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Computer animation in teaching surgical procedures

Can Cemal Cingi *

Instructor, Anadolu University, Eskisehir, 26470, Turkey

Abstract

Animation is a developing and interesting visual communication instrument. It may have multipurpose functions such as entertainment, advertisement and education. The aim of this paper is to investigate the use of animation in teaching theoretical medical information and especially surgical procedures. Three, animations were planned and created about endonasal surgery focused on procedures which are known as difficult to understand. Then a group of 20 medical students were taught with this animation whereas a second group of 20 students were taught by theoretical information and plain figures. Different evaluation questions were asked in order to clarify the benefit of the animations in learning. Then the second group was taught again by using the animations. It is concluded that animation is a very useful tool to teach difficult procedures in medicine especially in teaching complex topics.

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Keywords: Animation; Medical Education; Education Materials; Teaching; Teaching Methods

1. Introduction

Medicine may be the most interesting and important field of science, but it is extremely difficult to study and learn. Although learning a main concept may be sufficient in other disciplines, medical students must learn many details, must understand all mechanisms, and must study hundreds of pages. They must understand details and attempt to remember them forever.

* Corresponding author. Tel.: +90-222-335-0810/5242; fax: +90-222-320-4520.
E-mail address: ccc@anadolu.edu.tr

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In addition to texts, pictures and posters are widely used to explain medical information and surgical procedures. However, it is often difficult to verbalize procedures. Instructors must provide theoretical information and then explain the steps of the procedure. Diagrams used for this purpose may be insufficient. Thus, it is important for students to complete internships and residencies to learn the practical details of medicine.

Although many types of written information are widely used in education, studies have shown that visual perception is very important. For this purpose, new teaching strategies have been developed using figures, pictures and videos. Recently, education centers have begun preparing animations for both teaching and practice.

Many studies have examined this topic. Fallman said, "Learning consists of acquisition of information that is provided by the, in this case, virtual environment. Training, on the other hand, involves mainly responses from the user on the environment itself. Training arises from actions carried out by the user on the environment, while learning results from contextual factors" (Fallman, 2008).

Aydın stated, "In medicine, training will improve by operating on virtual argons, and training for pilots will benefit from VR training materials that will enable the user to saw or drill wood and build a project before attempting to use the real equipment" (Aydın, 2005).

Animation is a developing and interesting visual communication instrument. It may have multiple functions, such as entertainment, advertisement and education. For example, animation may be a useful tool to plan a new nose prior to rhinoplasty or to teach surgical maneuvers. The aim of this study is to investigate and quantify the use of animation to teach theoretical medical information, especially surgical procedures. Three animations were planned and created for endonasal surgery. These animations focused on procedures that are known to be difficult to understand.

2. Materials and methods

2.1. Study groups

Our study group consisted of 40 medical students between the ages of 21 and 29. The participants included 20 males and 20 females. They were divided randomly into two groups of 20 participants.

2.2. Educational material

Three tasks were prepared for rhinoplasty maneuvers. The two sets of educational materials included theoretical information with figures and the same information with animations. The steps of the surgical maneuvers were explained in both sets.

The two groups of subjects were given educational materials including either theoretical information with figures or the same information with animations. Twenty minutes later, each student was asked questions related to the subject. Then, the students were asked to explain the main idea of the educational material.

In a second step, the first group, which received theoretical information with figures, was given the second educational set, consisting of the same information with animations. Then, the students had the opportunity to compare the difference in the two materials. Finally, the students were asked the same set of questions a second time to evaluate the influence of the second set of educational material.

Task I: Alar cartilages are very important in the constitution of the nose. They may vary in shape and hardness, and they provide the projection of the nose. The nasal septum is an important support for the nose projection. The aim of this task is to show how septum or columellar grafts affect the projection of the nose and to focus on the influence of projection on the shape and position of the nostrils.

