

# Blended learning in anatomy education: a study investigating medical students' perceptions

Mehmet Akif Ocak  
Gazi University, TURKEY

Arzu Deveci Topal  
Kocaeli University, TURKEY

Received 24 August 2014; accepted 25 December 2014; published on 27 April 2015

The present study examines levels of satisfaction and perceptions of the students taking the blended anatomy course in Turkish Higher Education System. 15 students selected from 213 medical students participated in the study. An interview form was designed to identify the views of the students about the present study. The interview results were analyzed in the NVIVO program using the content analysis technique. Based on the results, the medical students' views on the blended anatomy course were classified into 8 categories: 1) visuality 2) content 3) effective learning 4) expectations from blended learning 5) accessibility 6) motivation 7) new perspective for the students and 8) continuity. Results indicate that medical students perceive blended learning environment positively. As a factor promoting learning, this study makes suggestions for taking advantage of the opportunities in a blended anatomy course successfully.

*Keywords:* anatomy education, blended learning, perception, medical students

## INTRODUCTION

The rapid changes in the information era affect the medical education along with the rest of the world. Medical sciences require the use of educational technologies in the field (Ward, Gordon, Field, & Lehmann, 2001). As Arman, Cankur, Çelik, Ersoy, İçke, Kopuz, Özbek and Pınar (2002) argue, it is not possible to give all the expanding knowledge to a medical student in a six-year period. Educators inevitably must select what they will and will not teach, and give the student the capability to use that information. At the very foundation of medical education lies anatomy. Anatomy is the oldest known medical science. Regardless of the

division or specialization, every medical student must learn anatomy in order to become a successful doctor. According to the Department of Anatomy in the Faculty of Medicine at Kocaeli University (2011), the anatomy course analyses human anatomy, the various structures in the body and how these structures relate to each other. The anatomy studies include many areas of sub-specialization from topographical anatomy and dissection to microscopic and ultramicroscopic methods, which are the latest methods.

The clinical sciences are becoming more dominant in medical education and the time for basic medical sciences is becoming precious. The studies on the cadaver dissections and living human models that would help the students gain skills and positive attitudes cannot be carried out sufficiently due to reasons such as an inadequate number of cadavers, the high number of students, lack of technical equipment and infrastructure, and inadequate number of instructors, etc. (Arman et al, 2002).

Different methods are required to solve the existing problems in anatomy education, which has an important

Correspondence to: Mehmet Akif Ocak  
Gazi University, Distance Education Application and  
Research Center, Besevler, Ankara, TURKEY  
Phone: +90312 202 3920  
Email: maocak@gazi.edu.tr  
doi: 10.12973/eurasia.2015.1326a

### **State of the literature**

- Different methods are required to solve the existing problems in anatomy education, which has an important place in the foundation of medical education.
- Research clearly indicates that there is an increase in the use of blended learning environments in medical education, in which materials such as 2D and 3D images, videos exams and lecturing are used frequently.
- The literature shows the factors (access, motivation, materials etc.) directly focusing on blended anatomy education are analyzed individually, instead of examining these factors together.

### **Contribution of this paper to the literature**

- This study contributes to the literature by using the flexibility of the blended learning environment in solving the limitations of face to face anatomy classes.
- The results led to the classification of the medical students' views on the blended anatomy course into 8 categories.
- Researching the integration and use of the blended learning environment in medical education in different ways and for different time periods seems an important issue.

place in basic medical education. Sayek, Odabaşı and Kiper (2010) indicated that alternative methods that would support anatomy education should be used more commonly. One of the methods that can be used to support anatomy education might be blended learning environments. This method includes the advantages of online learning as well as those of face-to-face learning.

