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APPLICATION OF CASE TECHNOLOGY IN THE PROCESS OF TEACHING CHEMISTRY TO FUTURE SPECIALISTS IN THE FIELD OF PHARMACY

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The article substantiates the expediency of using case technology in the process of studying chemical disciplines, which is not only one of the top priorities of modern professionally-oriented learning technologies, but also adapted to the formation of professional competence of future specialists in the field of pharmacy. The tendencies of introduction of the case study method in the practice of professional higher education are revealed; the main tasks and objectives of application of the case method in the process of professional training of students are formulated. Case-study based lessons are reviewed and described, major stages of "case" use are highlighted, as well as the role of the teacher and the student at each corresponding stage is indicated. Authors' own case-study based technologies and experience of their successful and effective practical application and exploitation in the process of studying chemical disciplines in Zhytomyr College of Pharmacy are revealed and substantiated.

The article contains the results and analysis of the responses of undergraduates and first-year students about the need for chemical knowledge, which were collected through an anonymous survey. The role, criteria, stages of realization of professional orientation of teaching chemistry as a complex multifunctional process aimed at students' awareness of motives, needs of future professional activity, combination of theoretical and practical components of educational content are clarified. The value of the case study method in the professional development of a pharmaceutical specialist during college studies is argued.

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The aim of the study is to expand the range of opportunities for teachers of professional higher education to use the latest technology of case-study in the process of forming the professional competence of future pharmacists in the process of studying chemical disciplines. The result of the use of case technology is the training of a qualified competitive specialist, as well as the formation of key competencies of the student, his/her ability to self-development, self-determination, self-education.

Key words: *learning technology, professionally-oriented learning technology, professional orientation of teaching chemistry, case technology, case study method, professional competence, pharmacy, pharmacy specialist.*

ЗАСТОСУВАННЯ КЕЙС-ТЕХНОЛОГІЇ У ПРОЦЕСІ НАВЧАННЯ ХІМІЇ МАЙБУТНІХ ФАХІВЦІВ ГАЛУЗІ ФАРМАЦІЇ

С. С. Вітвицька, І. С. Ковальчук

У статті обґрунтовано доцільність використання кейс-технології в процесі вивчення хімічних дисциплін, яка є не лише однією із пріоритетних сучасних професійно-орієнтованих технологій навчання, а й адаптована до формування професійної компетентності майбутнього спеціаліста у галузі фармації. Розкрито тенденції впровадження методу кейс-стаді в практику фахової передвищої освіти, сформульовано головні завдання застосування кейс-методу в процесі фахової підготовки студента. Висвітлено методіку проведення заняття з використанням методу кейс-стаді, виділено етапи роботи з кейсом, зазначено роль викладача та студента на кожному етапі. Представлено та проілюстровано власні розробки та досвід ефективного використання кейс-технології у процесі вивчення хімічних дисциплін у Житомирському базовому фармацевтичному фаховому коледжі.

Стаття містить результати та аналіз відповідей школярів-старшокурсників та студентів-першокурсників про необхідність хімічних знань, що зібрані шляхом анонімного опитування. З'ясовано роль, критерії, етапи реалізації професійної спрямованості навчання хімії як складного комплексного багатofункціонального процесу, спрямованого на усвідомлення студентами мотивів, потреб майбутньої професійної діяльності, на поєднання теоретичної і практичної складових змісту освіти. Аргументовано цінність методу кейс-стаді в професійному становленні фармацевтичного фахівця під час навчання в коледжі.

Метою роботи є розширення спектру можливостей викладача закладу фахової передвищої освіти щодо використання новітньої технології навчання кейс-стаді у процесі формування професійної компетентності студентів – майбутніх фармацевтів при вивченні хімічних дисциплін. Результатом застосування кейс-технології є підготовка кваліфікованого конкурентноспроможного фахівця, формування ключових компетенцій студента, його спроможності до саморозвитку, самовизначення, самоосвіти.

Ключові слова: *технологія навчання, професійно-орієнтована технологія навчання, професійна спрямованість навчання хімії, кейс-технологія, метод кейс-стаді, професійна компетентність, галузь фармації, фахівець фармації.*

Introduction of the issue. The pace of innovative development, which is constantly accelerating, sets requirements to pharmacy specialists, which include the following: a high level of professional competence; the ability to learn quickly and efficiently in order to master new technologies; ability to

act adequately; take responsibility for their actions; ability to work in a team. Thus, the main goal of professional education is to train a competent competitive in the labor market specialist capable of effective professional work according to the specialty.

