Educational Technologies
Образователни технологии

APPLICATIONS OF ANAGLIFIC IMAGES IN MATHEMATICAL TRAINING

[1)]Krasimir Harizanov, [2)] Stanislava Ivanova
[1)]Konstantin Preslavsky University of Shumen (Bulgaria)
[2)]Peyo Kr. Yavorov Secondary School - Varna (Bulgaria)

Abstract. The article presents the use of interactive approaches in mathematics education through anaglyph images**.** The basic functions and characteristics of the various applications through which such images can be created are presented. Examples of the adaptation of anaglyph images in mathematics training are described.

Keywords: anaglyph images; interactive training; mathematics training; e-learning; interactive education; education in mathematic; anaglyph

Introduction

The introduction of modern interactive teaching methods increases students' interest in the lessons and their active participation in the learning process itself. Such practices are not new in European countries, but their widespread introduction and use of specialized systems in Bulgaria is just beginning.

The rapid development of new technologies and the entry of computers and information technologies in all walks of life inevitably imposes appropriate requirements on the education system as well – it must respond adequately to the need to train staff capable of using and developing new technologies.

Application of anaglyph images in mathematics training

Interactive teaching methods are much more commonly used, not only in the fields of mathematics and informatics and information technology (Pavlova, 2011), but also in other teaching disciplines in almost every school (Naydenova, 2014). They have been known for a long time in education, but they can now be said to be a contemporary model for building an educational dialogue between teacher and student. "This task can be designed as a multidisciplinary project. Its complexity may vary depending on the interests of the students and the capabilities of the school" (Pavlova, 2020). A number of their peculiarities are due to the productions that define their nature.

In the modern world the idea of three-dimensional visualization of objects or so-called 3D technologies is popularized. Their main goal is to give the user a three-dimensional flat-screen viewing experience. It all comes down to how one focuses on objects. We

see because our eyes absorb the light that is reflected from the surrounding world. Our brain interprets light and creates image. Virtual reality is a computer-based simulation of a three-dimensional environment in which the user is able to interact with the content of the simulated scene. The basic idea is that it should be an integral part of the environment and have an impact on it in the same way as in the real world (Zlatev and others, 2014).

Stereoscopy is a technique for attaining or enhancing the illusion of depth of image through means of stereopsis intended for binocular vision. The word stereoscopy comes from the Greek (στερεός (stereos) –"solid, solid" and σκοπέω (scopeo) – "to look", "to see").

3D technology

There are two categories of 3D technology – active and passive. Viewers using the active technology have a display.

Active technology

The Shooter system works (Berkel, Parker & Franklin, 1996), presenting an image to the left eye while the right eye is blocked and then back. These actions are repeated quickly enough that interruptions in the change of the viewing eye do not take into account the perception of the images as a single three-dimensional image. Liquid crystal glasses are used (Figure 1).

Figure 1. Glasses with liquid crystal

Passive technology

The promotion of passive technology – these are two stacked images that are projected onto the screen through polarizing filters. The projection uses a gray screen. The viewer looks through glasses that also contain filters. Each filter transmits light with similar polarization and deters other types.

Color anaglyphic systems

Anaglyph is a method of obtaining stereoscopic (3D) images by color-coded signal intended for the left and right eyes. To obtain a realistic effect, anaglyph

glasses with special color filters are used: more often, the left eye is red and the right eye is blue (Figure 2), but there are other color combinations. The stereo image is formed by the simultaneous observation with the help of glasses of two pictures, each shot with the appropriate filter, ie. each eye perceives only the information filtered by the corresponding color.

Figure 2. Anaglyph 3D glasses

Anaglyph technology is achieved by creating two overlapping differently filtered color images for both eyes respectively. The screen images consist of two layers of color, overlaid but slightly offset to produce a deep effect (6). Usually the main theme is in the center, while the foreground and background are shifted sideways in opposite directions.

Creating anaglyph images

There are various ways to create 3D anaglyph images that can support math education, and now I will focus on some of them.

Through specialized software applications

Thanks to various specialized software applications, we can generate 3D anaglyph images. Such application is:

3D Anaglyph maker

3D Anaglyph maker is a computer program that generates 3D anaglyph images that works offline. It can be downloaded from the Internet for free. This program (Figure 3) is very easy and convenient to use, so we can choose what anaglyph images we want to get. All you have to do is place an image on the left and right as these are almost the same images that have a slight discrepancy.

Figure 3. Pictures for anaglyph image

Through image editors

There are various graphics editors that can create 3D anaglyph images. Paint. NET is a very good design editor, easy-to-read tools and effects that can be used to edit Web and printable images. He is a typical representative of editors for creating and processing bitmaps. (Figure 4)

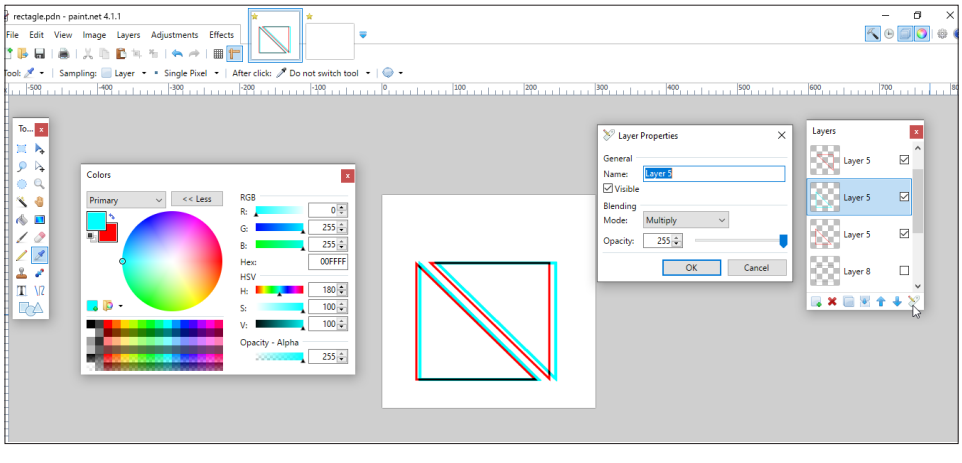

Figure 4. Making anaglyph image with Paint.net

Through online applications

ConvertImage

There are many applications for creating 3D anaglyph images and online. ConvertImage is a free online photo editor that includes an online image file converter. This website https://convertimage.net/ can easily convert photos online without any software, then change the file format of each photo from all these file formats to

