval of internal standards for QA in education, including those concerning the Higher Education Standard (HES) – HES LP 02 “Student-centered learning”:

HES LP 02.01. Regulations on the organization of educational process at Lviv Polytechnic National University;

HES LP 02.02. Regulations on the organization of educational process for postgraduate (PhD) students and for Doctor of Philosophy applicants beyond PhD studies at Lviv Polytechnic National University;

HES LP 02.03. Regulations on the academic mobility for applicants of bachelor, master, doctoral and postdoctoral studies and academic staff at the Lviv Polytechnic National University;

HES LP 02.04. Regulations on the organization of students’ practical training (PT) at Lviv Polytechnic National University;

HES LP 02.05. Regulations on the organization of the courses teaching in foreign languages;

HES LP 02.06. Regulations on the organization and monitoring of students’ independent extra-auditorium learning;

HES LP 02.07. The procedure of organization of study according to student’s individual schedules;

HES LP 02.08. Regulations of the student’s research work at the Lviv Polytechnic National University;

HES LP 02.09. Regulations on the provision of paid educational services of students learning certain disciplines and other components of the curriculum in excess of the syllabus established at the Lviv Polytechnic National University;

HES LP 02.10. Regulations on the organization of the Ukrainian student’s Olympiads at the Lviv Polytechnic National University.

HRS LP 02.11. Regulations on the organization of the Ukrainian competition of the student’s scientific projects according to the branch of study and specialties.

Consequently, student-centered learning involves educational methods that shift the focus of education from teacher to student. The principles of student-centered learning are as follows: 1) the teacher should not be a lecturer, but a facilitator of the learning process; 2) he/she provides successful group communication; 3) not so many lectures, but more research, discussions, and projects; 4) application of flip learning, problem-based learning; 5) clickers. The tasks of the EPP/ ESP development team consisted not only creation of training programs, but also solving the following questions: 1) introduction of student-centered learning practices into the educational process; involvement of employers in the development of educational programs (EP); 2) student’s participation in the training programs formation; 3) student’s choice of subjects; 4) implementation of contemporary quality assurance (QA) practices into the activities of Lviv Polytechnic National University.

Environmental, Social, and Governance (ESG) criteria as QA standards and recommendations in the European Higher Education Area (EHEA)⁶ according to the European Association for Quality Assurance in Higher Education (ENQA) provides for student-centered learning and teaching: 1) respect and attention to the diversity of students and their needs, making it possible flexible learning trajectories; 2) the application of different appropriate ways of material's presentation; 3) flexible use of various pedagogical methods; 4) regular evaluation and correction of material supply and pedagogical methods; 5) encouraging students' independence while providing proper mentoring and support from the teacher; 6) developing mutual respect in the relationship between the student and the teacher; 7) proper response to student complaints. Also, teachers should be aware of the available methods of examination and control of knowledge and must receive support in developing their skills in a certain area. Assessment methods, as well as evaluation criteria, should be notified previously. The assessment allows students to demonstrate the level of achievement of the intended LO. Students receive feedback, accompanied, when necessary, with advice on the learning process. If it is possible, more than one examiner measures student learning. The rules of assessment of LO should provide an opportunity to take into account mitigating circumstances. The assessment is applied consistently and fairly to all students and is conducted according to established procedures. There is a formal procedure for student appeals.

An internal system for assessing the quality of education is being formed at the Lviv Polytechnic National University. Student-centered learning is the main element of this system. For example, the involvement of students in the process of QA in an educational system is a fundamental principle of the regulation, and its purpose is an ensuring the requirements and expectations of the educational service seekers (entrants, students, PhD students). Particular attention is paid to the introduction of student-friendly forms and methods of learning, interactivity, mobility and mentoring.

The possibility of identification, quantification, and measuring are important for LO estimation.

The development of EP and systems for LO estimation can be represented as an informational outline of the relationship between elements of the HE system. The informational outline (Fig. 1) can be viewed from different perspectives: as an elements of the websites of HE establishments, including the electronic office of the HE seeker; as an opportunity for the employer to get acquainted with EPP/ESP, syllabus on disciplines, the system of LO assessment and to influence them in a certain way.

⁶ Standards and guidelines for quality assurance in the European Higher Education Area (ESG). Brussels, Belgium: European Association of Institutions in Higher Education. 2015. 27 p. URL: <https://enqa.eu/index.php/home/esg/>

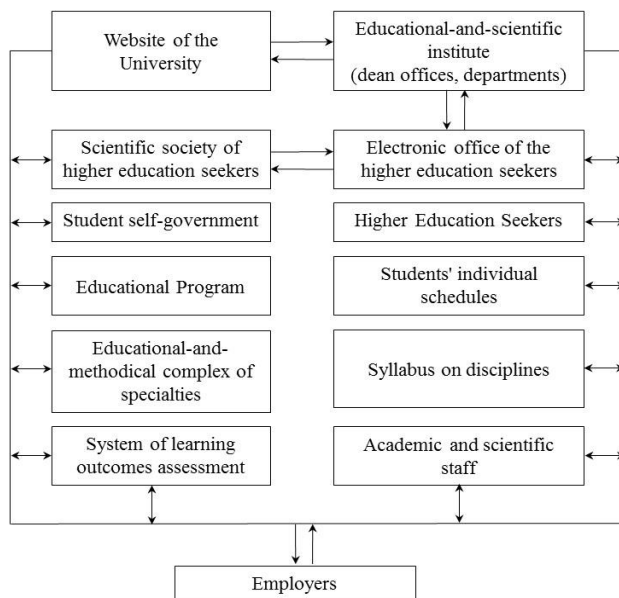


Fig. 1. Information outline of the relationship between the elements of the system of creation of educational-and-professional programs and the system of LO assessment

Also, the procedures for creating students' individual schedules, as well as the possibility of communication between HE seekers within their own partnership and student self-government are clear and transparent.

2. Elaboration of the structural-and-logical framework and defining competencies for disciplines at the first cycle study (bachelor program) at Lviv Polytechnic National University

Structural-and-logical framework of bachelor training (the first educational-and-qualification cycle) for specialty 226 "Pharmacy, Industrial Pharmacy" contains 2 selective blocks: "Pharmacy" and "Technologies of pharmaceutical preparations" (Fir. 2–3).

The 2 specializations – 226.1. "Pharmacy" and 226.2. "Industrial Pharmacy" within specialty 226 "Pharmacy, Industrial Pharmacy" have proposed at a meeting of the Scientific-and-methodological commission of the Ministry of Education and Science of Ukraine. Consequently, developed selective blocks are relevant.

We have selected competencies that are formed by the appropriate disciplines (table 1).