An important factor of the future qualified, competent professionals training in accordance with the Law of Ukraine "On Higher Education" is the quality of education [2].

In the National Doctrine of Education Development in Ukraine in the XXI century, one of the main tasks of the state is "the development of creative abilities and skills of independent scientific knowledge, self-education and self-realization, training of qualified personnel capable of creative work, professional development, improvement and implementation of knowledge and information technologies that are competitive in the labor market" [6].

One of the modern effective methods of learning is the case study, which is based on the analysis of specific situations, for it provides high efficiency of training, promotes positive motivation, forms personal qualities and competencies of future professionals.

Current state of the issue. Today the main methodological innovations are related to the use of interactive teaching methods, moreover, their essence presuppose that the learning process is organized on the basis of interaction, dialogue, during which students learn to think critically, solve complex problems based on the analysis of circumstances and relevant information, as well as take into account alternative opinions, make informed decisions, participate in discussions, communicate with other people.

In the domestic educational practice on the theoretical and practical issues of using the case study method research in the corresponding areas is conducted by the specialists of the Ukrainian Center for Innovation and Development, including I. Kateryniak, V. Loboda, K. Meier, O. Sydorenko, Yu. Surmin, A. Furda [5].

Among foreign scientists the works of J. Erskine, M. Leenders, E. Mointera, M. Norphy [7; 8] accumulated rich

experience in the development and use of the case method in professional training and must be mentioned.

The outline of unresolved issues brought up in the article. At the same time, the specifics of the use and introduction of the case method in the educational process of institutions of professional higher education, in particular pharmaceutical colleges, are insufficiently covered. While the flow of information in the modern world requires the use of such teaching methods that would allow the effective acquisition of a large amount of knowledge, as well as provided a high level of mastery of the material being studied.

Aim of research is to substantiate the expediency of use of case technology in the process of studying chemical disciplines, disclose authors' own methods of conducting classes using the case method in order to form the professional competence of future pharmacists. Psychological and pedagogical works of modern teachers-scientists were studied as research materials. In order to achieve the goals, the following methods are used: system approach; structural and logical analysis; generalization of positive own experience and experience of teachers of chemical disciplines; scientific observation.

Results and discussion. The method of situation analysis (case study) was first used in the educational process at the Harvard Law School in 1870, however, the application of this method in the Harvard Business School began in 1920. Thereafter, the first collections of cases were published in 1925 in Harvard University reports.

Today, two classic case study schools coexist – Harvard (American) and Manchester (European). In the first school, the purpose of the method is to teach student to search for the only right solution, at the same time, the second one involves a variety of solutions. American cases are larger in

volume (20-25 pages of text, plus 8-10 pages of illustrations), European cases are 1.5-2 times shorter.

From a *methodological point of view*, "case" is a specially prepared educational material that contains a structured description of situations taken from real (professional) practice; it is always a simulation of a real-life event, professional situation, and the solution that the participant will find can serve as a reflection of the level of his/her competence and professionalism, as well as a practical key to solving the problem under given circumstances. As a rule, cases do not have a single solution, therefore the student can always find his/her unique way of undergoing the issues of a given situation.

The value of case technology is that it not only reflects the practical problem, but also actualizes a set of knowledge that must be mastered in solving this problem, as well as successfully combines teaching, analytical and educational activities, which is effective and efficient in implementing modern tasks of the system of education.

According to the *type* and *sphere of application* the cases can be divided into training, educational, analytical, research, systematizing and prognostic. Long-term practice of teaching in the system of professional pharmaceutical education indicates that most students are unaware of how to express their opinions, substantiate their own point of view causing major flaws in their speech culture. Students with theoretical knowledge make mistakes in solving problems of a practical nature.

Therefore, there is a need to choose pedagogical technologies that improve the organization of the educational process, motivate students as well as activate their knowledge, form skills and need to think critically, the ability to perceive, analyze, compare information, make their own decisions and take responsibility for them, i.e. create the necessary conditions for

development and self-realization of the future specialist. Thus, one of the priority areas for improving the content of professional pharmaceutical education is the introduction of new teaching methods, innovative technologies, dissemination of best practices. A graduate of a professional educational institution will be successful if he/she possesses a holistic system of professional competencies that are formed during college practice and developed in the process of professional activity. In turn, the global processes of humanization of education, its focus on the disclosure of personal potential of students, led to the introduction of innovative technologies in the educational process as one of the priorities of public policy in education.

