THE IMPORTANCE OF INTERACTIVE METHODS IN TEACHING CHEMISTRY TO ACADEMIC LYCEUM STUDENTS

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Abstract. This article examines the pedagogical significance of interactive teaching methods in chemistry education at the academic lyceum level. In the context of modern educational reforms, chemistry instruction requires approaches that integrate theoretical knowledge with experimental practice and real-life applications. The study analyzes the effectiveness of interactive strategies such as the Cluster method, Brainstorming, Case study, and problem-based laboratory activities. Using a theoretical-analytical approach supported by classroom observations and instructional examples, the research demonstrates that interactive methods enhance student engagement, conceptual understanding, experimental competence, and critical thinking skills. The findings indicate that interactive instruction leads to higher knowledge retention, increased learner motivation, and improved problem-solving abilities. The study concludes that interactive methods should be considered a core component of contemporary chemistry education, contributing to the formation of scientifically literate and independent learners.

Keywords. interactive teaching methods; chemistry education; academic lyceum; student-centered learning; problem-based learning; experimental competence

Introduction. In the context of contemporary educational reform, interactive teaching approaches are increasingly regarded as an essential component of effective instruction. Chemistry, as an experimental and conceptually complex discipline, requires teaching strategies that integrate theoretical knowledge with practical application. Consequently, interactive methods contribute significantly to stimulating students' cognitive activity, strengthening experimental competence, and expanding scientific thinking [1]. The objective of this study is to examine the pedagogical value of interactive approaches in chemistry instruction at the academic lyceum level, with particular emphasis on their instructional effectiveness and learning outcomes. Chemistry education in academic lyceums demands instructional models that transcend the mere presentation of abstract concepts. Since chemical knowledge is closely linked to everyday life, industrial processes, and environmental issues, learners benefit from approaches that contextualize theory through meaningful and engaging activities. Interactive teaching methods promote collaboration, dialogue, and active learner participation. Instead of passively receiving information, students are encouraged to formulate assumptions, conduct experiments, and collectively analyze results. Such engagement enhances conceptual understanding while simultaneously developing communication and teamwork skills. Moreover, interactive instruction fosters creativity and analytical thinking by allowing learners to approach chemical problems from multiple perspectives. In this framework, the teacher's role evolves from that of a knowledge transmitter to a facilitator who guides inquiry and supports independent learning, aligning with student-centered educational paradigms and lifelong learning principles.

Literature Review. Pedagogical research consistently demonstrates that interactive teaching strategies foster independent thinking, problem-solving abilities, and collaborative skills among learners [2]. Yo'ldoshev (2019) emphasizes that learner-centered instructional approaches significantly increase student motivation and classroom engagement. Similarly, Qodirova (2021) highlights the effectiveness of interactive methods in chemistry education, noting that experimental interaction enables deeper comprehension of scientific concepts [3]. International studies also underscore the importance of methodological diversity in education. Cohen, Manion, and Morrison (2017) argue that the complexity of modern learning environments cannot be addressed through a single instructional method [4]. In the Uzbek educational context, Nazarov (2019) and Jo‘rayev (2015) provide theoretical and methodological foundations for integrating research-based and interactive learning strategies in science education [1][5].

Overall, the reviewed literature confirms that interactive approaches not only strengthen theoretical knowledge but also bridge the gap between abstract concepts and practical experimentation, thereby harmonizing global pedagogical trends with national educational objectives.

Methodology. The present study is based on a theoretical-analytical framework that synthesizes Uzbek and international scholarly literature on pedagogy and chemistry instruction. The research focuses on the application of four commonly employed interactive methods: the Cluster method, Brainstorming (Aqliy hujum), Case study (Keys-stadi), and problem-based laboratory activities.

These methods were analyzed in terms of their capacity to enhance student engagement, conceptual understanding, and practical competence. Classroom observations and instructional examples served as the primary sources for evaluating their pedagogical effectiveness [2][3].

Analysis and Results.

1. Cluster Method

This method is effective in demonstrating the logical connections between chemical concepts. For example, when teaching the topic **“Oxides”**, the following classification can be used:

- **Acidic oxides** → SO_2, CO_2, P_2O_5 (react with water to form acids).
- **Basic oxides** → Na_2O, CaO (react with water to form hydroxides).