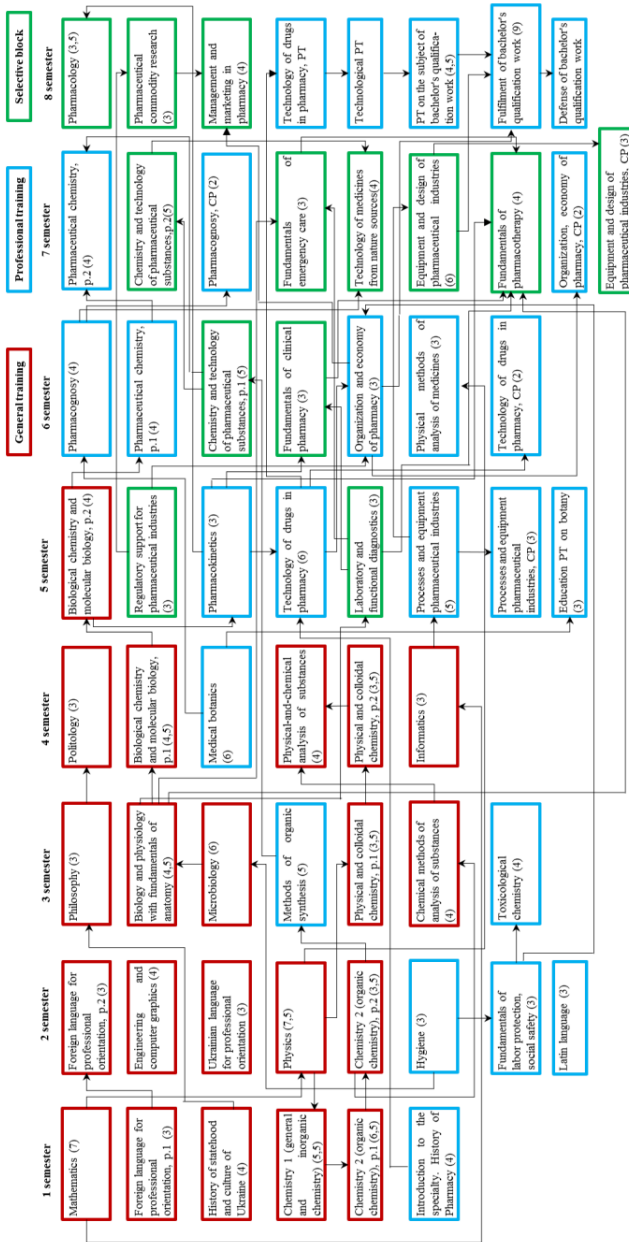


Fig. 2. The structural-and-logical framework of the first cycle study (bachelor program) for specialty 226 “Pharmacy, Industrial Pharmacy”, subject block “Pharmacy”, at Lviv Polytechnic National University (PT – practical training; CP – course project)

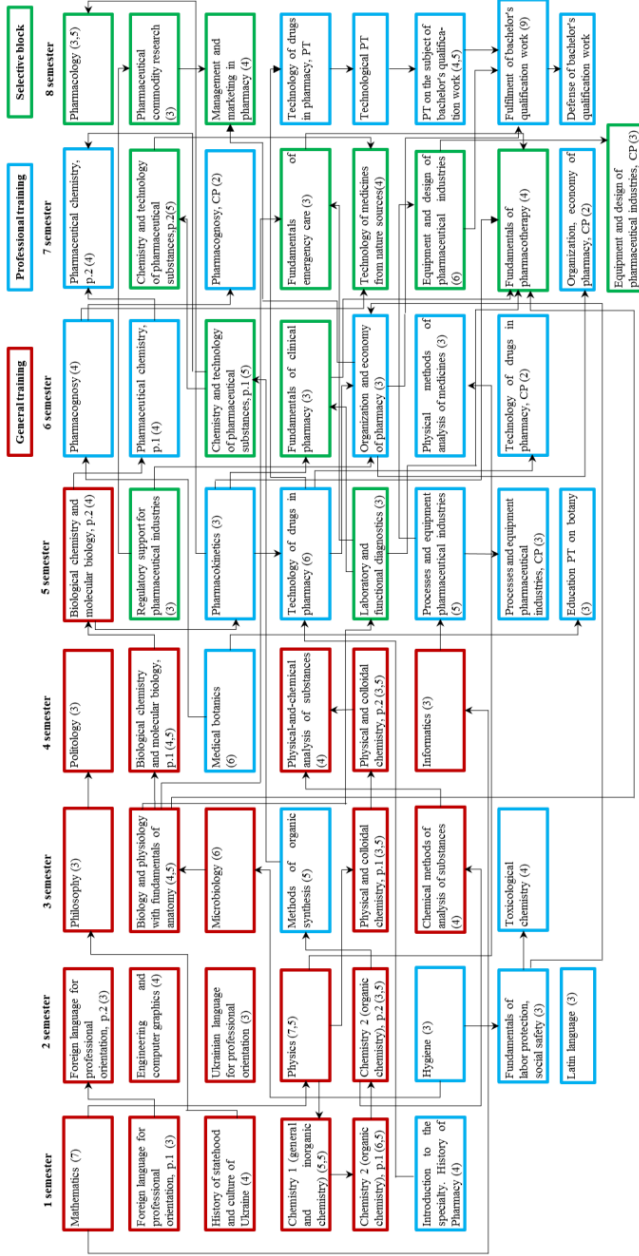


Fig. 3. The structural-and-logical framework of the first cycle study (bachelor program) for specialty 226 "Pharmacy, Industrial Pharmacy", subjects bloc "Technologies of pharmaceutical preparations" at Lviv Polytechnic National University (PT – practical training; CP – course project)

Table 1

Competences acquired in learning of separate disciplines

№	Subject	Amount of credits (including course project)	Competencies (PC – Professional competences; Program outcomes: KN (knowledge), SK (skills))
1	Drugs technology in pharmacy	8 (including course project)	<p>PC11. Knowledge concerning current methods of quality control of pharmaceutical products.</p> <p>PC28. Ability to analyze raw materials, intermediates products, finished pharmaceutical products.</p> <p>KN15. Knowledge of a variety of dosage forms of pharmacy production, the technology of their preparing and application.</p> <p>KN21. Knowledge of chemistry and technology of different classes of medicines, requirements for quality of raw materials and final products.</p> <p>SK14. Reasonably choose the appropriate method of dosage form manufacturing, be able to make the necessary calculations and make it</p>
2	Pharmacokinetics	3	<p>KN17. Basic knowledge of pharmacokinetics the most important medicines for clinical practice.</p> <p>KN30. Knowledge of classification, pharmacological properties, applications, mechanisms of action, routes of administration, absorption, distribution, metabolism, and excretion of drugs, side effects, indications, and contraindications.</p> <p>SK16. To apply knowledge of the drug's pharmacokinetics to predict their effects on the human body and prevent side effects.</p>
3	Organization and economics of pharmacy	5 (including course project)	<p>PC34. Ability to understand and consider the social, ecological, ethical, economic aspects that influence the formation of technical decisions.</p> <p>KN18. Knowledge of production, the practical and economic activity of pharmacy enterprises, fundamentals of accounting and reporting of pharmacy enterprises.</p> <p>SK17. To create and organize pharmacy enterprises, to provide them with medicines and medical products, to conduct operative accounting and to report on the activity of the pharmacy.</p> <p>SK18. Effectively motivate yourself and your subordinates to perform assigned the practical tasks.</p>
4	Physical methods of medicines analysis	3	<p>PC7. Ability to apply knowledge of specific methods of physical-and-chemical studies to identify organic compounds, substances of different classes, including potential medicinal substances.</p> <p>PC11. Knowledge concerning current methods of quality control of pharmaceutical products.</p> <p>SK27. To be able to summarize and systematize information on chemical structure, physical properties, methods of obtaining and analyzing novel medicinal substances.</p>
5	Regulatory support for pharmaceutical industries	3	<p>PC23. To demonstrate the accounting record-keeping skills, to know definitions following international requirements and principles.</p> <p>PC24. To identify and perform validation work necessary to confirmation of critical aspects control for specific manufacturing operations.</p>

Table 1 (continuance)

