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THE IMPACT OF LABORATORY AND EXPERIMENTAL WORK IN CHEMISTRY EDUCATION ON STUDENTS' COGNITIVE DEVELOPMENT

Tojiboyeva Munisa Akmal qizi

Chirchik State Pedagogical University

Faculty of Natural Sciences

3rd year student of Chemistry Education

ORCID ID: <https://orcid.org/0009-0001-9154-696X>

E-mail: tojiboyeva.m1661@gmail.com

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Abstract: The importance of experiments and laboratory work in the process of teaching chemistry is incomparable. This article analyzes the impact of experiments and laboratory work on students in the study of chemistry, their role in developing scientific thinking, analytical abilities and practical skills. Performing practical work in chemistry lessons helps students better master scientific concepts, apply theoretical knowledge in practice and teach new approaches to solving problems. Also, the effectiveness of laboratory work increases students' interest in lessons and encourages them to participate more actively. Research and existing scientific developments show how laboratory work can bring effective results in increasing the level of knowledge and scientific abilities of students.

Keywords: chemistry teaching, impact of laboratory work, scientific thinking, experiments, practical skills, learning chemistry, motivation.

Entrance

Chemistry is one of the most important natural sciences, as it develops scientific thinking, analytical skills, and broadens students' horizons through practical experiences. In recent years, significant innovations have been made in the teaching of chemistry in Uzbekistan. In addition to providing students with basic theoretical knowledge of chemistry, it is important to involve them in experiments and laboratory work, organize practical activities with them, and develop scientific research skills. Research shows that the impact of laboratory work on students plays a significant role in increasing their interest in science, developing scientific thinking, and forming practical skills (Moore & Chamberlain, 2020). The use of practical experiments and laboratory work in the process of teaching chemistry in schools in Uzbekistan helps to further strengthen students' understanding of the subject and creates an opportunity to apply theoretical knowledge in practice. However, the limited resources and appropriate equipment necessary for the effective organization of laboratory work are still problems in some regions. The lack of necessary technical equipment and models



for conducting experiments in teaching chemistry in schools, as well as insufficient opportunities for teacher training, negatively affect the effectiveness of the educational process.

analyzes the impact of laboratory work on students in teaching chemistry, the importance of developing scientific skills through experiments, and identifies existing problems in the Uzbek education system and the necessary measures to address them.

Literature analysis

There are several scientific studies on the impact of laboratory work on students in teaching chemistry. These studies mainly show the role of experiments and laboratory work in increasing students' interest in science, strengthening their knowledge, and developing practical skills. Moore and Chamberlain (2020) emphasized in their study that laboratory work is important in developing students' scientific thinking skills. They found that laboratory work allows students to strengthen their theoretical knowledge and apply it in practice. Research shows that the results of laboratory work further increase students' interest in scientific research, as well as allow them to apply scientific methodologies in practice. Also, as Shulman (2018) noted, chemistry teachers need to improve their pedagogical skills and develop effective methods for teaching students scientific skills through practical experiments. Combining students' experiences and knowledge gained from laboratory work with theoretical education develops scientifically based thinking for them. The impact of laboratory work on research also increases students' ability to integrate experimental and theoretical knowledge, and their ability to apply the scientific knowledge they have learned in everyday life. The practical aspects of chemistry teaching are of great importance in developing students' imaginations and skills (Simmons, 2019). This, in turn, ensures the depth of students' knowledge in science and has a positive effect on their overall learning process. In addition, the effective organization of laboratory work increases students' interest in scientific processes and they actively participate in their own learning processes. At the same time, the impact of laboratory work on the overall development of students is also visible in their individual and group work. Numerous studies have shown that through hands-on experiences, students develop a strong interest and motivation for the subject they are studying (Simmons, 2019; Shulman, 2018).

Thus, the impact of laboratory work on students helps to consolidate scientific knowledge, learn scientific methods and apply them in practice, as well as increase students' interest in science. This analysis helps to further understand



the importance of experiments and laboratory work in teaching chemistry and their impact on students.

