EVALUATION OF THE EFFECTIVENESS OF USING VIRTUAL LEARNING TECHNOLOGY IN TEACHING CHEMISTRY

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https://doi.org/10.5281/zenodo.10988201

Abstract. *This study is aimed at improving the effectiveness of the educational process using virtual educational technologies in chemistry circles of secondary schools, and is planned to be implemented step by step in the 2024-2025 academic years. During the research process, chemical reactions were used to model and design the molecules of matter using methods such as ChemOffice, Gaussian, HyperChem, Avagadro and virtual laboratory practice. In the lessons conducted using virtual educational technologies, the average mastery rate of students' skills in performing the given tasks when using virtual educational technologies is 20.2% up to 74,6%It was found to increase.*

Keywords: *virtual education technology, evaluation criteria, Likerd scale, animation education technology.*

Introduction

In recent years, the use of multimedia tools has significantly increased due to the introduction of modern pedagogical technologies into the educational process [1-3]. This learning method facilitates extensive complex and step-by-step processes and allows users to learn them in less time than traditional learning methods. In interactive multimedia technologies, compared to traditional technologies, information is expressed not in the form of text, but in the form of images, sounds and actions. This will teach students to be more active and attentive during training, as information is presented based on appropriate responses to specific motor actions. [4-6].

One of the interactive multimedia technologies is the creation of a virtual educational environment in the teaching of chemistry and its direct introduction to the improvement of the activity of chemistry circles. [7]. In many cases, the use of toxic, flammable and explosive reagents and complex equipment is required in the process of organizing chemistry science clubs and conducting laboratory training. [8-12]. Reviewing it in a virtual state with the help of a computer before starting to perform laboratory work directly leads to saving reagents, ensuring safety, and increasing the efficiency of the educational process. Also, in the educational process, you can use highly interactive and multimedia technologies to organize practical classes of natural sciences such as chemistry, biology and physics, by modeling and designing the process of laboratory classes, you can simulate real-life actions in an interesting and intuitive graphic environment. This allows students to acquire new knowledge and skills through practical learning [14-16].

For a long time, teaching chemistry laboratory activities to students has been based on the use of forms such as textbooks and lectures. However, with the advent of 3D modeling technology, teachers now have the opportunity to teach science to their students using a modern, innovative new tool. 3D modeling in science education allows students to interact with scientific concepts in a more engaging and immersive way [17]. At the same time, students will have the opportunity to better understand complex concepts and theories through 3D modeling of the process. This article describes the results of the research conducted in some general education schools on the topic "Methodology for improving the activities of the young chemists' circle in the virtual educational environment (in the case of general and secondary schools)"

Methods

This study is aimed at increasing the effectiveness of the educational process using virtual educational technologies in the chemistry circles of secondary schools, and it is planned to be implemented step by step in the 2024-2025 academic years. During the research process, chemical reactions were used to model and design the molecules of matter using methods such as ChemOffice, Gaussian, HyperChem, Avagadro and virtual laboratory practice. Borg-Gall's educational research model was used in this research process.

Results and discussion

III.1. Design stage

The research process was carried out on the basis of laboratory work on the topic "Atomic structure and the distribution of electrons in it" and "Qualitative reactions for the determination of some cations" in the chemistry section of the 8th grade students of some general secondary schools in Samarkand. In the course of research, information such as atomic structure and distribution of electrons in it, structure of electron layers and location of electrons in it, 3D models were created using ChemOffice and Gaussian programs (Fig. 1).