№	Subject	Amount of credits	Competencies (PC – Professional competences; Program outcomes: KN (knowledge), SK (skills))
5	Regulatory support for pharmaceutical industries	3	<p>KN4. To have basic knowledge of legislation and reference materials, current standards and specifications, instructions and other documents concerning pharmacy and industrial pharmacy.</p> <p>KN26. To know the legislation concerning the manufacturing of pharmaceutical products, the main categories of normative documents on standardization process, requirements for their content and composition; general principles of pharmaceutical product quality management, a regulatory framework for good manufacturing practice; plan of works on product and manufacturing certification.</p>
6	Equipment and design of pharmaceutical industries	9 (including course project)	<p>PC3. Ability to use regulatory-and-technical documentation necessary for engineering activities in the pharmacy branch and the ability to draw up technical documentation when designing a pharmaceutical production.</p> <p>PC16. Ability to choose the optimal parameters of the manufacturing processes of medicines (including veterinary, medical-and-cosmetic preparations and preparations of natural raw materials).</p> <p>PC17. Knowledge about types of equipment for pharmaceutical industries, features of using and principles of operation of different devices.</p> <p>PC20. To apply the acquired knowledge and understanding for identification, formulation and solving the problems of the creation and functioning of chemical-and-pharmaceutical industries.</p> <p>PC23. To demonstrate the accounting record-keeping skills, to know definitions following international requirements and principles.</p> <p>PC29. The ability to apply and integrate knowledge and understanding of different engineering disciplines for drawing up a technological-and-equipment scheme of manufacture with automation and supply of energy sources and systems of the utilization of pharmaceutical waste from manufacturing facilities.</p> <p>PC30. The ability to apply basic knowledge of technical, algorithmic, information and computer software for modeling and computer designing based on the pharmaceutical manufacturing principles.</p> <p>PC35. The ability to manage technological processes and maintain an enterprise quality management system.</p> <p>KN6. To know the legislative framework that regulates the rules for the organization and management of the manufacturing process at the chemical-and-pharmaceutical enterprises.</p> <p>KN16. To know the main devices and processes of pharmaceutical industries (separation, heat transfer, mass transfer, extraction, drying, etc.).</p> <p>KN24. To know the influence of the main factors on the structure of technological equipment, the characteristics of metals, which are used for making equipment, types of equipment for chemical-and-pharmaceutical industries.</p> <p>KN26. To know the legislation concerning the manufacturing of pharmaceutical products, the main categories of normative documents on standardization process, requirements for their content and composition; general principles of pharmaceutical product quality management, a regulatory framework for good manufacturing practice; plan of works on product and manufacturing certification.</p>

Table 1 (ending)

№	Subject	Amount of credits	Competencies (PC – Professional competences; Program outcomes: KN (knowledge), SK (skills))
6	Equipment and design of pharmaceutical industries	9 (including course project)	<p>SK5. To participate in the organization, research, and modernization of chemical-and-pharmaceutical industries and set tasks for the current repair of production equipment.</p> <p>SK6. To compose technological block-scheme and equipment diagram of chemical-and-pharmaceutical manufacture, to carry out material, technological, thermal calculations for production processes.</p> <p>SK9. To develop a project of chemical-and-pharmaceutical manufacture, using the legislation and reference engineering-and-technical literature.</p> <p>SK10. To draw up the technological flowcharts, equipment, and devices, schematic diagrams of technological and construction implementation of manufacture using computer programs.</p> <p>SK11. To develop a plan for the location of equipment, workplaces, according to legislation and standards, taking into account technology requirements.</p> <p>SK23. To design new technological schemes for drug manufacturing, perform the calculation for the technical project in the development of new manufactures, to operate, calculate and select equipment for the modernization of technological processes.</p> <p>SK25. To compose technological regulation for pharmaceutical products, to analyze production situations, to record them and to make decisions on compliance with the requirements of legislation, to certify working places.</p>
7	Management and marketing in pharmacy	4	<p>PC31. The ability to apply commercial and economic contexts to the design of pharmaceutical industries, to conduct a technical-and-economic evaluation of manufacture or scientific-and-technical development, and to manage and market pharmaceutical products.</p> <p>PC35. The ability to manage technological processes and to maintain an enterprise quality management system.</p> <p>KN22. To know the fundamentals principles of organization of chemical-and-pharmaceutical industry, production management; principles of creation, research, registration of medicines; Good Manufacturing Practice (GMP) and Good Laboratory Practice (GLP) systems, principles of industrial manufacturing of medicines, state system of quality control of medicines, fundamentals of pharmaceutical marketing and foreign economic activity of the enterprise.</p> <p>SK21. To organize work on creation and registration of chemical-and-pharmaceutical enterprise, to make its development plan; conduct research and industrial manufacturing of medicines; to carry out export-import operations.</p>

An analysis of the content of the EPP by component groups and training cycles was also conducted (table 2).

Table 2

The division of EPP by component groups and training cycles

№	Cycle training	The volume of academic load for HE applicants (credits /%)		
		Mandatory components of EPP	Selective components of EPP	Total
1	General training cycle	90/38	12/5	102/43
2	Professional training cycle	88,5/37	49,5/20	138/57
Total		178,5/75	61,5/25	240/100

3. Elaboration of the structural-and-logical framework and defining competencies for disciplines at the second cycle study (master program) at Lviv Polytechnic National University

The training of masters and master of research is carried out for organizational-and-managerial, investment and scientific-and-research activity, for training of teaching and scientific reserve of HE establishments, research institutions in the pharmacy and industrial pharmacy branch, as well as for the manufacture of medicines, their storage, quality control, delivery, distribution, regulation of drug supply, as well as advice, provision of information on medicinal products.

Structural-and-logical framework of master training (the second educational-and-qualification cycle) for specialty 226 “Pharmacy, Industrial Pharmacy” contains 2 selective blocks: “Pharmacy” and “Technologies of pharmaceutical preparations” (Fir. 4–7).

The courses provide the students’ competences according to the requirements of the HE standard (table 3).

The results of analysis of the content of the EPP by component groups and training cycles are presented in table 4.

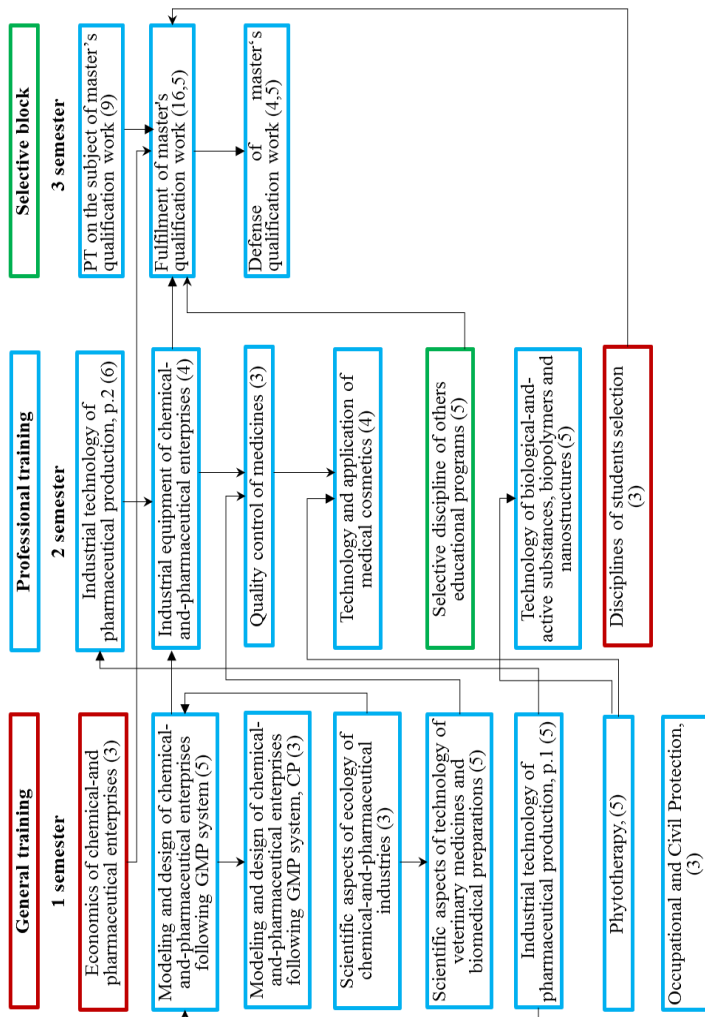


Fig. 4. The structural-and-logical framework of the second cycle study (master program) for specialty 226 “Pharmacy, Industrial Pharmacy”, line 01 “Technologies of pharmaceutical preparations” at Lviv Polytechnic National University (PT – practical training; CP – course project)

