

## METHODOLOGICAL ASPECTS OF CREATING AND USING AN ELECTRONIC TEXTBOOK OF POLYMER CHEMISTRY

Khaydarova Charos Kasimovna

Tashkent State Technical University, PhD student

[charosxaydarova8@gmail.com](mailto:charosxaydarova8@gmail.com) Tel: +998 91 019-26-26

### Article history:

**Received:** 30<sup>th</sup> March 2024

**Accepted:** 26<sup>th</sup> April 2024

### Abstract:

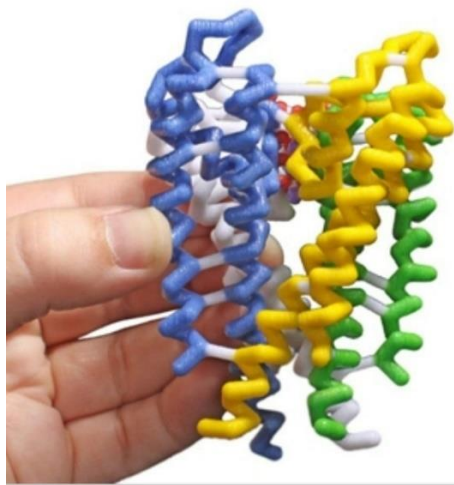
In the article, teaching based on 3D technologies, Augment reality- Augment reality (AR), Virtual reality Virtual reality (VR), Mixed reality Mixed reality (MR), programs focused on effectiveness in teaching chemistry.

**Keywords:** virtual education, Augment reality (AR), Virtual reality Virtual reality (VR), Mixed reality Mixed reality (MR), 3D virtual environment, virtual reality.

**INTRODUCTION:** Designing new molecules is a complex and time-consuming task that requires spatial understanding. When scientists create a new molecule, such as a catalyst, they first create a 2D model of the desired molecule, which is then converted to a 3D model on a computer. A 3D computer representation of the molecule is examined to determine whether the desired

structure is feasible and provides the desired capabilities, or if a redesign is necessary. Finally, the molecule is created in the laboratory and tested for its desired attributes [1].

**THE MAIN PURPOSE OF THE STUDY:** In particular, the design, development and examination of a spatial 3D structure still presents several challenges.



**Figure 1. Interactive electronic textbook models created on the basis of 3D and AR technologies**

Although the structure of a molecule is represented in 3D format, exploring the molecule from different perspectives requires the designer to interact with traditional computer input devices. Such devices abstract 3D movement to keys on a keyboard or to the 2D space of a computer mouse. The second issue is related to the change in the energy structure of the molecule during its development. The spatial structure changes every time a new atom, ligand or radical is added to the structure of an existing molecule [1].

The importance of e-textbooks can be seen when the experiments in the teaching of polymer chemistry are shown through videos. During the teaching of the structure of natural polymers, rubber, proteins, and polysaccharides among the 3rd year students of the university, in a non-traditional lesson, as usual, various visual aids and interactive methods are used for a

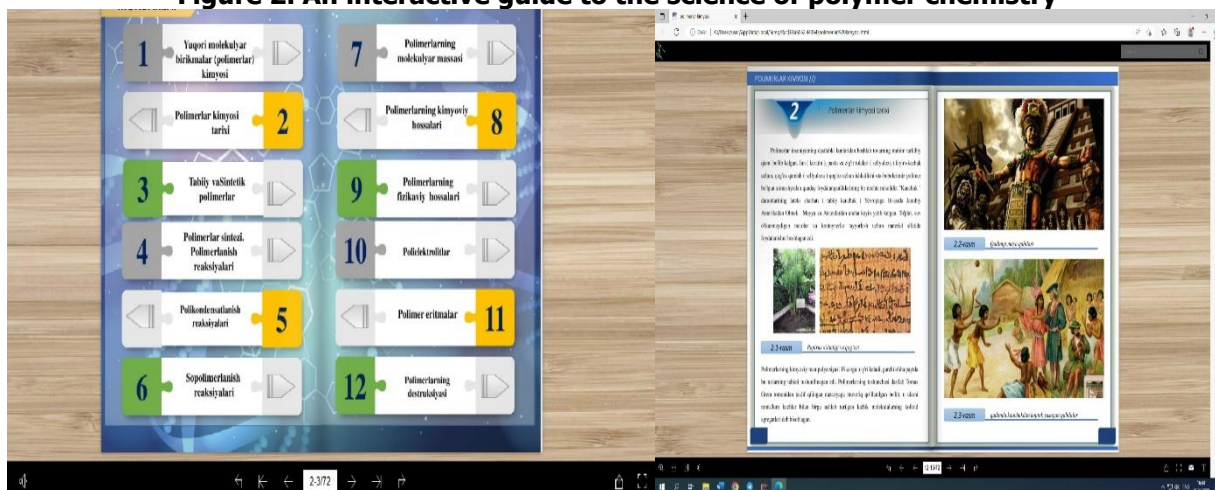
group, the teacher explains the structure of polysaccharides by drawing on the board if we conduct a lesson, the students learn only 60-70% of the subject. Students with weak interest in the lesson and low mastery cannot understand the subject, the student's interest in science is lost. And for another group, if 3D technologies are used from the electronic textbook during the teaching of this topic, the students will master this topic by 90-95%, because no matter how much the student memorizes and hears about the structure of polysaccharides, he cannot have a complete idea of their structure. . Below we will introduce the content and essence of the electronic textbook created on the subject of "Polymer Chemistry". For this textbook, a certificate was obtained from the Intellectual Property Agency (Figure 2). The structure of the created electronic textbook includes: interactive