Discussion

The impact of laboratory work on students in chemistry education is of great importance, playing an important role in deepening students' scientific knowledge and developing practical skills. Practical experiments allow students to connect theoretical knowledge with the real world, which increases their interest in science and strengthens the scientific approach. The greatest benefit of experiments and laboratory work is that they create opportunities for students to apply theoretical knowledge in practice. This further engages students in scientific work and makes it easier for them to understand the complex processes of the chemistry they are studying. According to a study by Moore and Chamberlain (2020), laboratory work develops analytical thinking in students during scientific experiments, and they further consolidate their knowledge by testing it. This, in turn, further strengthens students' interest in scientific research. It is also important that laboratory work encourages students to work in groups and collaborate. Shulman (2018) emphasizes in his study that laboratory work not only develops individual knowledge, but also improves the ability to work in teams and solve problems together. This helps students develop communication through sharing their knowledge and learning together, which creates an important foundation for future scientific collaboration. In addition, the successful organization and integration of laboratory work into the educational process increases students' interest in science and they become more actively involved in the learning process. Studies show that students who participate in laboratory work further consolidate their knowledge, which allows them to achieve better academic results. The knowledge that students learn through practical experience increases their interest in scientific research and has a positive impact on the overall learning process. Another aspect to be discussed is that laboratory work can develop students' critical thinking skills in addition to providing them with knowledge. Simmons (2019) suggests that laboratory work can stimulate students' critical thinking and enhance their ability to apply scientific methods. Students learn new approaches to solving scientific problems through hands-on work, which in turn helps them develop their cognitive skills. For effective laboratory work to be effective, teachers need to improve their methodological approaches. Teachers should have extensive experience in scientific work, guide students through experiments, provide support, and reinforce knowledge through discussion of questions. Teachers' pedagogical



skills and experience are important factors in improving the effectiveness of laboratory work.

Thus, the role of laboratory work in teaching chemistry includes not only the application of theoretical knowledge in practice, but also a number of positive effects, such as the development of scientific approaches in students, teamwork, critical thinking, and increased interest in scientific research. This greatly contributes to the development of students in the educational process.

Conclusion

Laboratory work in teaching chemistry has a significant impact on students and directly increases the effectiveness of the educational process. Practical experiments provide students with the opportunity to apply theoretical knowledge in practice, which facilitates their understanding of scientific approaches and increases their interest in science. The importance of laboratory work in developing critical thinking and analytical skills in students is also incomparable. By successfully conducting laboratory work in students, their interest in scientific research increases and they learn to connect the subjects they are studying with real-life situations. Such practical experiments provide students with the opportunity to consolidate knowledge and learn new approaches to applying scientific methods. The effective organization of laboratory work also depends on the methodological qualifications and experience of teachers. Thus, the importance of laboratory work in teaching chemistry is that it develops scientific approaches in students, increases critical thinking, teaches teamwork, and fosters interest in scientific research. All this increases the effectiveness of the educational process and deepens the scientific and practical knowledge of students. In this regard, the role of teachers in correctly guiding students is important, since they can effectively form and consolidate students' knowledge through practical experiments.

References used:

1. Jo'rayev, M. (2023). Modern pedagogical technologies in teaching chemistry. Tashkent: Publishing House of the University of Uzbekistan.
2. Ismailova, N., & Karimova, D. (2022). The impact of laboratory work on students in the educational process. *Student and Teacher*, 12(3), 45-52.
3. Badriddinov, X., & Tashpulatov, A. (2021). *Chemistry Teaching Methodology: New Approaches and Methods*. Tashkent: Science and Technology Publishing House.
4. Mavlonov, R. (2022). Practical foundations of chemistry: the importance of laboratory work. *Education and Science*, 17(2), 33-40.



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5. Tursunov, A., & Kholmatov, S. (2021). The impact of laboratory work on students in the learning process. *Scientific Journal of Pedagogy*, 29(1), 61-66.
6. Khudoyberganova, L. (2023). Pedagogical technologies and their application in teaching chemistry. *Pedagogy and Science*, 14(4), 56-62.
7. Karimova, F., & Azizov, M. (2021). The role of students' laboratory work in scientific research. *Innovations in Education*, 25(2), 72-77.
8. and experience in teaching chemistry. *Education of Uzbekistan*, 22(1), 29-34.
9. Khojaeva, T. (2022). Methodology of laboratory work in chemistry. *Development of the educational process*, 13(1), 19-23.