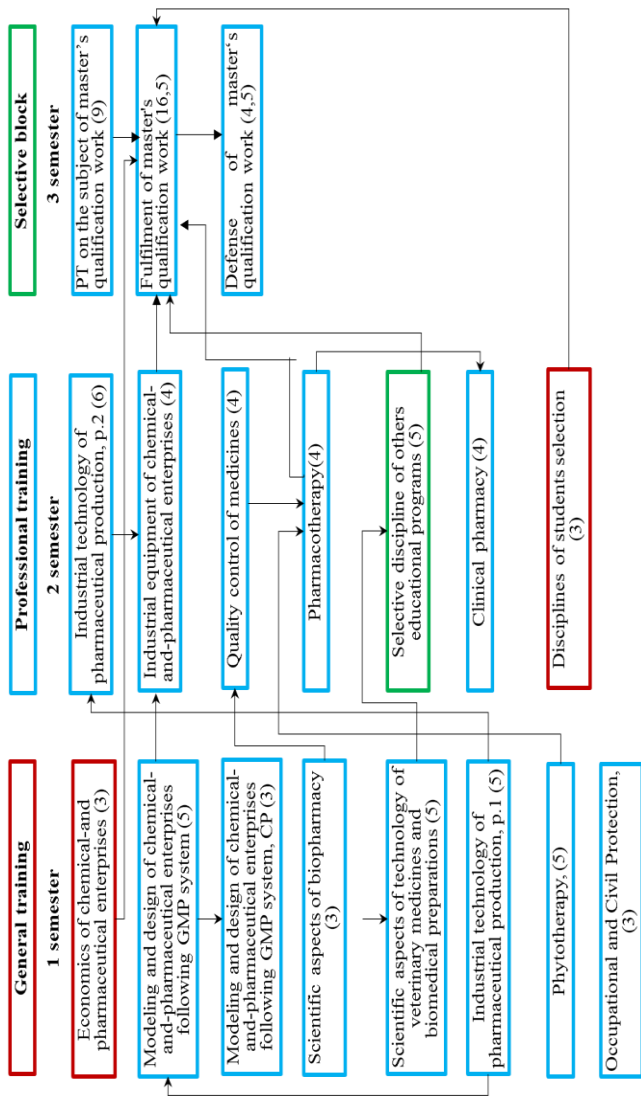


Fig. 5. The structural-and-logical framework of the second cycle study (master program) for specialty 226 "Pharmacy, Industrial Pharmacy", line 02 "Pharmacy" at Lviv Polytechnic National University (PT – practical training; CP – course project)

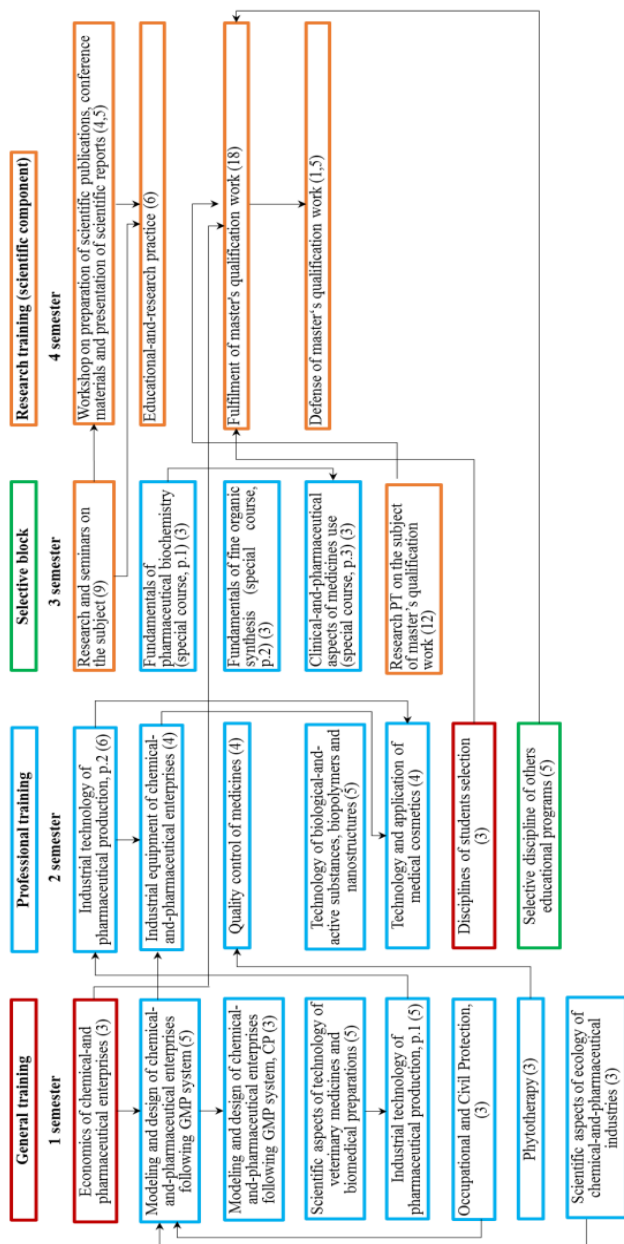


Fig. 6. The structural-and-logical framework of the second cycle study (master of research program) for specialty 226 "Pharmacy, Industrial Pharmacy", line 01 "Technologies of pharmaceutical preparations" at Lviv Polytechnic National University (PT – practical training; CP – course project)

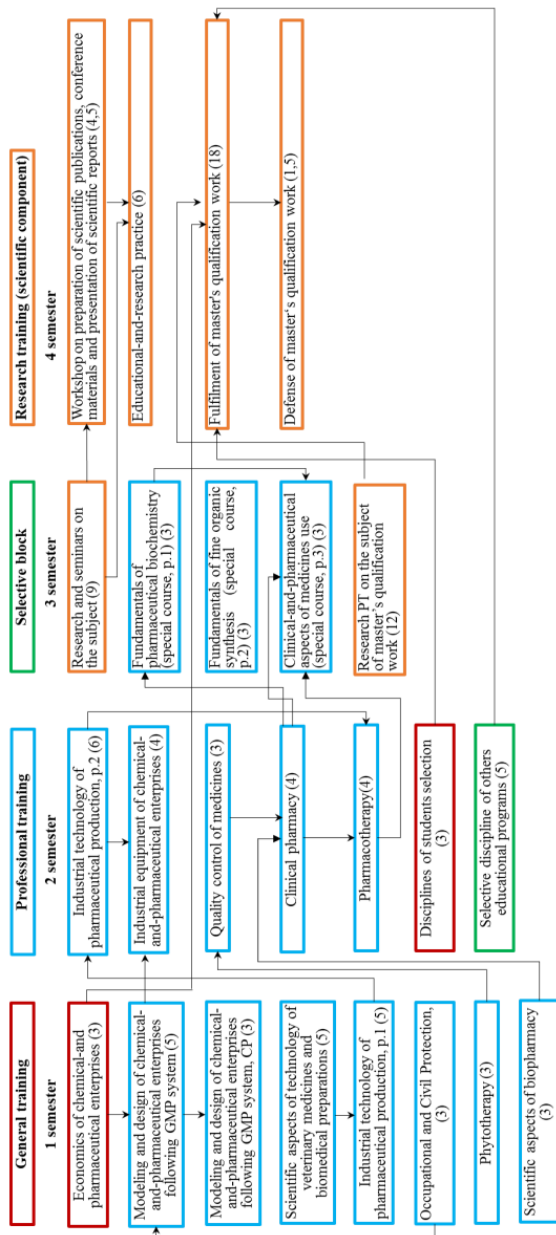


Fig. 7. The structural-and-logical framework of the second cycle study (master of research program) for speciality 226 "Pharmacy, Industrial Pharmacy", line 02 "Pharmacy" at Lviv Polytechnic National University (PT – practical training; CP – course project)