lectures, 3D animations, multimedia products, virtual laboratories, pisa tests, etc. (Fig. 3).



**Figure 2. An interactive guide to the science of polymer chemistry**

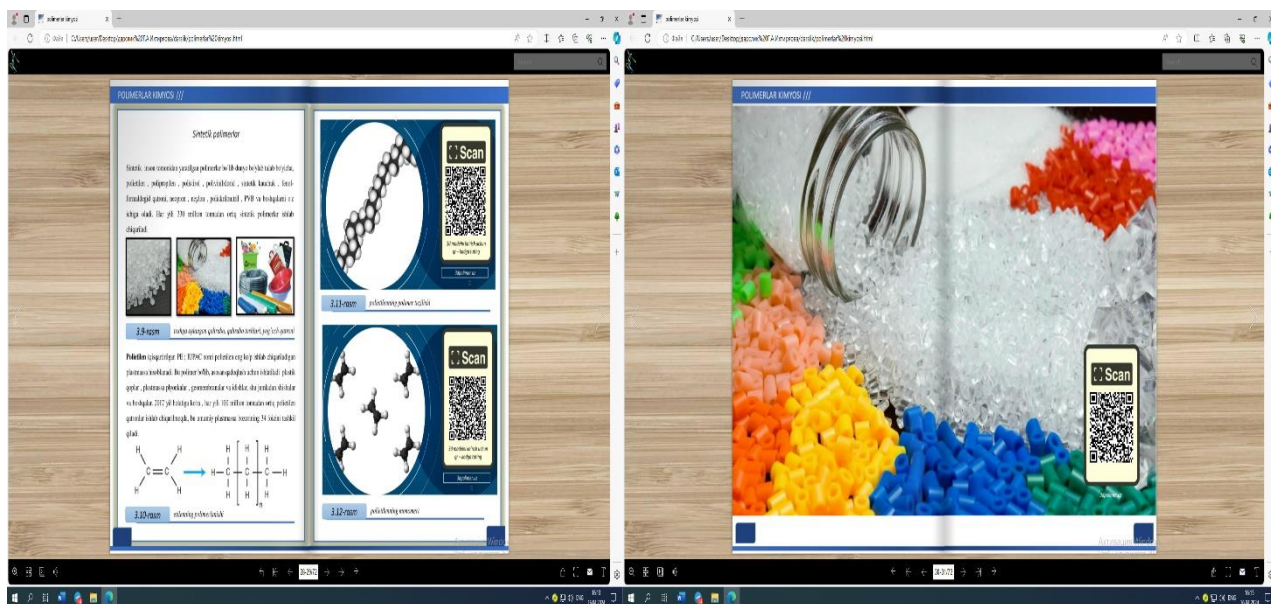


**Figure 3: Content and History of Polymer Chemistry Electronic Textbook**

During the scientific research work, an interactive educational system using augmented reality was studied on the example of simple molecules available in the database.

