

# SOFTWARE TOOLS AND THEIR CAPABILITIES FOR TEACHING FUTURE PRIMARY SCHOOL TEACHERS TO CREATE 3D INTERACTIVE INFORMATIONAL EDUCATIONAL RESOURCES

Ashurov M.A.

Doctoral student Tashkent state pedagogical university named after Nizami

<https://doi.org/10.5281/zenodo.11394611>

**Abstract.** *The article presents an analysis of the possibilities, shortcomings and areas of application of software tools for creating 3D interactive informational educational resources for future primary school teachers.*

**Key words:** *3D, Online, offline, digital learning, VRML, Cult3D, Pulse 3D, Java 3D, 3D Max, Canva*

Digital ("3D systematic interactive information educational resources", "SMART") technologies form the basis of the modern step of technological development and will retain their superiority in the near future. Currently, the process of digitalization of material and socio-humanitarian technologies and practices, including the digitalization of the educational system, is actively taking place. It is important to understand the place and role of digital technologies in any modern field of professional activity.

With the advent of the Internet, attempts to make it three-dimensional have been made regularly, especially in recent years.

Many educational organizations are working hard to improve visualization tools for financial and other data and 3D structured interactive information learning resources. There are recent developments aimed at facilitating the creation of three-dimensional images. One of the directions of these developments is an attempt to create three-dimensional models from two-dimensional images. Among others, Susoge and Immersion offer systems that typically use video cameras to capture multiple views of an object and custom software that transforms those views into 3D structured interactive informational learning resources.

The Internet already has a number of systems that allow viewing three-dimensional objects on a web page, the most common technologies being VRML, Metastream (Viewpoint), and Cult3D.

The simplest and cheapest way to implement three-dimensionality is the animated graphic data exchange format, when several dozen graphic images of an object from different angles are combined into one GIF (GIF) file. In this case, the sequence of their display, speed, background and some other parameters are set [1]. There are many programs that can create such GIFs, developed by different manufacturers.

Online 3D interactive educational resource creation platforms allow students to access 3D models using web browsers and create 3D interactive information educational resources. The following platforms are examples of this:

- Canva
- Sketchfab
- Clara.io

- Tinkercad
- Morphi

There are 3D interactive informational learning resources that can be installed on personal computers for students and are available for free.

In many fields, for example, in digital education, the main disadvantages of the practical application of animated GIFs are the large file size and the complete lack of interactivity, that is, the ability to control the viewing process.

VRML (Virtual Reality Modeling Language) is a protocol used to create 3D interactive informational learning resources. This language is used as a central language similar to HTML. VRML helps in creating and working with virtual objects

There are many file formats that describe 3D objects and images. But most of them are created by individual companies and developers. Each of them had its own limitations and was used to solve problems in very narrow areas. Therefore, it was constantly necessary to transfer files from one format to another in order to use previously obtained models for new tasks.

ParallelGraphics offers the widest range of VRML content creation tools, primarily for the entertainment industry and online catalogs and guides [2].

Internet Space Builder is a three-dimensional scene editor for the Internet, a tool for creating three-dimensional objects based on structural elements.

Internet Scene Assembler is a tool that allows you to assemble animated 3D scenes for the Internet and organize interactivity between the user and the scene.

Internet Character Animator is a tool for creating and animating web characters.

Metastream\Viewpoint. Currently, it is one of the most popular tools for virtual presentation of objects. In today's computer world, its support from market leaders plays an important role in the further development of technology, and Metastream is supported by corporations such as Intel and Microsoft.

Initially, this format was created to store scanned 3D structured interactive informational educational resources, identifying its strengths and weaknesses.

The advantages of the format include, first of all, its focus on working with very detailed geometry of the object and high-quality (detailed) texture (typical data for a 3D scanner). Thanks to its advanced algorithms, the format allows for compact display of even very large amounts of data and is the main achievement of the educational organization - algorithms for thinning and restoring the edges of the three-dimensional mesh ensure efficient loading of geometry (i.e. called "Streaming") is based on the theory of Dulonget triangulation [3].

