



METHODOLOGY OF MODELING AND USING VIRTUAL EDUCATIONAL PRODUCTS IN TEACHING INFORMATICS

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***Abstract.** In this article, an analysis of programs and platforms that create virtual educational products, such as virtual laboratories, virtual posters, virtual museums in the teaching of computer science subjects, is carried out, and necessary recommendations and directions are given to computer science teachers on the creation of a computer model for the creation of electronic virtual products. Also, the creation of a computer model and its capabilities are revealed.*

***Keywords.** Educational product, virtual poster, virtual laboratory, virtual museum, computer model, educational platform, educational simulation, infographics, dynamic poster, presentations.*

In the Decree of the President of the Republic of Uzbekistan "On Approving the Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030," it is stated that "the development of recommendations for improving the quality of higher education, improving curricula, and introducing modern pedagogical technologies by conducting surveys among professors, teachers, and students, studying the opinion of the public and employers, as well as analyzing best foreign practices,"¹ it can be said that in order to improve

¹ Decree of the President of the Republic of Uzbekistan On Approving the Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030. No. UP-5847 dated 08.10.2019

the quality of higher education through the analysis of foreign experience, the analysis of modern virtual educational products created and used in higher educational institutions of the world and their application in our practice, as well as the creation of similar educational resources, is an important issue in education today. [1].

Modern technologies often actively influence many spheres of our lives. Currently, virtual reality technology has begun to be used in many aspects of society. It can be said that it is widely used in industry, production, various design processes, and other processes. In the field of medicine, one can also cite virtual surgical rooms, rehabilitation centers, simulation of physical and chemical processes, experimental, research and development, etc.

Currently, virtual technologies are actively used in education and are strengthening their place. If the features of sensory perception of virtual reality are fully used to increase the effectiveness of the educational process, this new technology can become an effective teaching method with a new approach in educational institutions. The organization of training using virtual technologies is of particular importance and has a number of advantages over traditional interactive whiteboard presentations and educational materials. When using virtual technologies, the student better understands the information and participates in this process.

When using virtual technologies in education, teachers mainly create virtual products using mathematical and computer modeling methods.

Modeling is the replacement of an original object with a model object to obtain information about its most important properties. Such a

substitution is carried out in order to simplify, reduce the cost, and accelerate the study of the properties of the real. Modeling is advisable only if the properties (characteristics) of the original that prevent its. [2].

A model is a complex system or object that allows you to study in detail.

All models can be classified according to a number of characteristics:

- by area of application (educational, experimental, scientific-technical, game, simulation);
- by dynamics (static and dynamic);
- by fields of knowledge (physical, chemical, geographical, historical, sociological, economic, mathematical);
- by method of presentation (material and information).

In the field of education, the creation of educational products, electronic didactic and knowledge control materials using mathematical and computer modeling methods is developing as a pressing issue of today.

Several researchers have been engaged in the problem of creating virtual posters for students to describe concepts related to computer science in a virtual state, apply them in the educational sphere, and understand the topic.

Aslanov Kh.Sh. "A virtual laboratory is a software complex that allows conducting experiments without direct contact with a real laboratory or in their complete absence."² commented in his article. [3].

J.K.Haidarov in his research work "Multimedia technologies - the use of multimedia technologies such as animation, simulation,

² Aslanov Kh.Sh. "The Role of Programming Languages in the Organization of Virtual Laboratories." *Oriental Renaissance: Innovative, Educational, Natural and Social Sciences*. 3 (9) September, 2023. 615-619 p.

interactive programs, virtual laboratory environments effectively serves the formation of students' knowledge and skills in the field of computer modeling.”³ explained the didactic possibilities of the virtual laboratory.[4].

"Currently, due to the active implementation of ICT in the field of education, it is difficult to imagine modern teaching methods without multimedia interactive technologies that allow the teacher to improve their teaching methods and use text, graphics, audio, video, and animation in dialogue mode. According to leading experts, one of the leading trends in the use of information technologies is interactive posters.”⁴ S.E.Savotchenko and M.B.Sobolev, as a result of their scientific research.[5].

Speaking of a virtual poster, a virtual poster is an electronic (digital) poster created to present information in graphic form. There are several convenient ways to create it:

1. Online design on platforms (the easiest way). The following platforms can be cited as examples. These features are suitable for beginners.