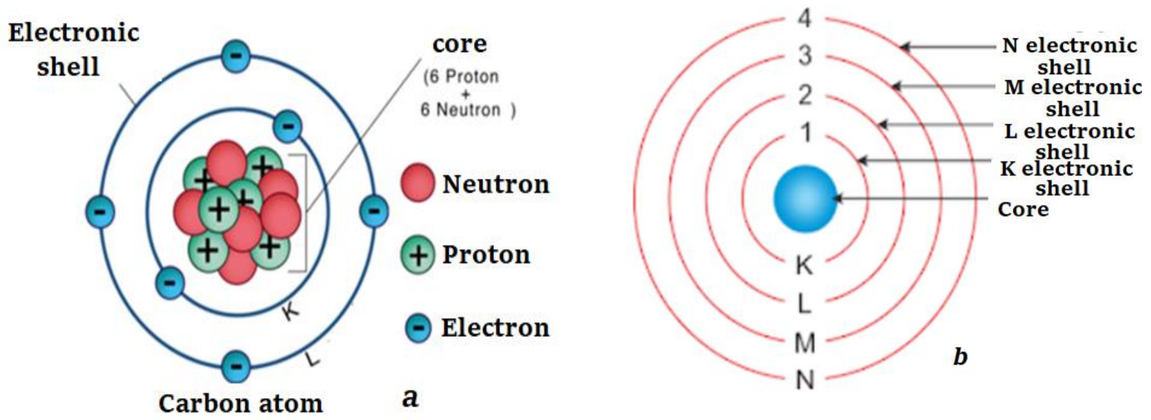

Figure 1. Atomic structure (a) and arrangement of electron positions in an atom (b) 3D model created in Avagadro software

Also, a 3D model of the position of electronic orbitals in an atom was demonstrated with the help of the Avagadro program (Fig. 2).

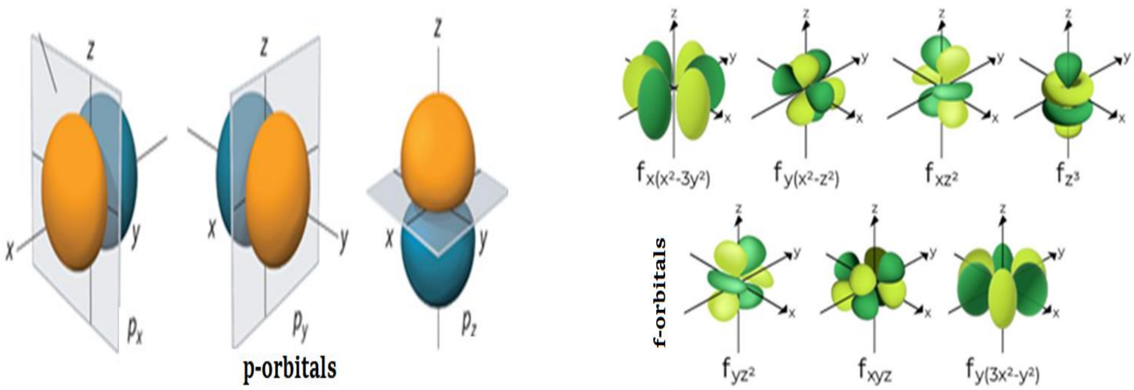

Figure 2. 3D model of p- and f-bitals generated in Avagadro software

The laboratory work on the topic "Qualitative reactions for the determination of some cations" was described through live animations of illustrations in virtual order (Fig. 3). Also, the main materials developed in the study were created using Adobe Flash CS3 Professional, and it is a virtual laboratory software that produces educational media products in ".exe" or "SWF" format.

III.2. Evaluation criteria

A Likerd scale was used to assess student achievement in a lesson using virtual learning elements and was calculated as a percentage for each criterion. [18-20] (Table 1).

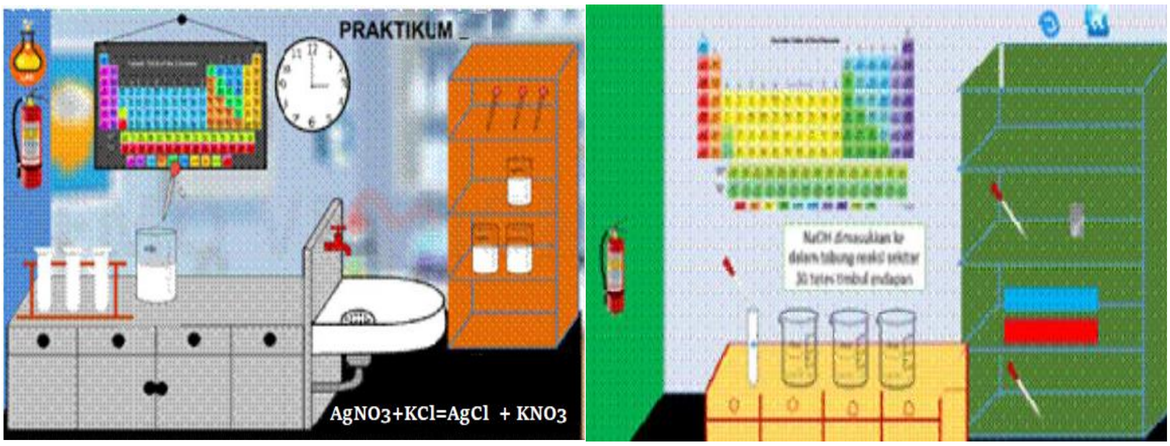

Figure 3. Excerpt from the virtual laboratory project for qualitative reactions in the determination of cations

Table 1

Assessment of students' knowledge on the Likerd scale

Category	Scale
Very good	5
good	4
Satisfactory	3
bad	2
Too bad	1

Quantitative evaluation of research results in terms of percentages was carried out according to the following criteria (table 2).