Table 3

Competences acquired in the learning of separate disciplines at the second cycle study

№	Subject	Amount of credits (including course project)	Competencies	
			PC – Professional competences; Program outcomes: KN (knowledge), SK (skills)	
1	Modeling and design of chemical-and-pharmaceutical enterprises following GMP system	8	PC14. The current concepts in modeling, scaling and validation of pharmaceutical manufacture following the GMP system. PC16. The ability to use professionally profiled knowledge of mathematical statistics for statistical analysis of experimental data and mathematical modeling of chemical-and-pharmaceutical processes. PC17. The ability to use theoretical knowledge and practical skills in the activity and modernization of pharmaceutical enterprises. PC28. The ability to create safe working conditions at a chemical-and-pharmaceutical enterprise. KN3. To know the fundamentals principles of design technologies, organization of the projection process, futures of industrial and auxiliary premises planning. KN4. To know the fundamentals principles of construction design of chemical-and-pharmaceutical enterprises and rules of technological equipment layout. KN19. To know the classes of fire and explosion hazard of industrial premises and substances, their toxicity, sanitary protection zones, safe working environment for employees of chemical-and-pharmaceutical enterprises. SK3. To design new technological schemes for medicines manufacturing. SK4. To solve the issue of building design using standard unified building components and typical standard equipment. SK16. The ability to design chemical-and-pharmaceutical enterprise following safety rules and GMP standards.	
2	Industrial technology of pharmaceutical production	11	PC3. The ability to develop technological processes and manufacturing methods for new drug substances and medicines. PC8. The ability to apply knowledge regarding the principles of the introduction of pharmaceutical development, the requirements for manufacture, distribution and retail sale and the rational use of medicines. PC18. The ability to search and use new excipients for the development of various dosage forms. PC25. The ability to develop new and improve existing technological processes to create low-waste technologies. KN7. To know of theoretical fundamentals of technological processes of pharmaceutical industries; the current technological processes and methods of manufacturing new medicinal substances and preparations. KN8. To know the fundamentals of standardization of biopharmaceutical assessment, methods of dosage forms improving, the influence of storage conditions and type of packaging on the stability of medicines. SK2. To implement measures of GMP and GLP, to carry out export-import operations, to realize marketing work. SK5. To conduct a step-by-step synthesis of veterinary preparation, to choose optimal parameters of processes, to organize the manufacturing of veterinary preparations. SK6. To choose alternative ways for obtaining medicines, to organize the production of biomedicines. SK7. To choose the most optimal method of manufacturing a certain dosage form, to work with technological equipment, legislation, and technical documentation.	

Table 3 (ending)

№	Subject	Amount of credits	Competencies (PC – Professional competences; Program outcomes: KN (knowledge), SK (skills))
3	Industrial equipment of chemical-and-pharmaceutical enterprises	4	PC21. To know the types of equipment for pharmaceutical industries, features of use and principles of operation of different devices. KN9. To know the types and design features of pharmaceutical manufacturing equipment, principles of operation of different devices. SK8. To operate industrial equipment.
4	Quality control of medicines	3	PC5. To apply knowledge on specific techniques of physicochemical investigations to identify organic compounds of substances of different classes, including potential medicinal substances. PC6. The ability to carry out the qualitative and quantitative analysis of raw materials, intermediates and finished pharmaceutical products (including veterinary and medical-and-cosmetic preparations) according to the provided method. PC7. To know the procedure of state registration of medicines and the rules for inspection of the manufacturing of medicines submitted for state registration. PC12. To know the current methods of quality control of pharmaceutical products. KN16. To know the fundamentals of the legislation of Ukraine in the field of quality control of medicines. SK14. To apply the requirements of the current legislation of Ukraine on quality control of medicinal products at the stages of drug manufacturing, preclinical and clinical trials, registration, medication re-registration, transportation, storage, and sale.

Table 4

The division of EPP at the second cycle study (master program) by component groups and training cycles

№	Cycle training	The volume of academic load for HE seeker (credits /%)	
		Mandatory components of EPP	Selective components of EPP
1	General training cycle	3/3	3/3
2	Professional training cycle	64/72	20/22
Total		67/75	23/25
			6/6
			84/94
			90/100

4. Elaboration of the structural-and-logical framework and defining competencies for disciplines at the third cycle study (doctoral program) at Lviv Polytechnic National University

At the 2003 conference in Berlin, for the first time, doctoral studies and synergies between the EHEA and the European Research Area (ERA) have been discussed. Whereas the Bologna Declaration referred to two cycles which include all programs of tertiary education (“The second cycle should lead to the master and/or doctorate degree as in many European countries”), the 2003 Berlin Ministerial Communiqué consequently defined doctoral programs as the third cycle.

The third cycle study at Lviv Polytechnic National University includes a broad variety of doctoral phases from pure (doctoral) study programs to fully independent research. These models have various implications for:

- the structure of doctoral studies (free, partially or fully structured);
- the responsibility is taken and the resources invested (e.g. staff and facilities for taught parts of the program) by the home institution;
- possible links with enterprises and/or professional bodies;
- the relation of mandatory and optional elements for the doctoral student;
- the status of the doctoral candidate (student, employee, researcher).

At Lviv Polytechnic National University, the individuals carrying out these projects are not regarded as students but as early-stage researchers/young professionals.

Structural-and-logical framework of philosophy doctor training (the third educational-and-qualification cycle) for specialty 226 “Pharmacy, Industrial Pharmacy” is presented in Fig. 8.

The main competencies that are formed by the appropriate disciplines are presented in table 5.

An analysis of the content of the EPP for the third cycle study by component groups and training cycles was conducted (table 6).

Modernization of professional training through international cooperation and recognition of certificates and assessment of acquired competencies has great importance⁷.

In the period 2016–2020, Lviv Polytechnic National University was a partner of the current agreement with Le Mans University (Le Mans, France) about the double diploma. The travel for students training in master’s programs, for PhD students to conduct the research and for teachers to give lectures and passing the training was organized within the framework of the signed agreements on international academic mobility according to the Erasmus + KA1 program with the Lviv Polytechnic National University and the University of Le Mans (Le Mans, France), the University of Opole (Opole, Poland), the University of Toulouse III Paul Sabatier (Toulouse, France), Isa Lille (Lille, France).

⁷ Pearson, M, Hubball, H. Curricular Integration in Pharmacy Education. *American Journal of Pharmacy Education*. 2012. Vol. 76. P. 204–220. DOI 10.5688/ajpe7610204.