- ✓ Canva is the most popular, there are many free templates.
- ✓ Adobe Express - for quick design.
- ✓ Visme - interactive (with moving elements) posters can also be created.
- ✓ Crello (VistaCreate) - similar to Canva, easy to use.
- ✓ Postermywall - specifically for posters and banners.

³ J.K.Haidarov. "Methodology of improving the teaching of "basics of computer science" to future civil engineers using computer modeling". Abstract of the dissertation for the degree of Doctor of Philosophy (PhD) in Pedagogical Sciences. Tashkent. 2025. 54 pages.

⁴ Савотченко С.Е., Соболев М.В. Интерактивные плакаты в предметной деятельности педагога в школе. [Текст]. Белгород: ГОУ ДПО «Белгородский региональный институт повышения квалификации и профессиональной переподготовки специалистов», 2009 г.

2. In Microsoft Office or Google services, the following supported programs and services are recommended and intended for middle-level users:

- ✓ Microsoft PowerPoint is convenient for creating presentations, posters, and infographics.
- ✓ Google Slides - online, free, and collaborative.
- ✓ Publisher (Microsoft Office) - created specifically for booklets, flyers, and posters.
- ✓ Lucidpress - easy for online design and printing

3. With the help of graphic programs (for creators) and for professional designers.

- ✓ Adobe Illustrator is the most powerful program for creating beautiful vector posters.
- ✓ Adobe Photoshop - you can add complex graphics and effects.
- ✓ CorelDRAW is widely used for printed products.
- ✓ Inkscape is free and open-source (alternative to Illustrator).
- ✓ GIMP is a free alternative to Photoshop.

With this method, you can completely customize the design and add beautiful visual effects.

If you have the desire to create an interactive poster (provided online, opening animation or video when clicked), then you can recommend the following online platforms:

- ✓ Genially - for creating interactive posters, infographics, and presentations.
- ✓ Presie - moving, dynamic posters and presentations.

For example, Genially is an online platform where you can create virtual posters, infographics, presentations, and interactive materials.

Unlike a regular poster, it allows you to add animation, buttons, videos, and links. There is also a free version with enough basic features.

To work in it:

1. Registration. Work will begin after you visit genial.ly and open an account via Google or email.

2. Select a template. After clicking the "Create Genially" button, select Poster, Infographic, Presentation, Interactive Image, and other types. After that, you can use ready-made templates or start from an empty page.

3. Editing. This includes adding text (writing headings, annotations, and points), adding images, icons, videos (uploading from a computer or posting from YouTube), creating animations (you can customize the appearance or movement of each item), and creating interactive buttons (for example, clicking on an image displays additional information or moves to another page).

4. Save and share. The finished poster is stored in the cloud (a paid version is required for computer download) and can be sent to others through the link or posted on the website/blog. There is also the possibility of full-screen viewing, such as a presentation.

Like other virtual poster-creating programs and platforms, it has several advantages and disadvantages, including the availability of many ready-made templates, interactivity (buttons, animation, video), and online functionality (no program installation required). Disadvantages include the need for Internet access (offline is not available) and a paid subscription for downloading PDF/PowerPoint.

Simulation (from the English word "simulation" translated into Uzbek as "simulation" or "imitation") is the imitation of a physical process using an artificial (for example, mechanical or computer) system.

Simulation simulates the operation of real-world processes or systems using models. The model represents the basic behavior and characteristics of the selected process or system, while simulation shows how the model develops over time under different conditions. Simulation has mainly two meanings: the first, in a broad sense, is any statement, creating a false idea about something for the purpose of distraction, and the second, in a narrow sense, is an imitation of some real process. (e.g., computer model and program). In the second case, it is often used in science and games, when creating a computer model for learning or entertainment, such as a flight simulator, simulators that teach driving vehicles.