In our opinion, the most effective and efficient technology in the process of studying chemical disciplines in institutions of professional pharmaceutical education is case method. The main purpose of using it is to include elements of professional orientation in the educational process, including the transition from theoretical educational situations to practical professional ones, which ensures the competitiveness of the graduate in the labor market. Today, the novelty and features of the use of case technology require its detailed analysis as an interactive method of teaching, adaptation to the peculiarities of use in the teaching of chemical disciplines in institutions of professional higher education.

Together with other subjects, chemistry is designed to realize the purpose of general secondary education, as well as to solve issues of personal development, the formation of scientific worldview, real-life and social competencies of the student in accordance with the chosen areas and profiles of study.

In recent years, there has been a decrease of students' interest in the

subjects of the natural (environmental) cycle, including chemistry. The following results were obtained during a survey of high school students about the need for knowledge in the sphere of chemistry: 60% of participants claimed that they will not need corresponding knowledge in the future; 35% complained about the complexity of the subject and meaninglessness of forcing

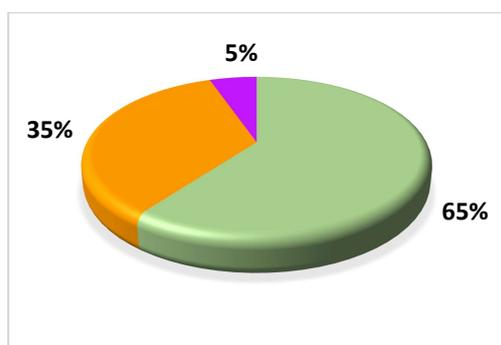


Fig. 1. High school students survey

Examination and evaluation of the current state of studying the course of chemistry at school shows the following: lack of motivation; undeveloped worldview; insufficient focus on vital issues, and especially on the problems of environmental education; lack of an approach that takes into account the interests and abilities of students (resulting in course being too difficult or too easy for some students to master) [3].

A survey of first-year students of the College of Pharmacy, for whom knowledge of chemical disciplines is not only basic but also professionally significant, indicated the following: 33.7% of surveyed realize that they will need knowledge of chemistry in the future; 39.6% of participants consider chemistry an interesting science and study it with pleasure; 16.7% of students realize that they will need knowledge of chemistry in the future, thus treating the subjects as the appealing one and study it with pleasure; 8% of respondents complain about the complexity of the subject and

themselves to learn it; 5% of respondents consider the issues under study to be easily accessible via Internet, books, television programs, etc. with explanations and ready-made solutions (Fig. 1). Also, the subject is mostly identified as highly specialized and suitable for only choice-based availability in the curricula.

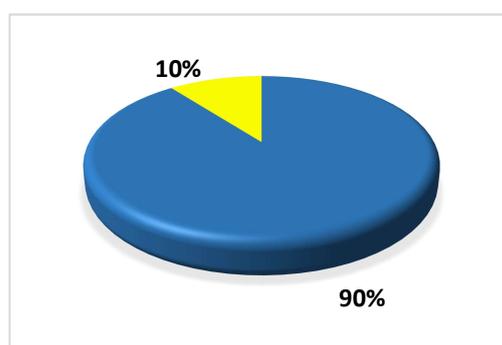


Fig. 2. HEI freshmen survey

believe that this discipline should be optional; 2% of surveyed are convinced that chemistry classes study issues already known to them from school, Internet sources, etc. Therefore, 90% of students consciously approached the choice of profession, understand the need for chemical knowledge in future professional activities. However, 10% of freshmen are not motivated enough, moreover, they consider the subject too difficult and boring (Fig. 2). The survey of students of the pharmaceutical institution confirms the following statement: the profile study of chemistry in the first year involves a focus on the future profession.

The professional orientation of teaching chemistry is a pedagogically adapted assimilation of the basic content of the subject by students at the level of the requirements of the profession of a pharmaceutical worker, which is concentrated around fundamental educational objects and goals, motives and needs of subjects of cognition.