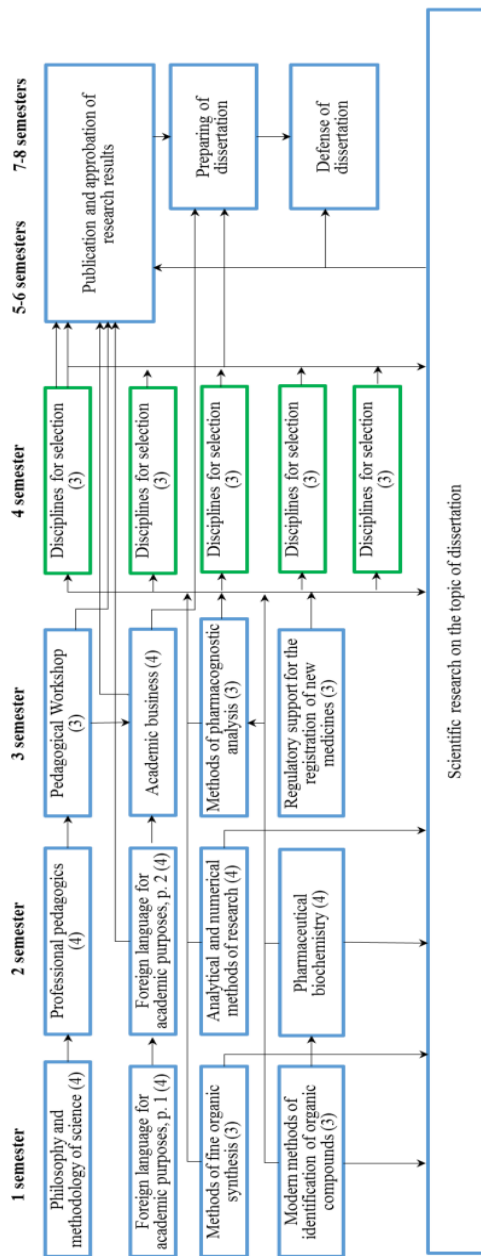


Fig. 8. The structural-and-logical framework of the third cycle study (doctor program) for specialty 226 “Pharmacy” at Lviv Polytechnic National University

Table 5

Competences acquired in the learning of separate disciplines at the third cycle of study

№	Subject	Amount of credits	Competencies Program outcomes
1	Methods of pharmacognosic analysis and quality control of plant raw materials	3	<p>(PC – Professional competences; KN (knowledge), SK (skills))</p> <p>SK3. The ability to demonstrate deep knowledge of pharmacognosic methods of analysis based on analytical regulatory documentation (State Pharmacopoeia of Ukraine, State Standards of Ukraine, Specifications of Ukraine), fundamentals of the legislative framework of Ukraine related to the development, registration, manufacturing, quality control and sale of medicinal products, including plant raw materials, and products of its processing.</p> <p>SK4. The ability to conduct scientific researches and to carry out scientific projects using in practice theoretical knowledge related to the identification of medicinal plant raw materials, determining its quality and conducting marketable, phytochemical and biological researches for development new quality control methods or Temporary Pharmacopoeia articles. The ability to independently search for new sources of biologically active substances among non-official medicinal plant raw materials, to isolate, identify extracts and individual substances and to determine the types of their biological activity.</p> <p>PC11. To understand the necessity for state registration of medicines and to know the procedure and features of functioning of State Drugs List and the procedure for inspection of the manufacturing of medicines submitted for state registration.</p> <p>PC12. The ability to use the knowledge on the principles of pharmaceutical drug development of various manufacturing types, laboratory testing, clinical trials, drug registration, requirements for manufacturing, distribution and retail sale and rational use of drugs.</p> <p>SK5. The ability to create a registration dossier for state registration (re-registration) of medicinal products. Understanding the order of import of unregistered medicines, standard samples, reagents into the territory of Ukraine. The ability to inspect the manufacturing of medicines submitted for state registration.</p> <p>PC10. The ability to conduct by the provided method of qualitative and quantitative analysis of raw materials, intermediates and finished products of chemical and pharmaceutical manufacture.</p> <p>SK6. To be able to explain the concept of quality assurance of medicines; to describe the approaches to pharmaceutical development of new drugs; to specify the requirements for preclinical and clinical trials of medicines; to interpret the rules of GMP; to specify the rules of good practice for storage and distribution of medicinal products; to substantiate the principles of pharmaceutical drug development; to explain the principles of achieving good manufacturing practice in the manufacture of medicines; to substantiate the role of factors affecting the quality of medicines; to know the legislation concerning registration of medicinal products and licensing in Ukraine.</p>
2	Regulatory support for the registration of new medicines	3	<p>KN8. To understand the content of term "quality" in medicine and pharmacy; to describe the conception of quality assurance of medicines; to know the main indicators of quality of medical and pharmaceutical technologies; to specify factors that influence the quality of medicines; to describe the principles of rational use of medicines; to understand the principles of quality assurance of medical technologies; to formulate principles of quality assessment of medical technologies.</p> <p>SK9. To apply the basic indicators of quality of medical and pharmaceutical technologies; to outline the factors that affect the quality of medicines; to describe the principles of rational use of medicines; to explain the principles of quality assurance of medical technologies; to formulate principles of evaluation of quality of medical technologies; to know the main regulations concerning the quality of medical and pharmaceutical technologies; to interpret the results of the evaluation of the quality of medical and pharmaceutical technologies; to justify approaches and to choose tactics to improve the quality of medical and pharmaceutical technologies; to implement in practice algorithms for improving the quality of medical and pharmaceutical technologies.</p>
3	Good Pharmaceutical Practices (GMP, GCP, GLP, GPP, GDP)	3	<p>SK7. To be able to explain the concept of quality assurance of medicines; to describe the approaches to pharmaceutical development of new drugs; to specify the requirements for preclinical and clinical trials of medicines; to interpret the rules of GMP; to specify the rules of good practice for storage and distribution of medicinal products; to substantiate the principles of pharmaceutical drug development; to explain the principles of achieving good manufacturing practice in the manufacture of medicines; to substantiate the role of factors affecting the quality of medicines; to know the legislation concerning registration of medicinal products and licensing in Ukraine.</p>
4	Assessment of quality of medical and pharmaceutical technologies (quality of drugs, quality of treatment)	3	<p>KN8. To understand the content of term "quality" in medicine and pharmacy; to describe the conception of quality assurance of medicines; to know the main indicators of quality of medical and pharmaceutical technologies; to specify factors that influence the quality of medicines; to describe the principles of rational use of medicines; to understand the principles of quality assurance of medical technologies; to formulate principles of quality assessment of medical technologies.</p> <p>SK9. To apply the basic indicators of quality of medical and pharmaceutical technologies; to outline the factors that affect the quality of medicines; to describe the principles of rational use of medicines; to explain the principles of quality assurance of medical technologies; to formulate principles of evaluation of quality of medical technologies; to know the main regulations concerning the quality of medical and pharmaceutical technologies; to interpret the results of the evaluation of the quality of medical and pharmaceutical technologies; to justify approaches and to choose tactics to improve the quality of medical and pharmaceutical technologies; to implement in practice algorithms for improving the quality of medical and pharmaceutical technologies.</p>

Table 5 (ending)

№	Subject	Amount of credits	Competencies
5	Clinical-and-pharmaceutical fundamentals of medicines development (principles of a search for new drugs, investigation of new drugs, medicines introduction into therapeutic practice)	3	<p>(FC – Professional competences; Program outcomes; KN (knowledge), SK (skills))</p> <p>KN6. To describe the approaches to pharmaceutical development of new drugs; to know the requirements for clinical and preclinical drug trials; to use the complex knowledge on methods and techniques of fine organic synthesis for planning the synthesis of model compounds.</p> <p>SK7. The ability to conduct a preclinical study of medicines; and to analyze the documentation concerning preclinical investigations. The ability to demonstrate knowledge of the rules of clinical trials of medicines.</p> <p>SK10. To determine principles for the search of new drugs and scientific approaches to their development; to describe the system of new medicines examination; to specify sources of information about medicines; to describe the principles for the medicines introduction into the pharmaceutical market and the use of new drugs; to formulate the tasks of scientific research in the branch of development of new medicines; to develop the scheme of pharmacological experiment taking into account ethical, deontological aspects, main indicators of information security; to search and perform analytical work with information on the development and use of medicinal products.</p>

