

UDC 615.1:54

**IMPLEMENTATION OF STEM EDUCATION IN THE TRAINING OF
PHARMACISTS**

Lyudmila Ivanivna Khmelnikova,

k. chem. n., associate professor

Slesarchuk Vladlena Yuriivna,

k. b. n., associate professor

Dnipro State Medical University

Dnipro, Ukraine

Ludmila.DMA@gmail.com

vladlenaslesarchuk@gmail.com

Abstract: The introduction of elements of STEM education into the educational process contributes to the synergistic combination of traditional and innovative methods of teaching chemical disciplines, the integration of natural sciences, which in the best way forms the necessary competencies in students, creating conditions for self-realization of personal potential and self-development.

Keywords: STEM education, integration of natural sciences.

The introduction of STEM education allows students to solve problems, find the necessary information in professional literature and databases of other sources, analyze, evaluate and apply this information.

The possibilities and directions of STEM education during the war are of particular importance due to the need for an increasing transition to remote forms of education with the use of digital technologies in order to ensure the security situation and preserve the health of students. The functioning of the education system in the conditions of martial law is characterized by an intensive search for new approaches to learning, innovative forms of organizing the educational process, effective pedagogical and information technologies.

According to American specialists [1, p. 8], it is predicted that 75% of the fastest-growing professions require the possession of STEM skills - elements for the purpose of developing and strengthening the competencies of students in the scientific and technical direction.

The task of modern pharmaceutical education is to form the future pharmacist as a creative, competitive personality, capable of independently acquiring knowledge and applying it, making non-standard decisions.

The teacher's task is to help the student-pharmacist to grow in success, to make them feel the joy of overcoming difficulties, to make it clear that nothing in life is given for nothing, it is necessary to make efforts everywhere and success will be equivalent to the efforts spent [2, p. 2]. Innovative models of pharmaceutical education are designed to stimulate the cognitive activity of students of higher education, including in the classes of chemical disciplines.

Means of STEM education are a set of equipment, ideas, phenomena and methods of action that ensure the implementation of research and experimental, design, inventive activities in education. Such activity involves integrated and creative cooperation of students - pharmacists, aimed at obtaining independent results under the guidance of the teacher [3, p. 30].

We will give several examples of the introduction of elements of STEM education in classes of chemical disciplines from our own experience. A special form of STEM-approaches are integrated classes, which are aimed at establishing interdisciplinary connections, which contribute to the formation of a holistic, systemic worldview in pharmacist students, and the actualization of personal attitudes to the issues discussed in classes.

Thus, when studying the section of physical and colloidal chemistry "Buffer systems", the concepts of alkalosis and acidosis begin to form in the course of inorganic chemistry (1st course), then they are consolidated and developed during the study of physical and colloidal chemistry (2nd course), analytical chemistry (2nd course), toxicological chemistry, biochemistry, normal and pathological physiology (3rd course) and further when studying pharmaceutical disciplines (pharmaceutical chemistry, pharmacology, etc. - 4-5 courses), and then - in professional activity. The

inclusion in the content of chemical disciplines of such sections as "Surface phenomena", "Dispersed systems", "Redox - processes and equilibria" will contribute to the understanding of the methods of obtaining medicinal preparations in the form of suspensions, emergence of bioelectric potentials, heart rhythm disturbances. No less important and professionally oriented in the structure of chemical disciplines is the section "Teaching about solutions", when mastering which students can: perform calculations necessary for the preparation of perfusion solutions, calculate the value of the hydrogen index, predict such processes as plasmolysis, hemolysis, acidosis, alkalosis, understand the processes that occur during the operation of the "Artificial Kidney" apparatus, as well as model biochemical processes.

In the process of studying various topics, students develop educational projects. The teacher manages such activities and encourages students to search, helps in determining the goal and tasks of the educational project. During the implementation of educational projects, a number of educational and developmental tasks are solved.

Project activity is one of the most promising components of the educational process, which creates conditions for creative self-development and self-realization of pharmacist students, forms all necessary life competencies: speech, information, political and social [4, p. 6].

The use of STEM-approaches provides an opportunity for students of higher education to carry out research activities. To stimulate cognitive interest in natural sciences, it helps to work in virtual laboratories, to conduct computer experiments with the help of simulation programs, using visualization, animation, video materials. With the help of the service, we create interactive worksheets for performing laboratory experiments and practical work in conditions of distance or mixed learning. One of the most important areas of work in the system of teaching chemical disciplines is solving tasks. Tasks of various types can be effectively used at all stages of acquiring chemical knowledge. According to the requirements of the competence approach, the tasks that we offer, which are close to the real conditions of human life, encourage the use of knowledge in life situations.