Professor M.Kh. Lutfullaev in his article "Methodology for Improving the Educational Process Based on Computer Simulation Models in Secondary Schools (in the example of 11thClass Computer Science and Information Technology Science) " writes: "Simulation modeling is a method used to create virtual copies of real-world systems or processes. This includes the creation of a compu.”⁵ put forward the idea that.[6]

Educational simulation is the creation of simplified, but accurate computer models of real-life situations or processes that allow students to practice performing specific tasks, making important decisions, and assessing the obtained results without real risks. This is a method of practical learning by the student, in which students are placed in "false,

⁵ M.X.Lutfullayev. "Methodology for Improving the Educational Process Based on Computer Simulation Models in Secondary Schools (in the Example of 11thClass Computer Science and Information Technology Science)". European Journal of Innovation in Nonformal Education (EJINE) Volume 4 | Issue 5 | May - 2024 ISSN: 2795-8612.

simulated" scenarios of real life for the development of certain competencies, which can subsequently be transferred to real life.

The following are examples of the main directions that are included in simulation products.:

1. Simulators for teaching and learning

- Virtual laboratories (for physics, chemistry, computer science);
- Training simulators (for example, mathematical modeling programs, computer science practices);
- Interactive educational platforms (PhET, Algodoo, Crocodile Physics);

2. Technical and production simulators are also divided into two categories:

a) Machine and transport control simulators:

- Automatic simulator (for driving training);
- Aviation (flight simulator);
- River and sea boat simulators;

b) Industrial simulators:

- Modeling of energy systems;
- Simulation of oil and gas production processes;

3. Simulation products in the field of medicine:

- Virtual patient programs (disease diagnostics exercise);
- Surgical simulators (3D simulators for surgical practice);
- 3D models for anatomy;

4. For computer science and computer science:

- Algorithm simulators (for example, programs for visualizing sorting, search algorithms);
- Computer network simulators (Cisco Packet Tracer, GNS3);

- Simulation of the programming environment (robot code control simulators);

5. Military and security simulation

- Weapon and Equipment Control Simulators
- 3D simulators for military training
- Emergency evacuation simulation (fire, earthquake, flood)

6. Game and entertainment simulations:

- Simulation of life (The Sims, Second Life);
- Urban planning and management (SimCity, Cities: Skylines);
- Economic and business simulations (Virtual Business Games);

Generally, simulation products include:

- virtual laboratories;
- training programs;
- 3D models and interactive platforms;
- Computer networks and programming simulators;
- game and entertainment models

Let's talk about simulation products designed for teaching computer science subjects in higher educational institutions. Such simulations can be divided into the following types:

1. Development of algorithmic thinking;
2. Training of networks;
3. Explanation of computer architecture;
4. Mathematical and system modeling;
5. Virtual laboratory experiments;
6. Artificial intelligence and robotics skills, etc.

We provide an overview of simulation products used in teaching computer science.

1. Algorithms and programming simulators include Scratch (MIT) (teaching programming through visual blocks), Algorithm Visualizer (searching for algorithms, sorting, showing them in step-by-step animation), PSeInt (writing algorithms in the form of a flowchart and simulating their execution), Code.org (interactive training in algorithmic thinking);

2. Computer network simulators include Cisco Packet Tracer (computer network design and testing), GNS3 (professional level router and switch simulation), NetSim (network device management training);

3. Computer architecture and hardware simulators include Logisim (building and testing digital circuits (with logic elements)), Multisim (modeling electronic circuits and microchips), Proteus (microcontroller and electronic device simulation);

4. Mathematical and computer modeling simulators include Matlab/Simulink (modeling mathematical models, algorithms and processes), GeoGebra (modeling for algebraic and geometric problems), Wolfram Mathematica (modeling complex mathematical calculations), AnyLogic (modeling systems (for example, queues, transport, logistics));

5. Virtual laboratories (online) include PhET Simulations (a platform of the University of Colorado for interactive experiments in mathematics and physics, chemistry, biology and earth sciences), Algodoo (testing of physical and algorithmic processes in a visual environment), Virtual Labs (MIT, India) (laboratory work in various disciplines);

6. Robotics and artificial intelligence simulators include RobotC / VEXcode VR (simulation of robots through programming), Gazebo

(modeling the movements of robots in the real world), OpenAI Gym (environment for training artificial intelligence agents);

In conclusion, the use and creation of mathematical and computer modeling methods, in particular virtual educational products, in the educational process, especially in teaching computer science subjects, is a pressing issue today, and it is the duty of every educator to conduct a number of studies to solve this problem and apply the results of the research into practice.

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