Thus, the professional orientation of teaching the chemical cycle subjects in the College of Pharmacy should be considered as a complex multifunctional process aimed at understanding students' motives, needs for future activities, a combination of theoretical and practical components of educational content – an introduction to the content of laboratory techniques of analytical and cosmetic chemistry, physical and colloid chemistry of professionally significant material, the mastering of which will ensure the formation of professional knowledge, skills, abilities and creative development of students.

The criteria that ensure the professional orientation of teaching chemistry, we include the following: motivational, semantic, value, activity, effective.

The implementation of professionally oriented teaching of chemistry in the pharmaceutical professional college is carried out in stages, namely: information-theoretical, laboratory-practical, independent-creative.

In the process of studying chemistry, we use case technology, which involves the use of the case study method. The problem of introducing the above-mentioned tools in the practice of professional education is due to two major trends: the first stems from the general direction of education, for it focuses mostly on obtaining specific knowledge instead of forming professional competence, skills and intellectual abilities of the students; attention is paid to the ability to learn,

change the paradigm of thinking, the ability to process huge amounts of information; second issue concerns the development of requirements for the quality of training, which must ensure the formation of the ability to behave optimally in different situations, therefore act systematically and effectively during crisis [1]. In this case, the use of the method of situation analysis is an effective factor in stimulating the creative activity of students, involving them in the assessment of everyday reality in order to combine theoretical material and practical understanding of multidimensional environment. Mentioned form of task stimulates students to carry out intensive creative work, as well as forms the ability to see the world not only through the prism of theoretical positions, but also in the context of living reality.

Based on the fact that chemistry is primarily an experimental science, with many different ways to solve an issue or problem, the use of case technologies allows the educators to realize all the benefits of this learning technology. The application of the case method is connected with activity, initiative, ability to make a collective decision(s), at the same time with the right to one's own opinion. The case method promotes the formation of constructive, projective skills, the ability to clearly and consistently express one's opinions, analyze and formulate conclusions [4].

The steps of working with the case are presented in table 1.

Table 1.

Stages of working with the case	Educator's activity:	Student's activity:
<i>1. Preparatory stage:</i>	- selection of case(s); - determining the purpose of the case; - preparing additional information materials.	- elaboration of theoretical material on this topic.
<i>2. Introductory stage (motivation for joint activity)</i>	- acquaintance of students with the case;	- acquaintance with the case, tasks and awareness

is formed):	<ul style="list-style-type: none"> - identification of the main problem underlying the case; - definition of didactic and information materials. 	of the problem-based situation.
3. <i>Main stage</i> (organization of joint activities to solve the problem):	<ul style="list-style-type: none"> - distribution of students in groups (4-6 individuals each); - answer to students' questions; - supporting the business mood in the audience; creating an atmosphere of cooperation and competition at the same time, ensuring compliance with the personal rights of the students; - assessment of students' contribution to the analysis of the situation. 	<ul style="list-style-type: none"> - acquaintance with information materials; - identification and discussion of problematic issues; - search for arguments and solutions; - discussion within the group; - determination of speakers; - presentation of analysis results.
4. <i>Concluding stage</i> :	<ul style="list-style-type: none"> - organization of the general discussion; - generalized speech (analysis of the situation, work of groups); - assessment of students. 	<ul style="list-style-type: none"> - general group discussion: comparison of different solutions to one problem; - outlining the optimal solution to the problem of the proposed ones.

Case technology can be represented in the methodological context as a complex system in which other methods of cognition are integrated: modeling, systems analysis, problem method, imaginary experiment, methods of description, classification, roleplay game.

Acquaintance with the case takes place in class or in advance (as homework). Cases should be presented *in paper form (printed), which contain reaction equations, tables, illustrations, diagrams; in the form of presentations and video cases.*

For example, in the process of studying organic chemistry at the Zhytomyr College of Pharmacy we used a case in the form of a presentation on the following topic: "**Phenolic acids**". Students were offered to solve this case as homework, and the results were presented and confirmed experimentally in the laboratory.

Case: "Where there is a willow, there is healthy water" – says a Ukrainian proverb. In folk medicine, an infusion or decoction of willow bark is used to relieve pain and lower fever, to treat rheumatism, gout and as a diuretic. Scientists have found that the active therapeutic component of this decoction is salicylic acid. The name salicylic acid comes from the Latin name **Salix alba** - White willow (**salix** – willow, **alba** – salicylic). Subsequently, a method for its synthesis was developed.