Table 6

The division of EPP for the third cycle by component groups and training cycles

№	Cycle training	The volume of academic load for higher education seeker (credits /%)	
		Mandatory components of EPP	Selective components of EPP
1	The cycle of disciplines that provide formation the general scientific competencies and universal skills of the researcher	27/45	3/5
2	The cycle of disciplines that provide formation professional competencies	15/25	12/20
3	The cycle of disciplines for free choice of the graduate student	-	3/5
Total		42/70	18/30
			60/100

Also, at the same period, Lviv Polytechnic National University was a partner of projects of international bilateral scientific and technical cooperation: Ukraine-France M/85-2017, M/113-2018 “Creating sulfur-containing derivatives of carbocyclic and heterocyclic systems – potential antithrombotic substances” (2017–2018); Ukraine-Poland M/120-2018, M/42-2019 “Derivatives of 9,10-anthraquinone and related carbo- and heterocyclic systems as prototypes for potential antitumor and antifungal substances” (2018–2019). As part of the cooperation agreement between the Lviv Polytechnic National University and the University of Opole (Opole, Poland), training for teachers was organized.

Thus, the analysis of particular directions of work in the process of training specialists for the pharmacy branch shows the important role of services of international cooperation, their direct and tangible influence on the process of formation of a competitive specialist. Internships, practices abroad, other types of academic exchanges contribute to the improvement of competency qualities, tempering of character, personality development of a specialist at different cycles of study⁸.

5. The peculiarities of formation of professional competencies on Good Pharmaceutical Practices in the training of specialists at Danylo Halytsky Lviv National Medical University

The development and implementation of GPP standards in the healthcare establishments' activities should be a logical continuation of the strategy of implementation of the Good Practices System in our country, which guarantees the quality of medicines at all stages of their circulation from manufacture to sale for the end consumer. The most important requirement for pharmacy professionals involves the support and continuous improvement of their professional activity⁹.

An analysis of the syllabuses of the disciplines, learned by HE seekers in second (master program) and third (doctoral program) cycles study at Danylo Halytsky Lviv National Medical University concerning mastering the future specialists expertise in GPP competencies has demonstrated some problematic issues and unresolved tasks.

At the Danylo Halytsky Lviv National Medical University, the core element of doctoral studies in almost all disciplines for a lot of years was

⁸ Pittenger, A, Chapman, S, Frail, C, Moon, J, Undeberg, M, Orzoff, J. Entrustable Professional Activities for Pharmacy Practice. *American Journal of Pharmaceutical Education*. 2016. Vol. 80. P. 57–65. DOI :10.5688/ajpe80457.

⁹ Галя Л.О. Постійний професійний розвиток фармацевтичних працівників – вимога належної аптечної практики. *Управління та економіка в фармації*. 2016. № 3 (47). С. 24–30.

self-contained research including a scientific dissertation. However, with influences from overseas, a range of innovative doctoral programs have been emerging in response to the changes in society and the challenges of a global labor market.

But, there are no separate disciplines on GPP for HE seekers at the second and third cycles of study. Some competences concerning GPP students acquired at the second (master program) cycle study, when learned disciplines such as “Technology of drugs”, “Clinical pharmacy and pharmaceutical care”, “Management and marketing in pharmacy”, “Organization and economy of pharmacy”, “Medicinal Plants Resources Science”, “Standardization of medicines” (table 7).

The third (doctoral program) cycle study includes courses, private study, research and writing a thesis. This approach requires a great deal of autonomy and responsibility.

The HE seeker at the third (doctoral program) cycle should: 1) demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialized knowledge of research methodology in general and the methods of the specific field of research in particular; 2) demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work; 3) demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general; 4) demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

Accordingly, there are no specific disciplines that are related to the principles of GPP at the third cycle study. Only a few issues of GMP are discussed in elective courses “Technological aspects of pharmaceutical development”.

CONCLUSIONS

The scientific analysis of the state of the problem of the professional training of pharmaceutical branch specialists in terms of GPP at the technical and medical institution on the example of Lviv Polytechnic National University and Danylo Halytsky Lviv National Medical University is carried out.

**Competences concerning GPP acquired in learning of separate disciplines
at Danylo Halytsky Lviv National Medical University**

№	Subject of drugs	Amount of credits (including practical training)	Competences
1	Technology of drugs	14,5 (including practical training)	<p align="center">PC – Professional competences; Program outcomes: KN (knowledge), SK (skills)</p> <p>PC 1. The ability to use knowledge of Ukrainian laws and regulations and the recommendations of good pharmaceutical practices in professional activities.</p> <p>PC2. The ability to develop and complete documents for the compounding and manufacture of drug preparations following recommendations of good practices.</p> <p>PC3. The ability to organize production activities of pharmacies for compounding drug preparation in different dosage forms prescribed by doctors and by order of health facilities, including the substitution of technology and choice of excipient by GPP.</p> <p>PC4. The ability to organize and participate in the manufacture of drug products in pharmaceutical enterprises, including the choice of manufacturing process and equipment by GMP.</p> <p>PC 16. The ability to ensure proper storage of medicinal preparations and medical following Good Storage Practice (GSP) in healthcare facilities</p> <p>KN1. To know the general principles of pharmaceutical provision of the population, the basic mechanisms of state regulation of pharmaceutical activity</p> <p>KN2. To know the requirements of normative documents (orders, guides etc) to the development of drug products and the production documents, to know the rules for the development of production documents</p> <p>KN3. To know: the technology of compounded preparation: the basic groups of biologically active substances of medicinal plant material; stability and shelf life of compounded preparations; active ingredients and excipients of drug preparations; pharmaceutical incompatibilities (physical, chemical, pharmacological) and preventive techniques, orders of Ministry of Health care of Ukraine for dispensing narcotic drugs, toxic drugs, and precursors.</p> <p>KN4. To know manufacture of drug products; requirements of GMP and other good pharmaceutical practices; to compose material balance for manufacture of drug products; theoretical aspects of extraction, mass-exchanging processes, manufacture of tinctures and extracts; requirements for containers, sealing and packing materials; manufacture of solid preparations, pharmaceutical solutions, suspensions and emulsions, enzyme and hormone preparations, semi-solid preparations (creams, ointments, gels and pastes of different types), suppositories; manufactures of parenteral preparations. Requirements to containers for injections, manufacture of sterile and aseptically prepared preparations (manufacturing process, stabilization, purification); manufacture of aerosol systems; manufacture of biotechnology preparations.</p> <p>KN16. To know classification of drug products and dosage forms Storage conditions of toxic, strong active plant raw material, the general requirement to the storage of drug products in pharmacies</p> <p>SK1. To use laws and regulations that regulate pharmaceutical activity in Ukraine and abroad; to provide the information on the material and technical resources of pharmacy.</p> <p>SK2. To perform an investigation on the development of drug products; to make the process schemes and the instructions for compounding drug preparations “as a reserve”; to create technological documents for the manufacture of drug products in industrial conditions.</p>

Table 7 (continuance)

