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FORMATION OF STUDENTS EDUCATIONAL AND COGNITIVE ACTIVITY IN THE PROCESS OF PRACTICAL CLASSES IN CHEMISTRY

***Annotation.** The article is devoted to the study “formation of educational and cognitive activity of students in the process of practical classes in chemistry”. Research on aspects of the formation of educational and cognitive activity of students, the development of their search and creative abilities, creative thinking are carried out in the process of studying the cycle of chemical disciplines.*

***Key words:** activities, education, creative thinking, chemistry, students.*

***Анотація.** Стаття присвячена дослідженню формування навчально-пізнавальної активності студентів у процесі практичних занять з хімії. Дослідження аспектів формування навчально-пізнавальної активності студентів; розвиток їхніх пошукових та творчих здібностей, творчого мислення проводяться в процесі вивчення циклу хімічних дисциплін.*

***Ключові слова:** діяльність, освіта, творче мислення, хімія, студенти.*

Introduction. A solid understanding of fundamental chemical concepts, laws, theories, and terminology is essential for identifying chemical substances and

phenomena, as well as predicting the course of chemical processes. Students engaged in cognitive and practical chemistry-related activities constantly rely on established chemical facts, concepts, and laws. Crucially, the process of acquiring chemical knowledge fosters the development of students' cognitive abilities. Mastering new, advanced, and complex theories, particularly through hands-on experience in practical chemistry classes, signifies a student's progress to a higher level of thinking and mastery of a new system of cognitive activity. Therefore, studying the development of interest and educational-cognitive activity among higher education students in practical chemistry classes is of significant importance.

In this context, the President of the Republic of Tajikistan, the Leader of the Nation, Emomali Rahmon, proposed to the Majlisi Namoyandagon Majlisi Oli to declare the years 2020-2040 the «Twentieth Anniversary of the Study and Development of Natural, Exact, and Mathematical Sciences in the Field of Science and Education», stating, «In the name of further improving the study of natural, exact, and mathematical sciences, as well as expanding the technical thinking of the younger generation» [1].

The purpose of the article is to study the formation of students' educational and cognitive activity in the process of practical classes in chemistry.

Research Results. The role and status of practical, experimental, and hands-on activities in general chemistry education are crucial for fostering interest, educational and methodological skills, creativity, professionalism, and practical abilities in students. These issues are addressed in the works of numerous foreign and domestic scientists in chemistry education, including T.S. Nazarova («Chemical Experiment at School», 1981), A.A. (same title, 1981), S. Kholzarov («Methods of Teaching Chemistry», 2015), L.A. Svetkov («Experiments in Organic Chemistry», 1973), K.Ya. Parmenov («Chemical Experiment in School», 1959; «Methodology for the Formation of Basic Concepts of Organic Chemistry in Students», 1990), S.S. Abdurahimov («Guidelines for Conducting Chemical Experiments», 2009), S.G. Bandaev («Practical Exercises in Inorganic Chemistry», 2010), A. Haydarov (same title, 2010), M.Z. Kadyrova («Laboratory Work in Organic Chemistry», 2019), B.V.

Kadyrov and F. Faizalizoda («Information Technologies in the System of Secondary Professional Medical Education», 2016), S.I. Rajabov («Laboratory Work on Organic Chemistry», 2019), F.A. Abdullaev («Practical Classes in Inorganic Chemistry», 2010), and others [2]. And also in the works of Ukrainian authors [3 - 6].

The experimental method plays a vital role in chemistry education, fulfilling educational, instructional, and developmental functions in accordance with pedagogical and didactic requirements. The study of chemistry fosters labor, aesthetic, and environmental education. Furthermore, the development of tasks cultivates students' cognitive processes, including emotions, worldviews, motives, attention, memory, and thinking.

Scientists like N. Chertkov and G.N. Zhukov emphasized the importance of experiments as a practical method in chemistry education, particularly for developing students' cognitive and scientific understanding, problem-solving skills, and educational processes, including study, research, and the development of knowledge, skills, and abilities. The contribution of medieval Persian-Tajik scientists to the history of natural sciences is immense, especially the contributions of Jabir ibn Hayyan and Abu Bakr Muhammad ibn Zakaria Razi [7 - 8].

The first documented chemical laboratory experiments are found in the works and poems of Persian and Tajik scholars like Jabir ibn Hayyan Tusi and Abu Bakr Muhammad ibn Zakaria Razi. Jabir ibn Hayyan stressed the importance of experimental, practical work in chemistry, arguing that researchers who ignore it cannot achieve success. He believed that scientists should focus on the principles of using experimental methods rather than simply possessing equipment [9].

M. Bobizoda highlights the importance of fostering students' interest in chemistry through aligning theoretical material with experimentation, connecting theory and practice, incorporating the historical development of chemistry, and organizing engaging games and experiments. Academic disciplines in higher education, depending on their content, goals, and objectives, as well as the available scientific, theoretical, and methodological materials, offer educational perspectives

and a scientific worldview for students [10]. Practical classes build upon students' existing knowledge to facilitate the discovery of new information. Teachers should pose questions that encourage students to creatively seek solutions independently. These practical classes are interconnected, covering topics such as demonstrating the genetic relationships of organic substances (through chemical transformations), synthesizing organic acids, benzene, nitrobenzene, aniline, oxidizing alcohol to aldehyde and aldehyde to acid, and synthesizing various esters.

Chemical experimentation, as emphasized by numerous scientists, is crucial in chemistry education, serving as a source of both knowledge and personal development. Its purpose is to introduce students to new information and reinforce previously learned theoretical concepts. Observing students' educational and cognitive activities in chemistry classrooms, during extracurricular activities, and beyond allows teachers to assess their understanding and the quality of their chemical knowledge, as well as to influence their attitude towards learning and stimulate their interest in acquiring knowledge. Practical and laboratory work must be conducted under the direct supervision of a teacher. Only experiments outlined in the curriculum should be performed in the classroom, using appropriate quantities of substances as indicated. No equipment should be used without prior inspection. Special attention must be paid to the ventilation system in the chemistry room to ensure the safe removal of toxic gases and vapors without disrupting demonstrations or obstructing students' view of experiments.

Environmentally safe conditions must be maintained for both students and teachers in the chemistry room. The chemistry teacher is responsible for monitoring the condition of the room and reporting any malfunctions in the ventilation system, plumbing, or other equipment to the appropriate authority. In addition to the centrally supplied list of devices, components, educational materials, manuals, etc., other necessary items may be purchased or, in some cases, created by the teacher and students. Conducting a demonstration class requires defining the purpose of the experiment, formulating a hypothesis, gathering the necessary equipment, planning the experiment, testing new experiments, and writing a report. Developing students'

educational and cognitive activity during demonstrations involves applying chemical principles and developing teaching aids.

Conclusions. A practical course or a set of practical works comprises a series of experimental tasks that students perform independently after completing the core chemistry curriculum. These practical classes introduce students to modern chemical methods. The teacher can adjust the specific practical work based on available laboratory resources. Through experimental work, students not only reinforce previously learned material but also gain new knowledge about experimental techniques and related content. The success of practical training depends significantly on students' prior preparation.

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