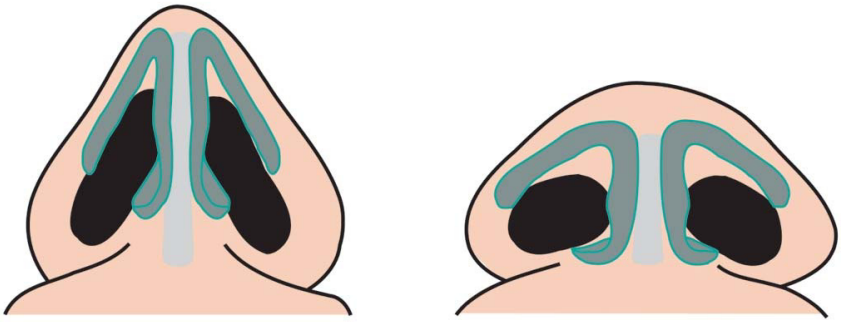

Fig. 1. (a) The relationship between the shape of the alar cartilages and the nostrils;
(b) The relationship between the shape of the alar cartilages and the nasal valve angle

Task II: Dome suture is a very important binding to narrow the tip of the nose. It also serves as an important support to provide symmetry for the nose. The level of this suture is an important issue because this level affects

the tip position. When the dome-binding suture is placed high, the tip becomes sharper, and the rest of the cartilage flares and looks wider at the middle portion.

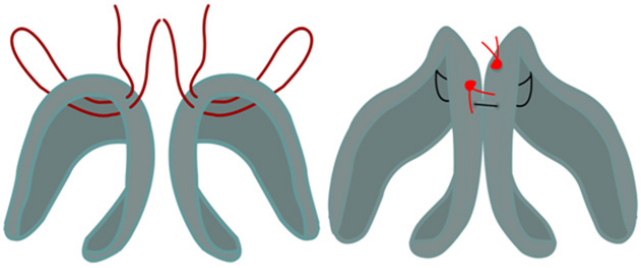

Fig. 2. (a); (b) The narrowing effect of the dome suture

Task III: When the dome-binding suture is placed 3 or 4 mm lower than the highest point of the tip, the tip looks slightly wider but more natural, and the rest of the cartilage becomes closer.

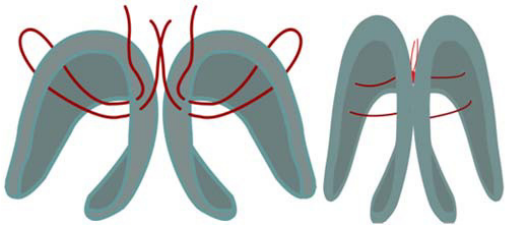

Fig. 3. (a); (b) The narrowing effect of the dome suture at a lower localization

2.3. Evaluation Questions:

After the educational period, the subjects were asked to explain the tasks in detail. The study group was asked questions related to the data. A jury was established, and this jury evaluated each subject's knowledge about the tasks that were explained.

The topics were as follows:

1. The shape and the position of the alar cartilages
2. The correlation between the position of the alar cartilages and the nostrils
3. The effects of the alar cartilages on nose projection
4. The correlation between dome binding sutures and the width of the tip
5. The correlation between dome binding sutures and alar flaring

6. Where to put the suture to prevent a pinched nose
7. Where to put the suture to narrow the nostrils.

2.4. Self-Evaluation of the Subjects:

Each subject evaluated the educational material on a scale of 0 to 10, with 0 indicating the worst and 10 indicating the best.

3. RESULTS

The age and sex distribution of the study groups and the evaluation of the students and the jury are shown in tables 1 and 2.

Table 1. Age, sex distribution and evaluation grades of study group I

No	Age	Sex	Evaluation by students after instruction with theoretical information + figures	Evaluation by jury after instruction with theoretical information + figures	Evaluation by students after instruction with animations
1	22	f	4	4	9
2	22	m	5	5	9
3	21	m	5	4	10
4	21	f	6	5	8
5	21	f	4	6	8
6	21	f	5	4	8
7	21	f	6	6	9
8	21	m	5	5	9
9	21	f	6	6	10
10	21	f	3	5	8
11	21	m	7	5	10
12	21	m	3	5	8
13	21	m	4	5	8
14	21	m	4	6	9
15	21	f	5	6	9
16	21	f	5	4	9
17	21	f	6	7	10
18	21	f	4	5	9
19	26	f	5	5	10
20	28	f	6	8	9