№	Subject	Amount of credits	Competencies
1.4.5	Technology of drugs	(including practical training)	<p>(PC – Professional competences; Program outcomes; KN (knowledge), SK (skills))</p> <p>SK3. To characterize dosage forms in accordance to the type of disperse system, route of administration, physical state, considering physical and chemical properties of active ingredients and excipients; to determine and prevent the incompatibilities of active ingredients and medicinal plant material in prescription (physical, chemical, physical-chemical pharmacological); to check single and daily doses of toxic, narcotic, strong active substances and the dispensing norms of narcotic and equivalent to them substances, considering individual features of a patient (age, body weight, etc.); to weigh, measure and dose various preparations following prescription; to prepare extraction solvents in an appropriate concentration, using different calculations; to stabilize preparations, considering biological, physical-chemical and technological properties of active ingredients and excipients, using suitable agents; to compound various dosage forms; to perform sterilization of drug products, considering physical and chemical properties and stability of medicinal substances; to prepare drug products, which contain toxic, narcotic substances, for dispensing; to write passport of written control for the compounded preparations</p> <p>SK4. To choose an optimal technology of dosage form, using a suitable equipment; to select excipients (stabilizers, emulsifiers, prolonging agents, ointment and suppository bases, fillers for tablets, etc.) to produce a drug product; to elaborate technological regulations for the manufacture of the drug products, which are frequently small-volume produced; to make manufacturing schemes and instructions for small volume manufacture of injection and infusion solutions in the conditions of enterprises and hospital pharmacies; to study technological and physical-chemical properties of powders and granulated materials; to perform, pretreatment and analysis of ampoules and containers for injection solutions; to stabilize pharmaceutical preparations, considering biological, physical-chemical and technological properties of active ingredients and excipients, using specified agents.</p> <p>SK.16. To control storage conditions for starting material in the pharmaceutical entities.</p> <p>PC11. The ability to use knowledge of regulatory, legal acts of Ukraine, and recommendations of good pharmaceutical practices in the professional activity.</p> <p>PC18. The ability to provide rational use of prescription and OTC medicines according to physicochemical, pharmacological characteristics, biochemical, pathophysiological features of a specific disease and pharmacotherapeutic regimens</p> <p>PC20. The ability to provide counseling and pharmaceutical care when selecting and dispensing medication by assessing the risk/benefit, compatibility, indications, and contraindications based on the patient's health status, taking into account the pharmacokinetic, pharmacodynamic and physicochemical characteristics of the medication.</p> <p>KN11. To know the basics of the system of law and pharmaceutical legislation; the main mechanisms of state regulation of pharmaceutical activity; principles of organization of providing pharmaceutical assistance to the population; basic principles of organization of pharmaceutical supply to the population; legal and ethical standards of pharmaceutical activity.</p>
3	Management and marketing in pharmacy	9	<p>SK11. To Use the legal acts that regulate pharmaceutical activity in Ukraine; track and identify changes and additions to native Ukrainian pharmaceutical legislation; build relationships with patients and physicians in order to meet WHO ethical criteria and good pharmacy practices to promote medicines on the market; minimize abuse and misuse of medicines.</p> <p>PC10. To obtain a systematic knowledge of the theoretical foundations of management in pharmacy and pharmaceutical marketing</p> <p>KN10. The main issues of management, including the essence of modern management theories, subjects and levels of management</p> <p>KN12. Principles, types, organizational forms and features of entrepreneurial activity in pharmacy, the order of functioning, management of organizations of the pharmaceutical industry.</p> <p>KN13. The mechanism for managing the decision-making process.</p> <p>SK10. Identify tasks of structural units of pharmaceutical organizations.</p> <p>SK12. Make the scheme marketing areas of the company.</p> <p>SK13. Conduct positioning of drugs on consumer preferences.</p>

Table 7 (ending)

№	Subject	Amount of credits	Competences
4	Organization and economy of pharmacy	8,5 (including practical training)	<p>PC – Professional competences; Program outcomes: KN (knowledge), SK (skills)</p> <p>PC 1. The ability to use knowledge of Ukrainian laws and regulations and the recommendations of good pharmaceutical practices in professional activities.</p> <p>PC 16. The ability to ensure proper storage of medicinal preparations and medical devices following GSP in healthcare facilities</p> <p>KN1. To know the general principles of pharmaceutical provision of the population, the basic mechanisms of state regulation of pharmaceutical activity</p> <p>SK1. To use laws and regulations that regulate pharmaceutical activity in Ukraine and abroad; to provide the information on the material and technical resources of pharmacy.</p> <p>SK16. To control storage conditions for starting material in the pharmaceutical entities.</p>
5	Medicinal Plants Resources Science	3	<p>PC19. To develop a holistic view of the current state of plant resources in some regions and the state as a whole, promising medicinal plants, to provide for future professionals a comprehensive knowledge concerning medicinal plants, sustainable use and protection of resources</p> <p>KN20. The modern methods for determination of productivity and stocks of wild medicinal plants.</p> <p>KN22. Ways of rational use and protection of resources of medicinal plants.</p> <p>SK20. To apply knowledge for the sustainable use of plant resources and environmental protection.</p>
6	Standardization of medicines		<p>PC7. Ability to properly store medicines and other pharmacy products by their physicochemical properties and GSP rules in healthcare settings.</p> <p>PC12. Ability to use in the professional activity the knowledge of regulatory, legal acts of Ukraine and the recommendations of good pharmaceutical practices.</p> <p>SK19. Ability to organize and carry out quality control of medicinal products by the requirements of the State Pharmacopoeia of Ukraine and good practices, to determine the methods of sampling for the control of medicinal products and to carry out their standardization according to current requirements, to prevent the spread of counterfeit medicines</p> <p>SK20. Ability to develop quality control techniques for medicinal products, including active pharmaceutical ingredients, medicinal plant raw materials and auxiliaries using physical, chemical, physico-chemical, biological, microbiological, pharmacotechnological and pharmaco-organoleptic control methods.</p>

Certain individuality of professional training of specialists in the pharmaceutical industry in the context of the acquirement of professional competencies in GPP based on the analysis of the EPP and ESP was disclosed.

EPP for first (bachelor program) cycle study at Lviv Polytechnic National University consists of 14 general competencies, 35 professional competencies, 62 pieces of knowledges and skills. EPP for second (master program) cycle study involves mastering with 15 general competencies, 28 professional competencies, and 35 pieces of knowledges and skills. 16 general competencies, 8 professional competencies, 20 pieces of knowledges and skills comprise ESP for third (doctoral program) cycle study at Lviv Polytechnic National University. Almost all competencies related to GPP issues.

The logical conclusion of the training of specialists in the field of pharmacy is the discipline “Good Pharmaceutical Practices”, which includes the whole range of practices, so it is proposed at the Lviv Polytechnic National University for study at the third (educational-scientific) level.

Unlike Lviv Polytechnic National University, HE seekers at Danylo Halytsky Lviv National Medical University study principles of GPP only at the second (master program) cycle study.

SUMMARY

As the complexity of the pharmaceutical industry increases a there is an increasing need for suitably qualified personnel. Universities must respond to needs for employers and graduates with the appropriate skills and knowledge to enable the transformation and future growth of this industry. Restructuring educational offerings to focus on graduate attributes, such as analytical and critical thinking, collaboration and problem-solving, creativity, flexibility and self-direction in the context of the pharmaceutical industry facilitates the changes needed for future growth and to the improvement of the pharmacy industry as a whole.

The aim of this article is to provide an overview of the applications of competency based education in the education and training of pharmacists, the process for constructing a competency based pharmacy curriculum, and the potential advantages and challenges associated with its implementation. The formation of competencies of future professionals for the pharmaceutical field, taking into account the relevance and expectations of potential employers, is an important component in the development of educational-and-professional and educational-and-scientific programs at all cycles (bachelor, master and doctoral programs) of higher education. The article present the result of scientific analysis of the state of the problem of

the professional training of pharmaceutical branch specialists in terms of Good Pharmaceutical Practices at the technical and medical educational institution on the example of Lviv Polytechnic National University and Danylo Halytsky Lviv National Medical University. Certain individuality of professional training of specialists in the pharmaceutical industry in the context of the acquirement of professional competencies in Good Pharmaceutical Practices based on the analysis of the educational-and-professional and educational-and-scientific programs was disclosed.

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