

Developing an Anatomy Lecture Model for Medical Students Using 3D Anaglyph Imaging Method

Üç Boyutlu Anaglif Görüntüleme Yöntemi Kullanarak Tıp Öğrencileri İçin Bir Anatomi Ders Modeli Geliştirme

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ABSTRACT

Technological developments have been reflected in the methods and materials used in the field of education, as a result, educational technologies have progressed. In the present study, in order to make the organ anatomy of the female genital system more understandable for medical students, digital images were taken from the anatomical structures related to the lecture and transformed into 3D anaglyph stereo images. As a result of the evaluation questionnaire applied at the end of the lesson, it was seen that the students found the anatomy lecture using 3D materials more understandable. It suggests that the development of 3D presentations and visuals in order to contribute to the understanding of the lectures related to macro and micro anatomy containing complex anatomical structures will increase the learning and participation performance of the students.

Keywords: 3D, anaglyph stereo, female genital system, anatomy education

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ÖZET

Teknolojik gelişmeler eğitim alanında kullanılan yöntem ve materyallere de yansımış, bunun sonucunda eğitim teknolojileri ilerlemiştir. Bu çalışmada, kadın genital sisteminin organ anatomisini tıp öğrencileri için daha anlaşılır kılmak amacıyla dersle ilgili anatomik yapılardan dijital görüntüler alınarak 3 boyutlu anaglif stereo görüntülere dönüştürülmüştür. Ders sonunda uygulanan değerlendirme anketi sonucunda öğrencilerin 3 boyutlu materyallerin kullanıldığı anatomi dersini daha anlaşılır buldukları görülmüştür. Karmaşık anatomik yapıları içeren makro ve mikro anatomi ile ilgili derslerin anlaşılmasına katkı sağlamak amacıyla 3 boyutlu sunum ve görsellerin geliştirilmesi öğrencilerin öğrenme ve katılım performanslarını artıracaklarını önermektedir.

Anahtar Sözcükler: 3-boyut, anaglyph stereo, kadın genital sistemi, anatomi eğitimi

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INTRODUCTION

Recently, increasing technological developments have also been reflected in the methods and materials used in the field of education, as a result, educational technologies have progressed (1, 2). It can be predicted that the development of technologies such as hologram technology, virtual reality, robotic coding, and 3D printers can contribute to the creation of new educational materials and increase the interest of students in both theoretical and practical courses (3, 4). 3D imaging techniques are commonly referred as stereoscopy (5). Stereoscopic (3D) vision methods are methods such as polarization method, active system, autostereoscopic and anaglyph imaging (6).

In the anaglyph stereo method, a 3D image is obtained by using a 2D image (7). The fact that this method is accessible and financially more affordable than other methods increases its preferability by improving the image quality (8). In the anaglyph stereo method, the images taken separately for the right and left eyes are combined in a single image and 3D vision is achieved through filters using an anaglyph glasses (9). While the compatibility of the anaglyph method with all color screens increases the usage prevalence, the low quality of the stereoscopic image compared to other methods makes it difficult to obtain full color stereoscopic images with the anaglyph method (10, 11).

Within the scope of anatomy course, which has an indisputable importance in medical education, considering the limitation of laboratory time, the intensity of the course content and the number of students, it is important to develop new educational materials related to the course (12). Textbooks, atlas and prosection / dissection are among the tools and methods used in the anatomy course from past to present (13, 14).

The integration of three-dimensional technologies into anatomy education with different methods has continues to be shared with positive results (15, 16). In our study, in order to make the organ anatomy of the female genital system more understandable for medical students, digital images were taken from the anatomical structures related to the lecture and transformed into 3D anaglyph stereo images. One of the images supported by 3D technologies belonging to the female genital system used in the anatomy lecture, which is the subject of our study, is shared with Figure 1.

Feedbacks of medical students was also evaluated, at the end of the female genital anatomy course supported by 3D Anaglyph Imaging Method.