In addition to the lecture text, electronic textbooks on polymer chemistry include a glossary, laboratory

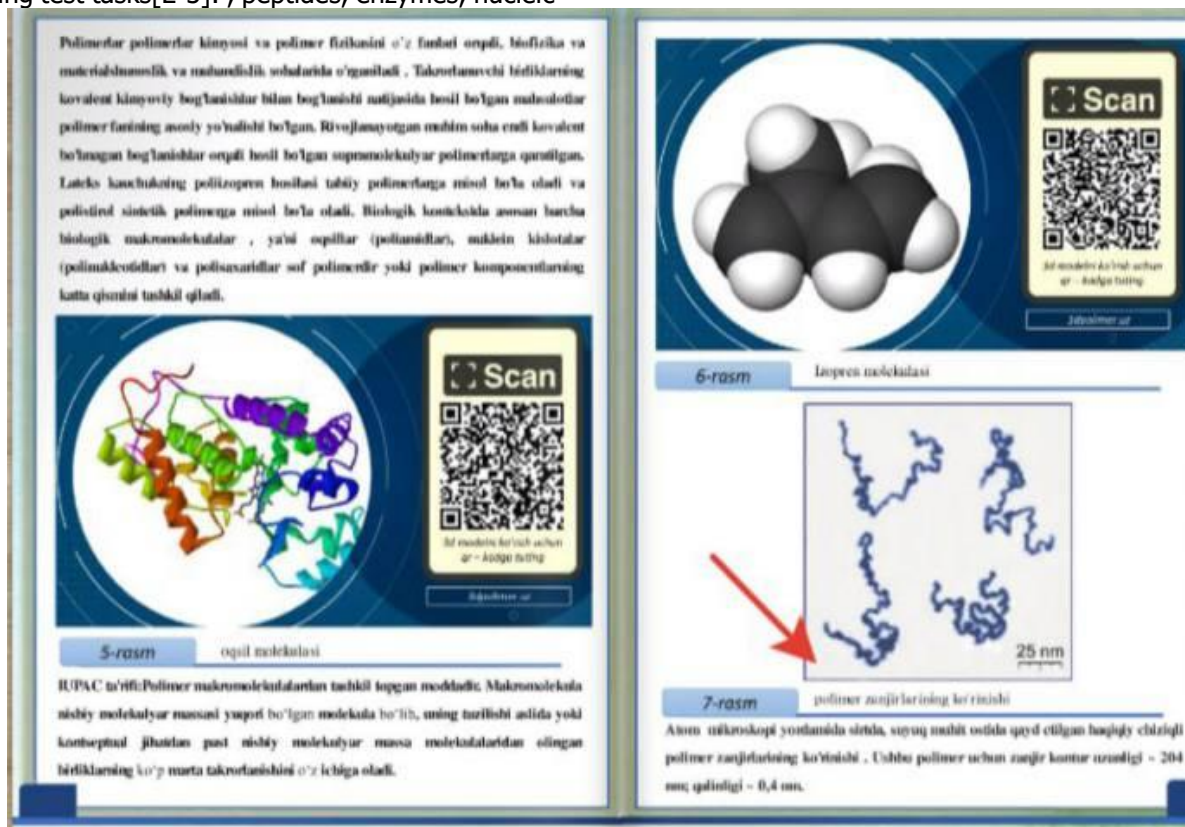
works, animated animations, the lives and works of scientists who contributed to this science, tests and problems and exercises for independent solving (Figures 4-5).



**Figure 4: QR codes for synthetic polymers topics in an e-textbook of polymer chemistry**

Virtual, as one of the interactive technologies of teaching in the e-learning environment, provides an opportunity to organize the evaluation of students' knowledge based on a quick response. The e-learning system provides the user with the opportunity to check the learning materials and the knowledge obtained from them using test tasks[2-3]. , peptides, enzymes, nucleic

acids, carbohydrates, lipids, biological membranes) and small molecule bioregulators (alkaloids, vitamins, flavanoids, hormones, antibiotics, prostaglandins, plant growth regulators, pheromones, pesticides, etc.) is a science that studies the relationship between their structure and biological activity [4].