each other, directly online: BMP, WBMP, DIB , CUR, GIF, JPG, JPEG, JPE, PCX, RLE, PDF, PICT, PCT, PIC, PNG, PSB, PSD, TIF, XCF. The tools provided by this online software are many in number, one of which is precisely a stereoscopic 3D effect. The conversion itself is very fast in just a few seconds. All we have to do is upload the image we have chosen. Then there are two options to choose from: 3D anaglyph (color) or 3D anaglyph.

Implementation of anaglyph images in the school mathematics course.

In mathematics training, lessons involving anaglyphic imagery can be implemented to illustrate the drawings of the tasks.

The Geometric Bodies section in Grade 5, including Cube and Parallelepiped, is very suitable for the use of anaglyph images (Figure 5), because in them students should:

– Know the basic elements of rectangular parallelepiped and cube and their properties;
– Recognize rectangular parallelepiped and cube and can detect them in objects (objects) from the surrounding world;
– Calculate face on a rectangular surface parallelepiped and cube;
– Calculate calculate the volume of a rectangular parallelepiped and a cube.

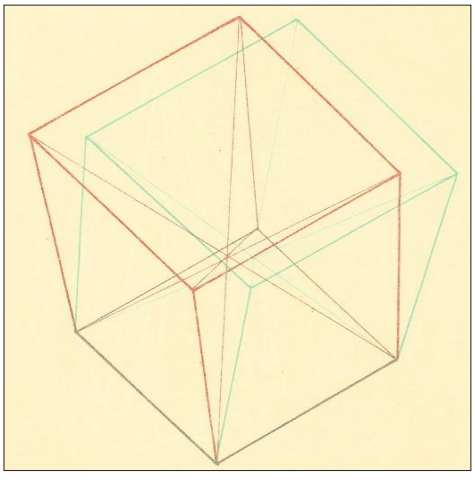

Figure 5. Anaglyph images of cube

It is appropriate to use this type of image in the topic "Cube. Elements. Development". With their help, students can much more easily imagine the body of the Cube, which is very unknown to them. The topic itself is extremely difficult for students to understand and learn. At this age, it is dif-

ficult for them to imagine that there is a three-dimensional space, and with the use of 3D anaglyph images they can very easily visualize their idea of a geometric body.

In 6 grade, new geometric bodies are studied – prism, pyramid, cylinder, cone, only one sphere. These topics are well suited for using anaglyph images because in them students should:

– recognize the right prism, the right pyramid, know their elements and developments;
– recognize a straight circular cylinder, a straight circular cone, know their elements and developments;
– recognize a sphere, know the elements only one sphere.

The theme "Prism. Right Prism" can again be visualized through 3D anaglyph images. With the introduction of the new concept of a straight prism, various 3D illustrations of the types of prisms that students will be introduced to may be presented – triangular, quadrangular, pentagonal, etc.

Conclusion

The use of information technology in mathematics education is an integral part of the modern learning model. This requires the introduction of new, modern and interesting teaching methods for learners. Some of these methods are related to the presentation of knowledge, while others are related to the use of knowledge from other disciplines.

One of the big challenges for any teacher is to keep students' attention in their classes. Modern interactive teaching methods make it accessible and easy.

Gratefulness

This article was supported in part by a project №89/2020 – "Modern didactic technologies in the teaching of information technologies and mathematics" from the Research Fund of the University of Shumen Bishop Konstantin Preslavsky for 2020.

REFERENCES

Berkel, C., Parker, D. W. & Franklin, A. R. (1996). Multiview 3D-LCD. Proc. Of SPIE Vol. 2653, Stereoscopic Displays and Virtual Reality Systems III, ed. S S Fischer, J O Merritt, M T Bolas, pp 32 – 39, Apr. 1996.

Naydenova, D. (2014). Stimulating Active Learning through an Interactive Educational Environment, I Continuing Education Magazine, Issue 37. [in Bulgarian]

Pavlova, N. (2011). Software Technologies for Creating Didactic Materials for Mathematics Education. Shumen: Ep. Konstantin Preslavski. [in Bulgarian].

Pavlova, N. (2020). Didactic game "Posssible cross sections". Mathematics and Informatics, Volume 63, Number 4, pp 391 – 397.
Zlatev, S. and others. (2014). Applying Extra Devices to Interactive presentation system in food technology education. V National Conference on E-Learning in Higher Education, [in Bulgarian].

✉ **Dr. Krasimir Harizanov, Assoc. Prof.**
ORCID ID: 0000-0002-5783-8328
Konstantin Preslavsky University
Shumen, Bulgaria
E-mail: kr.harizanov@shu.bg

✉ **Stanislava T. Ivanova**
Teacher
Peyo Kr. Yavorov Secondary School
Varna, Bulgaria
E-mail: stanislavkaaa123@gmail.com