

APPLICATION OF INTERACTIVE METHODS IN CHEMISTRY

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Abstract: This article discusses the importance of using interactive methods in teaching chemistry as an effective way to organize the educational process, encourage students to participate actively, develop their creative and critical thinking skills, and help them understand the topics being studied more deeply. This article discusses the use of interactive methods in chemistry and the benefits they provide to students.

Keywords. Interactive, Case-study, problem-based learning, chem-office, PhET, virtual, discussion, digital technology, simulation.

Chemistry is one of the fields that is interesting for students, but sometimes perceived as difficult. Traditional teaching methods - reading from a textbook and relying on teacher explanations - often fail to fully arouse students' interest or help them understand the subject in depth. Therefore, interactive methods are widely used in modern education. These methods make students active participants in teaching chemistry, allowing them to master knowledge in a practical and creative way. Interactive methods, including case technology, project-based learning, group discussions and the use of games, help to increase student cooperation in chemistry lessons and reinforce topics with practical examples. The use of interactive methods in inorganic and organic chemistry, for example, in teaching the topic of alkaline earth metals, increases students' interest in the subject and helps them master the subject more deeply. Also, using virtual laboratories and ChemOffice programs to visually demonstrate complex chemical reactions helps students better understand the subject.

The use of interactive methods in teaching chemistry makes the process of acquiring knowledge more effective and interesting for students, develops their creative and critical thinking skills, and improves the quality of education. Interactive methods include methods aimed at increasing cooperation between the teacher and the student, as well as among students. The following interactive methods are effectively used in chemistry:

Problem-Based Learning. Students are given a problem from real life. For example, they are asked to conduct an experiment based on the question "How can the hardness of water be softened?" Students study how water reacts with calcium and magnesium salts, and try out soda or boiling methods. Example: Students test water samples in groups and use chemical indicators to determine hardness.

Experiments and practical exercises. Chemistry cannot be fully understood without experience. For example, by demonstrating the reaction of copper (II) hydroxide ($\text{Cu}(\text{OH})_2$) with ammonia to form the dark-colored $[\text{Cu}(\text{NH}_3)_4]^{2+}$ complex, students directly observe the

reaction process. Example: Study the properties of gases by producing CO₂ gas in common household conditions (for example, with citric acid and baking soda).

Group work and discussion. Students divide into small groups and collect and discuss information on the topic, for example, “How are nitrogen fertilizers produced?” Each group presents its conclusions to the class. Example: Analyze the contact method of sulfuric acid production in groups and describe each step.

Digital technologies and simulations. Chemical reactions can be viewed virtually using computer programs or mobile applications. For example, study atomic structure or acid-base reactions through PhET simulations. Example: Explaining gas laws by showing the movement of molecules in a 3D model.

Games and quizzes. Learning the periodic table of chemical elements through a game or conducting a “Find a chemical reaction” quiz. For example, students compose a reaction equation based on the given substances (HCl, NaOH). Example: Competing in the “Which substance is an acid?” quiz on the Kahoot platform.

Interactive methods in teaching chemistry not only make the lesson interesting, but also have a positive effect on the process of learning for students. Below are their main benefits:

Increased interest. Through experiments and games, students develop an interest in chemistry. For example, a color change in a simple experiment (copper turns dark blue with ammonia) amazes them and encourages them to learn.

Better understanding and long-term memory. While traditional methods only require memorization, interactive methods allow students to see the processes in action. For example, by boiling water and temporarily removing its hardness, they will understand the reaction mechanism.

Development of practical skills. By conducting experiments, students learn to use laboratory equipment, follow safety rules, and analyze results. This will be the basis for future scientific research.

Development of social skills. Group work and discussions increase students' ability to work together, defend their opinions, and listen to others. For example, discussing the steps in the production of sulfuric acid in a group develops teamwork.

Problem-solving skills. Through problem situations, students become accustomed to finding solutions independently. For example, searching for an answer to the question “How can we purify water economically?” develops their critical thinking.

In short, interactive methods turn students from passive listeners into active participants in teaching chemistry. Methods such as problem situations, experiments, group work, digital simulations, and games not only make the lesson interesting, but also help students deepen their knowledge, develop practical skills, and strengthen their social relationships. Teachers can integrate these methods into their lesson plans to increase students' interest in chemistry and create a solid foundation for their future success.

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