However, the approach based on rendering the object as an empty shell has many limitations and does not allow for the organization of an advanced hierarchy of objects, complex animations, advanced interactive behavior - in general, the dynamics of the scene. All animation and scene interactivity provided by Viewpoint is built on top of the basic format. This explains why a 3D scene is represented by two (and not one) files. An XML file contains a description of a hierarchy whose nodes are geometric objects contained in one or more external files in Metastream format. Interactivity and animation are provided by writing ECMAScript (JavaScript) programs placed in the same XML file. Thus, creating complex dynamic scenes is very laborious and is done manually and only by skilled professionals.

When a page containing Metastream objects is loaded on your computer for the first time, you will automatically be prompted to download and install a free software distribution by

Viewpoint to view these objects. After that, you can view the object from any side, rotate it in any plane, move it (while holding down the "Shift" key), as well as resize it by increasing or decreasing it (holding down the "Ctrl" key). can be changed.

If you have a slow Internet connection, the image will appear slowly after downloading, because Metastream belongs to so-called "streaming" technologies.

After an ambitious project to create VRML, a language for describing virtual worlds, which for a number of reasons has become an academic and scientific language, Metastream technology looks like an important breakthrough in the direction of the 3D Internet. Now the developer educational organization is promoting the idea of "Any tool, Any media, One player", that is, the ability to use different methods of presenting information with the help of one plug-in, that is, a single information processing module.

This technology is used in digital education, digital education, museum presentations, in the field of electronic and computer games presented on the Internet and distributed on CD-ROMs, as well as in Internet advertising [4]. Among Cult3D's many applications, its ability to create realistic 3D representations of data in digital education is currently the most widely used. They allow not only to see products from different angles, to study their operation, but also to test them in real time. Many educational organizations use this technology on their websites.

With built-in compression and streaming capabilities, Cult3D provides fast loading and easy viewing.

Cult3D consists of three components: Designer - a program that allows adding interactivity to 3D models; Exporter - converts models created in Maya and 3DS Max programs into a format suitable for Cult3D Designer; Viewer is a plug-in that allows users to view Cult3D objects in web pages, Microsoft Office applications, and Adobe Acrobat (.pdf) files.

Cult3D responds to mouse input, allowing users to scale and rotate the scene.

The advantages of this technology include a very reasonable price for the license. Objects have a very high quality of imitation of real materials and surfaces. Unfortunately, Cult3D files are MetaCreations larger than files created with competitive Metastream technology. And the size of the browser plug-in can scare off many visitors. However, Metastream does not have the same interactivity as Cult3D.

Exporting 3D objects to the special Cult3D format does not allow further editing, which protects them from possible changes by other users and ensures copyright protection.

Cult3D's event-driven architecture allows you to define criteria by which various changes are made to an object based on the user's actions in the displayed scene. The set of events can be supplemented with simple animations to create complex interactive models, allowing you to design almost any type of presentation while maintaining a simple workflow with the product.

Pulse started many years ago as an entertainment and educational organization that developed computer games. Over the years, Pulse has redirected and leveraged its experience in game development to enter the 3D industry. Game development expertise and deep knowledge of 3D have allowed Pulse to dominate the online 3D entertainment market so far. Not leaving the gaming industry, Pulse is now actively involved in digital education. New Pulse trainees include Volvo and FAO Schwarz.

Pulse 3D is a multi-platform technology for creating and viewing animated 3D content for use in electronic entertainment and, to some extent, digital education, advertising and education.

Java 3D API. The rapid success of the Java programming language is largely due to the fact that it is offered as a universal cross-platform application development tool. In addition, it includes advanced object-oriented solutions, advanced tools, and an extensive general-purpose API library [5].

The Java programming language has become very popular because programs written in Java can be transferred to Web pages. Essentially, Java allows a Web page to provide visual content as well as miniature applications (applets) that can animate the page after it is loaded.

However, applets also have a downside. An applet can be written in such a way that it crashes the system or deletes files stored on the user's computer, so some users opt out of applets and disable Java Applet support in their browsers.

An important argument in favor of Java is the implemented and successfully working Java Media API library.

To view such scenes, you need to download a small special Java 3D Runtime Environment library. But when using other latest technologies, you need to copy plugins yourself. Developers do not need to adapt their software for different operating systems and browser interfaces, and most similar commercial solutions are very expensive. You can always rewrite the latest versions of the SDK and various libraries for free from the Java Soft website. You can also copy Borland's Java Builder, one of the best and most popular development environments for Java. Both educational organizations (Borland and Java Soft) regularly release updates to their products and offer versions of their packages for different platforms.