MATERIAL and METHOD

Preparation of anaglyph stereo images

In order to prepare anaglyph images of female genital organs, 3D models of genital organs were made. For this purpose, a modeling and animation program called Cinema 4d was used (Cinema 4d, R.24, Friedrichsdorf, Germany). In addition, plastic models of female genital organs in the anatomy laboratory were used. In order to take anaglyph images, the second image was taken by moving the camera 8° to the right or left on the horizontal axis after the first image was taken during the digital image acquisition phase. Here, the first and second images were the object images seen by the right and left eyes, and the 8-degree angle between them corresponded to the angle between the axes of both eyes (for 3D vision). Then, the obtained object images were created anaglyph stereo images by using Anaglyph Maker (Version 1.08), a free software developed by Takashi Sekitani. Right and left eye images obtained from the 3D texts used in the presentation were converted into anaglyph stereo images using the anaglyph stereo image preparation software mentioned above. The obtained anaglyph images were viewed with the help of cardboard anaglyph glasses with red glass on the left side and blue glass on the right side. Powerpoint (Microsoft Corp., Seattle, WA, USA) presentation program was used to create both traditional 2D and 3D lecture presentations.

Application of the Course

Endocrine and Urogenital Course Board Female Genital System Anatomy course was shown as lecture presentations containing 3D images to Gazi University Faculty of Medicine term II Turkish students (n= 161 students). While choosing the students for the course, attention was paid that the participants did not have amblyopia and refractive errors. The lecturer took care not to affect the students' concentration during the lesson. The presentation took about 45 minutes. The lecture was made by projecting on the screen from a projection device connected to a computer.

Before the lesson, each participant was given anaglyph (blue / red) glasses to watch the lesson in 3D (Figure 2). The feedback forms distributed to the students after the lesson were asked to be filled. Participants were asked to answer the questions on the form, and to comment on the 'your comments' section on the subject (Table 1).

Ethics Approval

Study is approved by Gazi University School of Medicine Clinical Research Ethics Committee at 25/01/2021. Before the start of the lecture, students attending the course were informed about the method to be applied in the course content and the questionnaire afterwards. Survey participation was completed on a voluntary basis.

Table 1 - Feedback form

Questions	Evaluation
The course increased my knowledge on the subject	Disagree / Undecided / Agree
The lesson increased my awareness of the topic	Disagree / Undecided / Agree
I was able to watch this lesson without any distractions.	Disagree / Undecided / Agree
The chosen 3D materials allowed me to better understand complex structures.	Disagree / Undecided / Agree
This app changed my perspective on human anatomy	Positive / Negative / Not Changed

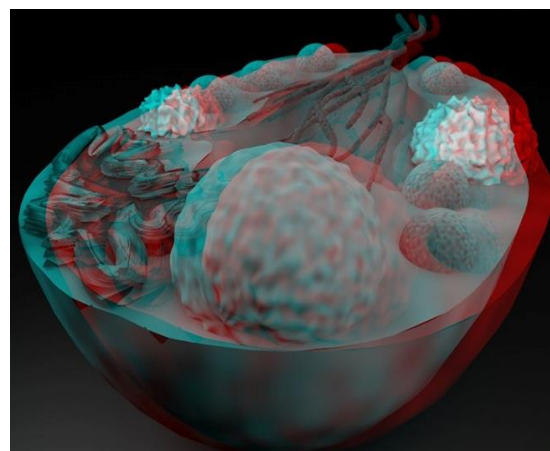


Figure 1. The anaglyph stereo presentation for anatomical teaching of the ovary section (blue-red anaglyph glasses needed)

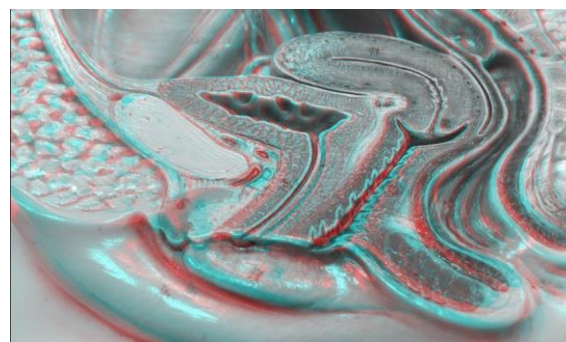


Figure 2. The anaglyph stereo presentation for vagina and uterus anatomy (blue-red anaglyph glasses needed)



Figure 3. A view from the lecture hall where the anatomy lecture included in the study was taught

RESULTS

In this study, the effect of the lecture presentations for the students prepared by using the 3D educational material prepared for the Female Genital System Anatomy course in Gazi University Faculty of Medicine term II Turkish Endocrine and Urogenital Course Board was evaluated.

