

INNOVATIVE PEDAGOGICAL APPROACHES IN ORGANIZING CHEMISTRY LESSONS

Leading Chemistry Teacher

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Abstract. This article analyzes effective methods of teaching chemistry in general secondary schools, their alignment with modern educational requirements, and the development of students' research-based and scientific thinking. In addition to traditional lesson formats, the advantages of interactive and innovative teaching methods – such as experiment-based learning, problem-based learning, the STEM approach, and the use of digital tools—are discussed. The article also presents analytical views on modern forms of assessment and the methodological importance of laboratory work. Based on a review of scientific and pedagogical literature, methodological recommendations aimed at improving the effectiveness of chemistry education have been developed.

Keywords: chemistry teaching, methodology, interactive methods, laboratory work, STEM technology, problem-based learning, student engagement, assessment, didactic approaches, modern educational technologies.

Introduction. The modern education system aims not only to provide students with knowledge but also to develop their ability to apply this knowledge in solving real-life problems. Among the natural sciences, chemistry plays a special role in developing students' research skills, analytical thinking, experimental inquiry, and the ability to draw logical conclusions.

At present, practice shows that traditional approaches to teaching chemistry no longer yield sufficient results. This requires teachers to seek innovative, student-centered methods of instruction. In particular, interactive teaching methods, virtual laboratories, STEM projects, model-based learning, and problem-based learning technologies are becoming increasingly important for explaining chemical phenomena.

In addition, there is a noticeable decline in students' interest in chemistry, caused by the theoretical complexity of the subject, insufficient attention to practical activities, and outdated teaching tools. To overcome these challenges, it is necessary to revise chemistry teaching methodologies and implement modern didactic approaches. This article focuses on the methods and educational technologies used in teaching chemistry, as well as on approaches that promote the development of students' chemical thinking from both theoretical and practical perspectives. Furthermore, based on advanced international and national experience, methodological recommendations are proposed.

Literature Review.

The works of classical scholars such as N.I. Glinka, A.V. Tarasov, V.V. Firsov, M.Yo. Ismailov, and B.O. Tashmukhamedov have played a significant role in the development of chemistry teaching methodology. Their studies analyzed the content of chemistry lessons, instructional forms, laboratory teaching methods, and the integration of theory and practice.

In recent years, methodological research enriched with modern educational approaches has gained particular importance. In particular: S. Jonbekova (2020) analyzed the effectiveness of developing students' chemical thinking through experiment-based learning activities. Based on the "21st Century Skills" model proposed by S. Beers (2011), the importance of fostering creativity, project-based learning, and problem-solving skills in chemistry education is emphasized. T.Solikhova and M.Rakhimova (2022) presented empirical data on the integration of digital pedagogy, virtual laboratories, and interactive methods into chemistry education. The OECD (2018) education report highlights that functional literacy and life-oriented learning modules in chemistry significantly improve the quality of education. R. J. Marzano (2007), in his well-known methodological guide, emphasized differentiated instruction, taxonomy-based deepening of knowledge, and the activation of students' learning strategies in chemistry teaching. In his dissertation "A Modern Model of

Chemistry Education Based on STEAM Technologies”, T. Karimov (2021) justified that integrated interdisciplinary approaches lead to the development of productive and result-oriented thinking in students.

Analysis and Results

The Role of Modern Teaching Methods In chemistry education, the following methods have demonstrated high effectiveness: Problem-based learning – encourages students to think independently and solve scientific problems; Observation- and experiment-based instruction – deepens understanding by allowing students to directly observe the properties of substances;

Integrated (STEM) lessons – link chemistry with physics, biology, and mathematics;

Digital technologies – including animations of chemical processes, simulations, and the use of QR-coded laboratory activities.

The Importance of Laboratory Work Laboratory activities help develop students’ experimental skills and reinforce theoretical knowledge through practice. Experiment-based learning enables students to gain a deeper understanding of chemical phenomena. Assessment Methods Assessment in chemistry should not be limited to tests only, but should also include laboratory work, project outcomes, and experiment-based tasks. Formative assessment methods, such as written feedback, peer assessment, and reflection, provide particularly effective learning outcomes.

Conclusion

Updating methodological approaches in chemistry teaching is a requirement of the modern era, as actively engaging students in experimental, innovative, and practical activities is of great importance. Through the use of the STEM approach, problem-based learning, and modern technologies in lessons, chemistry becomes more accessible and meaningful to learners. The teacher should act not only as a

transmitter of knowledge, but also as a facilitator, guide, and collaborative partner in the learning process.

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