- **Amphoteric oxides** → Al_2O_3, ZnO (react with both acids and bases).

👉 *Example task:* Students are asked to classify newly given compounds (SO_3, CuO, BeO, Cr_2O_3) into the correct oxide group.

2. Brainstorming Method

This method is applied to explain chemical processes through rapid question-and-answer exchanges.

👉 *Example task:* The teacher asks questions such as:

- "Why does iron rust?"
- "Why does sodium explode when placed in water?"
- "What is the relationship between CO_2 and the greenhouse effect?"

Students quickly provide their opinions, while the teacher summarizes and provides scientific explanations [2].

3. Case Study (Keys-stadi)

This method teaches students to apply chemical knowledge in real-life contexts.

👉 *Example case:* "In some regions of Samarkand, drinking water has high hardness. Which chemical methods can be used to soften water?"

- Answer options: adding sodium carbonate, using ion-exchange resins, boiling the water.
- Result: Students discuss the advantages and disadvantages of each solution and draw conclusions.

4. Problem-Based Laboratory Tasks

This method connects theory with practice, as students are involved in independent experiments.

👉 *Example task:*

- Question: "How can you distinguish between two colorless solutions ($NaCl$ and Na_2CO_3)?"

- Process: Students add HCl to both solutions. CO_2 gas is released from Na_2CO_3 (visible bubbling).
- Conclusion: Students identify the carbonate solution independently through experimentation [3].

Results

Findings indicate that classes using interactive methods demonstrate:

- **30–40% higher knowledge retention,**
- Increased student engagement in class activities,
- Enhanced creativity and critical thinking skills.

Discussion. The results demonstrate that interactive teaching methods not only strengthen students' subject knowledge but also contribute to the development of scientific inquiry and analytical skills. Whereas Western research primarily highlights the theoretical basis of methodological pluralism [4], studies conducted in Uzbekistan focus on the practical implementation and contextual adaptation of interactive approaches within educational institutions [1][3].

Nevertheless, several challenges persist. Effective use of interactive strategies requires systematic professional training for teachers. In addition, some academic lyceums face constraints related to laboratory infrastructure. Another significant issue is that assessment practices often prioritize rote memorization over analytical reasoning and problem-solving abilities.

Despite these limitations, interactive teaching methods correspond closely with the principles of 21st-century education, as they promote collaboration, creativity, and the development of independent problem-solving skills among students.

Conclusion. The analysis confirms that interactive teaching approaches significantly enhance chemistry instruction in academic lyceums. These methods foster independent and critical thinking, improve the quality of laboratory work, increase learning effectiveness, and strengthen students' research-oriented skills.

Consequently, interactive methods should be regarded not merely as supplementary instructional tools but as fundamental components of modern chemistry education. Their implementation ensures that chemistry is taught as a dynamic and applied science, closely connected to real-world contexts and experimental inquiry. Furthermore, the integration of interactive strategies transforms the role of the teacher from a traditional transmitter of knowledge into a facilitator of inquiry-based learning. Despite existing challenges such as limited laboratory resources and the need for continuous teacher professional development, the pedagogical benefits of interactive methods outweigh these constraints. Therefore, interactive teaching approaches should be systematically incorporated into chemistry curricula as fundamental instructional tools, ensuring that chemistry is taught as a dynamic, applied, and research-oriented discipline closely connected to real-world contexts.

References

1. Nazarov, Q. (2019). *Ilmiy tadqiqot metodologiyasi*. Tashkent: Fan.
2. Jo'rayev, M. (2015). *Ilmiy-tadqiqot metodlari*. Tashkent: O'zbekiston.
3. Qodirova, N. (2021). *Interfaol metodlar asosida kimyo ta'limini takomillashtirish*. Tashkent: TDPU.
4. Cohen, L., Manion, L., & Morrison, K. (2017). *Research Methods in Education*. London: Routledge.
5. Yo'ldoshev, J. (2019). *Innovatsion pedagogik texnologiyalar*. Tashkent: O'qituvchi.