In 1893, the chemist Felix Hoffmann, an employee of the German pharmaceutical company Bayer, first synthesized acetylsalicylic acid, which in 1899 was patented under the name "aspirin". Subsequently, the original technology for the synthesis of acetylsalicylic acid (aspirin) was developed in our country, which was not inferior in quality to the German.

These drugs immediately became very popular and have survived to this day. The volume of their production per year reaches tens of thousands of tons. In Ukraine, well-known manufacturers of the drug "Acetylsalicylic acid" are PJSC Pharmaceutical Company "Darnitsa", PJSC "Farmak" (Kyiv).

Aspirin has pronounced anti-inflammatory, antipyretic and some analgesic effects. It is used to eliminate pain in migraine, as the mean of prevention of cardiovascular diseases (myocardial infarction, stroke, thrombosis), cancer, type II diabetes, Alzheimer's disease, herpes and more. However, this does not exhaust its effect on the body, as studies reveal new possibilities for the biological activity of the compound.

Aspirin has twice been entered in the Guinness Book of Records: for the first time in 1950 as the analgesic with the highest sales volume; for the second time on March 6, 1999 as the largest package (120 m in height and 65 m in width) of the drug "Aspirin", which became the administrative building of the company "Bayer AG" in honor of the 100th anniversary of the drug. A new variety of roses bred in Germany in honor of the 100th anniversary was named "Aspirin".

Some housewives add aspirin tablets to jars when canning vegetables and fruits.

Case-related questions:

1. Suggest methods for the synthesis of acetylsalicylic acid.

2. Remember which medicines in your home first-aid kit contain salicylic and acetylsalicylic acids. What are they for? Learn about promising uses of acetylsalicylic acid from additional information sources.

3. What cosmetics in your cosmetic bag contain salicylic acid? What properties does it show as a cosmetic ingredient?

4. Find out what transformations acetylsalicylic acid undergoes:

a) in the human body;

b) in a jar with canned vegetables.

Conclude the most appropriate canning technology which exploits aspirin. Are there recipes for homemade cans without the use of aspirin, vinegar, synthetic citric acid, etc.?

5. Suggest storage conditions for aspirin and reactions to determine its benignity.

When applying the case method, the teacher must create such conditions in the classroom that would develop students' ability to think critically, analyze, encourage them to share their thoughts, ideas, knowledge and experience during the discussion. The student's role is to take responsibility for the effectiveness of the learning process. At the same time, he should be aware that the teacher is in the classroom to help, but the main responsibility for why he learns lies with him.

Our observations allow us to state that solving cases promotes the development of students' basic features of critical thinking: the ability to make logical inferences; make informed decisions; to evaluate the positive and negative features of both the received information and the mental process itself; be result-oriented. Such thinking is characterized by controllability, reasonableness and purposefulness. A critical student is able to ask the right questions, highlight the main thing; determine the necessary information; recognize biased judgments, separate facts from subjective opinions, separate false information from correct ones; identify the problem; make comparisons; put forward solutions; anticipate the consequences; find and present arguments; draw conclusions and test them in practice. In addition, the case study method promotes the development of analytical, practical, creative, communicative, social and introspection skills.

Therefore, based on the analysis of factors, characteristics and advantages of using the case method, we can

conclude that the use of the case method in the process of professional training of students contributes to:

1. Obtaining the necessary set of professional knowledge, skills and abilities;

2. Formation of constructive and critical thinking in future specialists;

3. Inclusion of future specialists in the context of practical activities in institutions of professional higher education;

4. Gaining practical skills (decision making, observation, situation analysis);

5. Development of a set of abilities (leadership, communication) necessary for further personal and professional growth;

6. Building and activating the intellectual potential of the future specialist;

7. Formation of a system of professional, universal, moral, cultural and other values.

The main function of the case study method is to teach students to solve complex unstructured problems that cannot be solved analytically. The case motivates students, leaving them alone with real, professional situations.

Conclusions and research perspectives. The practical value of the introduction of case technology in the system of pharmaceutical education is due to it being competence-oriented while focusing on training professionals, who possesses such characteristics as critical thinking, creativity, flexibility in solving professional tasks. The use of case method not only stimulates students to solve practical issues, but also motivates them to acquire additional knowledge, gain experience, vary methods of activity, promotes the development of self-educational and research skills, ensures acquisition of future culture of business communication.

The prospect of further research in this direction is to develop a

methodology for implementing case technology in the other spheres of educational process.

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