While 73% of the students agreed that the applied lecture increased knowledge and awareness about the subject, 51% of the students stated that they could watch this lesson containing 3D images without being distracted compared to the classical lecture presentations.

61% of the students who attended the course stated that they understood the complex anatomical structures better by using 3-dimensional materials, and again 66% of them stated that this application positively changed the perspective of human anatomy.

Some students wrote their opinions in the 'comments' section on the feedback form. Comments such as 'Trying different methods in terms of facilitating learning', 'presentation was great', 'it was more understandable than the classical lectures we had previously in the lecture theater', 'image quality could be improved', 'it was not very effective because we couldn't make eye contact', 'animation could be', 'images could be colored', 'glasses quality can be increased', 'increased my interest in the lesson', 'different subjects such as skeletal musculature can be studied' and 'I was less sleepy' were among the views of the students.

DISCUSSION

Anatomy is a visual science that has an important place in basic medical sciences during and after medical education (17). Data on the use of different 3D technologies in different anatomical locations have been reported (16). Students studying in the field of medicine and health use various educational materials such as video, images and animation as well as cadavers within the scope of the anatomy lecture, making it easier to understand. The aim of this study is to evaluate the contribution of the anatomy course to the students using 3D anaglyph stereo presentations.

The contributions of 3D technologies to anatomy education have been shared with different studies. In addition to anatomy education, 3d technologies are used in different surgical methods. For example, its possible effects are shared in studies that have been tried in neurosurgical techniques (18). In addition to neurosurgical techniques, there are results regarding the use of 3d technologies in orthopedic surgery methods (19). Undoubtedly, the three-dimensional perception of the anatomical structure is of great importance in the successful conclusion of surgical techniques (18, 19). At this point, it can be thought that the use of three-dimensional techniques in medical education prepares medical school students to be better equipped for the clinical process.

As a result of the evaluation questionnaire applied at the end of the lecture, it was seen that the students found the anatomy lecture using 3D materials more understandable. In the topographic anatomy lecture given to the students of the faculty of dentistry by Peker and his colleagues used the 3D anaglyph stereo visual tool used facilitated the better understanding of the lesson and supported that it could be an alternative to 2D lecture presentations (20).

With the development of technology and digital materials, especially the methods of teaching basic medical sciences are gaining innovation. It was stated that the 3D models used in the study conducted by Murakami et al., Such as the 3D atlas, gave the student strong perspectives in clinical lessons and provided significant improvements in his skills in radiological fields (21). In our study, 73% of the students agreed that the applied lecture increased knowledge and awareness on the subject.

Ribas et al stated that 3D anaglyph printouts are a realistic teaching and reporting tool, especially for radiologists and surgeons (22). Ciuffreda et al. had shared that eye problems such as amblyopia, ocular dominance and refractive error are encountered quite frequently among students (23). The shared data indicated that these types of eye problems can cause vision problems with 3D techniques (24). In order to exclude a similar problem in our study students with a diagnosis of those eye problems were not included in the study. But still some students reported negative opinions about the image clarity on the feedback form. We have opinion that this problem can be solved by increasing the quality and resolution of the glasses.

CONCLUSION

The results of different 3D technologies in different anatomical locations compared to classical education are available in the literature (18, 19). In our research, the effects of anaglyph methods in explaining the anatomy of the female genital system, which has a great place in anatomy education, to medical school students are shared. Our study on this topic constitutes a first in the literature. However, further studies supported with control groups are still needed for a wider perspective.

It suggests that the development of 3D presentations and visuals in order to contribute to the understanding of the lectures related to macro and micro anatomy containing complex anatomical structures will increase the learning and participation performance of the students.

Conflict of interest

No conflict of interest was declared by the authors.

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