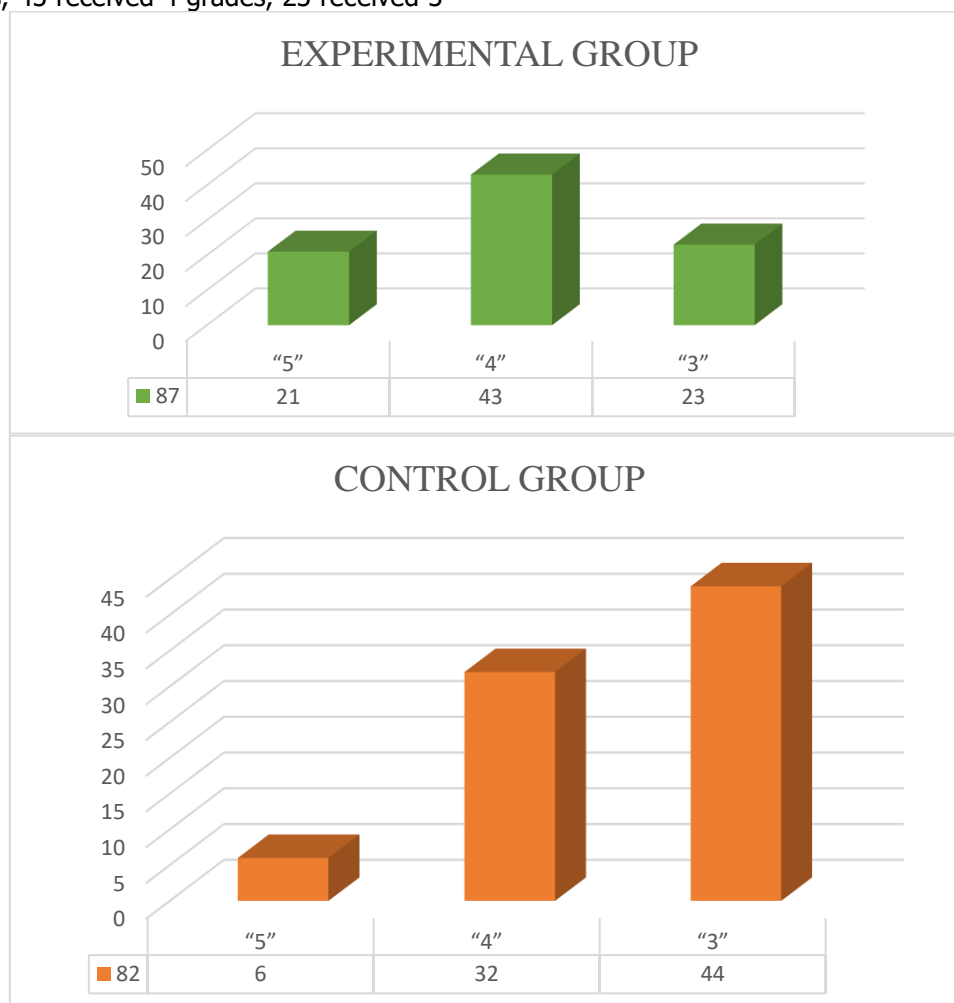


**Figure 5: Molecules in an electronic textbook of chemistry**

### QR code of 3D view

87 students from the 3rd year students of the Karshi Institute of Engineering and Economics were selected for the experimental group, 82 students for the control group, 21 students from the experimental group received 5 grades, 43 received 4 grades, 23 received 3

grades, 6 from the control group received 5 grades, 32 got 4 grades, 44 got 3 grades. Based on these data, we calculate the mean score of the group, the standard deviation, and then the t-test:



**Figure 6. Results for the experimental and control groups at the Karshi Institute of Engineering and Economics vs**

In the experimental group

Average score: 3.98

Standard deviation: 0.71

In the control group

Average score: 3.54

Standard deviation: 0.63

T-test

T-statistic: 4.25

P-value:  $3.59 \times 10^{-5}$

These results show that there is a statistically significant difference between the mean scores of the experimental and control groups. A high T-statistic and low P-value of the t-test indicate that the difference is not random.

**CONCLUSION:** The skills of working with electronic textbooks were formed in students, organizational management, motivational, cognitive, technological and creative stages were developed and analyzed by these criteria. The results of the experimental work were analyzed according to the Fisher criterion, and the efficiency of the proposed method was determined.

### REFERENCES

1. Cody W. Pinger\*, Morgan K. Geiger, and Dana M. Applications of 3D-Printing for Improving Chemistry Education Spence Cite this: chem. Education 2020,97,1,Pp112-117.
2. G.A. Ixtiyarova, Ch.Q. Haydarova Kimyo fanida 3D tyexnologiyalarini qo'llash samaradorligi Zamonaviy



organik kimyoning dolzarb muammolari. Respublika ilmiy -amaliy. anjumi Qarshi 2021 yil. 264-265 betlar.

3. G.A Ikhtiyarova, Ch.K Khaydarova, Z.U Ishmanova, M Norova // Possibilities and advantages of using an innovative electronic textbook in chemistry. Asian Journal of Multidimensional Research Vol 10, Issue 3, March, 2021.
4. Haydarova Ch.Q, Ixtiyarova G.A. Polimerlar kimyosi fanidan 3D texnologiyalar asosida interaktiv elektron qo'llanma yaratish metodikasi (texnika yo'nalishi talabalari uchun).UzMU. Funktsional polimerlarning fundamental va amaliy jihatlari mavzusida xalqaro ilmiy-amaliy konferintsiyasi Toshkent-2023. 17-18 mart 547-552 betlar.