Table 2

Evaluation by descriptive criteria

Quantity	Category
0-20%	Too bad
21%-35%	bad
36%-60%	Satisfactory
61%-80%	good
81%-100%	Very good

In the course of the lesson, the situation of the students in completing the given tasks was compared before and after the use of virtual learning elements (Fig. 4).

It can be seen from the figure that after the use of virtual learning technology, the students' mastery of the concepts of the subject: from 28.4% for very poor to 8.6% for poor decreased from 40.2% to 10.4%. Also, when virtual educational technologies are used in the course of the lesson, students' satisfactory grades are from 8.4% to 15.4%, acquisition of good grades is from 7.7% to 27, By 4%, it was observed that the acquisition of excellent grades increased from 15.3% to 38.2%.

Based on the above table, the total personality ratings for the virtual laboratory for learning technology aspects are determined to be 80.6% and 85.4% for e-Chem Edu. The obtained percentage is classified as a very correct criterion, that is, very correct criteria are 81-100%.

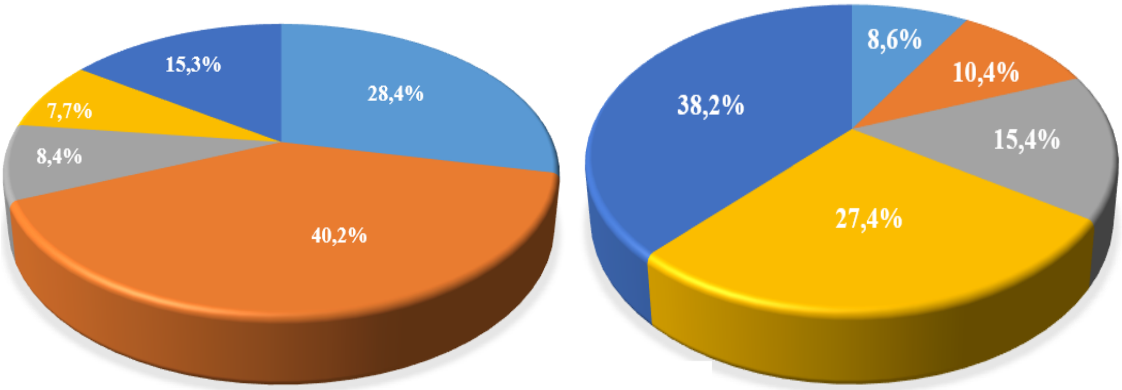

Figure 4. Indicators of students' mastery of assigned tasks before the experiment (a) and after the experiment (b)

Blended learning, based on virtual learning technology, allows learning to be applied by combining traditional learning technology. In the course of the lesson, students usually use the cognitive domain in addition to effective and psychomotor use by collecting briefly obtained information, but most of the obtained information cannot be retained for a long time, especially when describing macro and micro images. aspects and symbols, especially in the case of inorganic chemistry, information on main group elements has a wide scope. Implementing it in learning using blended learning virtual labs, that is, providing a learning environment that can connect all aspects of video, animation, text, etc., will increase the effectiveness of students' acquisition of subject information. . This will make the presented presentation more interesting and allow teaching and learning activities to achieve the set educational goals. This increases the efficiency of students' learning based on the use of virtual laboratories in the course of the lesson.

Conclusion.

Virtual learning technology was used to improve students' mastery of scientific concepts and to form their skills in performing practical experiments in chemistry circles of general secondary schools. After the use of virtual learning technology, students' mastery of subject concepts: from 28.4% to 8.6% for very poor, from 40.2% to 10 for poor decreased to .4%. Also, when virtual educational technologies are used in the course of the lesson, the students' satisfactory grades are from 8.4% to 15.4%, the acquisition of good grades is from 7.7% to 27.4%, and the acquisition of excellent grades is It was observed that it increased from 15.3% to 38.2%. In this case, it was found that the average mastery rate of the students' skills to perform the assigned tasks, when using the virtual education technology, increased from 20.2% to 74.6%.

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