We offer students competence tasks in which interdisciplinary connections and applied orientation of learning chemical disciplines are clearly traced. For example,

one of the multivitamins includes minerals in the following quantities: potassium and phosphorus - 4% each, magnesium - 1.6%, iron - 0.07%, zinc - 0.06%.

Calculate the mass (mg) of each mineral contained in one multivitamin tablet, the weight of which is 25 g. Or, the human body should receive 0.5 - 0.8 g of calcium with food per day. Calculate the mass (g) of milk per day that you should drink to provide yourself with calcium (based on the fact that 100 grams of milk contains 0.1 g of calcium).

Problem-based learning is also reflected in the scientific and research activities of students of higher education. Students who have written a research paper at least once, "lived" it from the first to the last word, then independently search for topics that interest them, solve research tasks.

It is important to develop scientific and research skills in pharmacist students, so they participate in various scientific conferences. An example of such activity was the participation of pharmacist students in: the second international symposium "Education and health of the younger generation", 2018; VIII and X All-Ukrainian scientific and technical conferences of students, postgraduates and young scientists "Ecological problems of the regions", Dnipro, 2019, 2020. r.; XX, XXI All-Ukrainian conferences of young scientists and students on topical issues of modern chemistry, Dnipro, 2022, 2023. VIII International scientific and practical conference "Innovative development of science, technology and education", Vancouver, Canada, 2024; The 10th International scientific and practical conference "Modern research in science and education "Chicago, USA, 2024

XX, XXI Всеукраїнські конференції молодих вчених та студентів з актуальних питань сучасної хімії, Дніпро, 2022, 2023р.р;. VIII Міжнародна науково-практична конференція «Innovative development of science, technology and education», Ванкувер, Канада, 2024р.; The 10th International scientific and practical conference «Modern research in science and education «Chicago, USA,2024.

In order to understand the principle of STEM, it is necessary to see not just a phenomenon, but to understand what mathematically determined physical, chemical, biological regularities led to its emergence. The method of forming students' valuable

attitude to chemical knowledge is the disclosure of the achievements of domestic science and highlighting the contribution of Ukrainian scientists to the development of natural sciences, because concrete examples of the achievements of Ukrainian scientists, especially of the world level, are of decisive importance in the national education of students, forming in them a sense of pride for their Motherland and the Ukrainian people. In the process of learning chemical disciplines, we show the life and work of scientists - chemists as an example, what and how they did to achieve success in a certain field of knowledge. Mastering the content of the educational disciplines of the science and mathematics cycle can have a positive effect on students, if this task is carried out through the implementation of interdisciplinary connections in extracurricular time.

So, STEM education is: integration of four disciplines (natural sciences, technology, engineering, mathematics) into a single educational scheme; introducing the principles of STEM education into the educational space, which contributes to the creation of a fundamentally new model of education with new opportunities for teachers and students of higher education.

The future lies in the integration of natural sciences, because it best contributes to the formation of the necessary competencies in students, holistically ensures the cognitive orientation of the individual, creating conditions for the self-realization of personal potential and self-development.

Using an interdisciplinary approach, practical orientation, research and project activities during classes, orienting our activities on the STEM concept, we will be able to build a modern, economically stable, high-technological, smart and happy society.

The use of STEM technologies promotes the development of critical thinking skills and cognitive interests of pharmacist students, encourages them to show imagination and creativity, and increases their activity.

The teacher is obliged to create comfortable learning conditions under which the student of higher education will feel successful, intellectual perfection, which will make the educational process itself productive, and the teacher, in turn, has the

opportunity to see the results of his work and get satisfaction and reward for his efforts.

Reference list

1. Наказ МОН України № 188 від 29.02.2016 р. «Про створення робочої групи з питань впровадження STEM-освіти в Україні». URL: <https://mon.gov.ua>.
2. David W. White What is STEM education and why is it important? /W. David //Florida Association of Teacher Educators Journal- Volume 1, Number 14, 2014, с. 1-9.
3. Коршунова О. В. STEM-освіта. Професійний розвиток педагога : збірник спецкурсів / О. В. Коршунова, Н. І. Гущина, І. П. Василяшко, О. О. Патрикеева. К. : Видавничий дім «Освіта»,2018.80 с. ISBN 978- 617-656-972-5.
4. Про затвердження плану заходів щодо реалізації Концепції розвитку природничоматематичної освіти (STEM-освіти) до 2027 року: розпорядження Кабінету Міністрів України від 13 січ. 2021 р. № 131-р. Київ, 2021. [https://zakon.rada.gov.ua/laws/show/131-2021- %D1%80#Text](https://zakon.rada.gov.ua/laws/show/131-2021-%D1%80#Text) (дата звернення: 12.11.2022).