Java Soft brought 3D capabilities to Java by creating its own library and linking it to standard OpenGL and DirectX tools. But the programming interface for Java 3D applications is significantly different from OpenGL, which has become the next step in the development of tools for creating 3D graphics.

In its current implementation, the Java 3D API provides the following additional features:

Working with LightWave's two format scene files. This unique feature allows you to prepare LightWave animated scenes and present them in applets or Java applications, focusing on project and design development rather than programming.

Java provides flexible mechanisms for optimizing 3D object rendering. The developer can choose what and how much to optimize - model frame, texture, etc. Thus, the size of objects can be significantly reduced to speed up their loading over the Internet. In addition, depending on the situation, it is possible to specify the dimensions of the model, which significantly speeds up real-time processing, for example, it is necessary to reduce the number of polygons in the model depending on the scale.

Unlike the previously discussed technologies, the Java 3D API is designed for trained programmers, so it is in some ways a more flexible technology, but it is also more labor-intensive and therefore time-consuming.

### **1-table**

#### **Analysis of software and technologies used in the creation of 3D interactive informational educational resources**

<b>№</b>	<b>Software/ technology</b>	<b>Advantages</b>	<b>Disadvantages</b>

1.	VRML	can run on multiple platforms such as web browsers, mobile apps and VR devices, VRML files can be installed in formats that can be integrated with other programs and sites	files may take a long time to download
2.	Metastream	Programm with open source code. It creates a lot of convenience for its users. Metastream supports many different media formats, including videos, audios, and photos	had trouble setting restrictions or usage restrictions on some platforms
3.	Cult3D	The platform provides effective and realistic tools for creating 3D models and animations, which ensure that the content presented to users is well mastered.	there may be limitations in customization and integration with other platforms
4.	Pulse3D	Pulse 3D approaches the 3D audio technology of the PlayStation 5 platform and also improves special audio effects.	it may be difficult to find and buy because it is specially produced
5.	Java 3D	Java 3D has convenient options for creating hundreds of games and applications. It provides the ability for developers to create and modify their desired 3D objects.	Incompatibility issues with older or newer versions of operating systems may occur
6.	Macromedia Flash	an ideal program for creating interactive applications and animations. It is used to create interactive elements, games and multimedia applications on websites	Flash may not be compatible with mobile devices
7.	3D Max	offers a wide range of possibilities to users in many fields, including creating animation, modeling, games, movies and interactive programs	3D Max is a professional software, so it can be more expensive
8.	Canva	It has the advantages of easy and simple use. This allows users who are not involved in design to easily create graphics and designs	The free version has limited features and requires additional fees to create high-quality graphics and designs.
9.	ActiveX	powerful integration between browsers and Windows applications, allowing the use of dynamic and interactive elements on websites	designed to work with Windows applications only
10.	DirectX	A graphics card and multimedia application platform developed by Microsoft and optimized for the development of graphics, multimedia and gaming applications	Installing and updating new versions can usually be difficult

Each program has advantages and disadvantages that are suitable for its users and tasks. Users choose based on their field of application, tasks and capabilities. The technologies discussed above provide the necessary level of interactivity and require the transfer of a large amount of data

over the Internet. Creating complex dynamic scenes with their help is difficult and can be done only with the involvement of highly qualified specialists.

### **REFERENCES**

1. Молочков В. П. Компьютерная графика для Интернета. Самоучитель. -СПб., Питер, 2004. - 368с.
2. Лыткин И.И. Разработка интерактивных технологий трехмерной визуализации и анимации для электронной коммерции. Диссертация на соискание научной степени кандидата экономических наук. Москва – 2007. 133 с.
3. Гладышев Х. Султ 3D, Метастреам & ИПИХИ ! Планета Интернет - 2000. - №10. -с. 30
4. Макгиливейр К., Хэд Э. Использование 3D-технологий при создании WEB-сайтов. -М.: ХТ Пресс, 2006 - 336 с.
5. Selman D. Java 3D Programming. -Greenwich: Manning Publications, 2002. - 376 p.
6. Yegupova M.V. Metodicheskaya sistema podgotovki uchitelya k praktiko-oriyentirovannomu obucheniyu matematike v shkole. Avtoreferat dissertatsii na soiskaniye uchenoy stepeni doktora pedagogicheskix nauk / Moskovskiy pedagogicheskiy gosudarstvenniy universitet. Moskva, 2015