Table 2. Age, sex distribution and evaluation grades of study group II

No	Age	Sex	Evaluation by students after instruction with animations	Evaluation by the jury after instruction with animations
1	21	f	6	9
2	21	m	7	8
3	21	f	9	7
4	21	m	10	8
5	21	m	7	9
6	22	f	7	9
7	22	m	8	9
8	25	m	9	8
9	25	f	9	8
10	26	f	10	8
11	26	m	7	9
12	28	m	6	9
13	28	f	6	8
14	27	f	9	7
15	28	m	9	8
16	28	m	10	8
17	25	m	7	7
18	29	m	6	9
19	21	m	9	9
20	21	m	10	8

The grades of the second group are much higher than the grades of the first group. The second group of subjects, who were given information with animations, showed a better learning curve then the first group. They explained the main idea of the education much better than the first group. The difference is statistically significant ($p<0.001$) for the evaluations of the students and the jury.

The first group, which received the theoretical information with figures, was given the second educational set, consisting of the same information with animations. Then, this group had the opportunity to compare the difference between the two materials. The fifth and seventh columns of the first group show their comparison, which is statistically significant ($p<0.001$). All of the students concluded that animation is a useful educational material.These data were not available for the second group because they were initially educated with the theoretical information supported with animations. Therefore, they could not compare both methods. However, their higher grades may be considered proof of the benefit of animations for education.

4. DISCUSSION

It is well known that education is the first level of influence in all disciplines. Medical education is particularly important because the subject of this study involves human life. Thus, before beginning to work on the human body, one must learn as much as possible. We suggest that theories of cognitive development and education may support the importance of animations and virtual reality (VR) in medical education and training. VR provides an exciting educational medium to explore information and to explore oneself. VR provides a training environment that is rich and responsive and that permits the direct evaluation of educational theory. The central educational issue for VR involves the transfer of experience (Bricken, 1990). Increasing numbers of researchers and educational practitioners believe that VR technology offers significant benefits to support education and training. For some of these researchers, VR's ability to facilitate constructivist-learning activities is a key issue (Bricken, 1990). Turkish noses often have humps so many people in Turkey seek rhinoplasty. Due to the unique nasal structure in Turkey and other Mediterranean countries, rhinoplasty is a very common procedure that should be mastered by all ear, nose and throat surgeons.

In practical practice, issue it is obvious clear that it is easier to that we all can learn easier by watching a procedure than by reading that about it. we see rather than that we read. But of course, in both we need theoretical knowledge is needed prior this step. I agree with Brick (Bricken, 1990) in that the idea that "animations and VR technology offers strong benefits to support education and training". Many authors have stated similar ideas on this same topic (Bell&Fogler, 1905;Alexiou et al., 2004).

Practical experience is an important component of the educational process. However, the time and economic resources required for to establish scientific laboratories is outside the scope of many institutions. A solution to this problem may be found in the adoption of virtual laboratories, which can be an important educational tool to address the lack of practical experience in education (Bell&Fogler, 1905).

I agree with the author that practical experience is an important component of the educational process. However, it is extremely difficult and dangerous to teach surgical procedures practically. Thus, before students begin surgical interventions, it is important to fully teach the procedures. Animation can be a helpful tool for this purpose. Other surgical interventions have been taught by animations in recent years (Ullrich et al.,2009; Henderson&Ali, 2007), and new studies will be published on this topic in the near future.

Animations and virtual reality are more efficient that training on real patients. These methods eliminate the risk that students will harm patients while attempting to learn new skills. They also eliminate the time restraints of waiting for specific types of cases and allow the trainees to practice independently. Furthermore, using virtual patients for training is less expensive and less offensive than training on animal models.

5. CONCLUSION

The importance of education is clear in all disciplines. Education in medicine has particular importance because the material involved in this subject is human life. Thus, before beginning work on the human body, medical students must learn as much as possible.

Teaching materials are useful in all scientific fields, but they are especially important in medicine. It is extremely difficult and dangerous to teach surgical procedures in practice. Therefore, before students begin surgical interventions, it is important that they are completely familiar with the procedures. A theoretical education is usually not sufficient for complete comprehension. Visual devices such as diagrams, drawings, and pictures can be utilized for this purpose.

Animations of anatomical structures and surgical procedures are helpful educational materials. When we compared the efficacy of various education materials, we observed that animation was an effective teaching tool.

Further studies should be performed to improve this type of educational material. Cooperation among various disciplines, such as medical doctors and visual art creators, is particularly needed.

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