Research clearly indicates that there is an increase in the use of blended learning and online learning environments in anatomy courses, in which materials such as 2D and 3D images, videos exams and lecturing are utilized (Nicholson, Chalk, Funnell, & Daniel, 2006; Potomkova, Mihal, & Cihalik, 2006). Since the cadaver dissection courses cannot be executed effectively in many medical schools due to the difficulty in obtaining cadavers and increasing costs, instructors have started gaining interest in supplementing or substituting live demonstrations with computer-based technologies (animation, 3D images) (Nicholson, Chalk, Funnell, & Daniel, 2006). Blended learning environments that combine the strengths of face-to-face learning and online learning may contribute to solving teaching problems in the anatomy education, such as lack of materials, crowded anatomy classes and intensive

curriculum programs. Schmidt, Reinehr, Leucht, Behrendt, Geiler, and Britsch (2011) showed that blended learning used in undergraduate medical education enabled students to steer their own learning processes in line with their personal needs. Blended learning environments allows students to have social interactions without overlooking the practical skills, provides students time flexibility and increases their levels of satisfaction (Donnelly, 2010). The present study aims to create an environment for students which they can use during independent study hours so that they can further benefit from cadaver training.

### **Blended learning and practices in the medical education**

#### ***Definition of blended learning***

Blended learning is an integration of different learning approaches and new technologies, activities and activity types (Heinze, & Procter, 2004). It combines the advantages of face-to-face learning and online learning. The courses using blended learning environments can be developed using technical tools creating realistic environments. Moreover, it allows for high flexibility and costs less compared to conventional classes (Graham, 2006).

From a medical perspective, Shahoumian, Parchoma, and Hanson (2014) argued that blended simulation-based medical education expanded the understanding of how actors in a complex medical system interact with each other and the practices that support or hinder blended learning. They analyzed the data in reference to online briefing, simulation sessions, and debriefing. Results indicated that the students have varied views on blended learning system. Their results, also, indicated that other factors such as emotional and affective should be taken into account while integrating blended learning into medical education.

Accordingly, in this study, the learning objectives for each subject, the environment to provide these objectives, the methods to be used and the reasons why these methods should be used were determined. The majority of the theoretical issues were provided online and the practical parts were performed face-to-face in the anatomy laboratory. Moreover, a video showing the instructor dissecting the cadaver was prepared for the anatomy laboratory course and presented to the students online.

#### ***Benefits of using blended learning in medical education***

Blended learning supports a wide range of learning models such as situated, relational, systematic, stimulative and constructivist learning that help increase

the quality of medical education (Woltering, Herrler, Spitzer, & Spreckelsen, 2009). According to Khogali, Davies, Donnan, Gray, Harden, McDonald, Pippard, Pringle, and Yu (2011), blended learning environments can be implemented successfully alongside the conventional learning methods in an existing medical curriculum. In addition, the online learning sources generated with cooperation among medical schools can be integrated into a local curriculum. However, attention should be paid to the pedagogy used, and not just the technology. This is because the expectations of students and the methods they use to benefit from the sources can be different (Beldarrain, 2006).

In the present study, the students were able to understand the subject better and repeat the points they could not catch through the online share of the camera shoots and 3D images taken in the laboratory. In addition, they were able to reach the instructor and ask questions online out of class hours. Furthermore, the online materials allowed the students to gain perspectives that would not normally be possible in a strictly face-to-face environment; for example, the microscopic organelles are enlarged online during the cadaver dissection and displayed with their working principles, which helps students understand the subject better than simply watching the dissection live in the classroom. Since all these studies will be archived, they can be recurrently used.

The use of blended learning environments in anatomy courses is not frequent in Turkey, except for web-based distance education in anatomy (Zihni, Turhan, & Çan, 2012) and online learning activities in cardiology training (Gürpınar, Zayım, Başarıcı, Gündüz, Asar, & Oğuz, 2009). In this regard, gathering and analyzing medical students' opinions on the blended learning environment prepared in the present study is of great importance for the further development and dissemination of these studies in the future.

### ***Studies in medical education***

In medical education, various studies dealing with blended learning have been carried out. Shaffer and Small (2004) found that students displayed a more positive attitude towards the blended learning method in radiologic anatomy compared to academicians. Moreover, Inwood and Ahmad (2005) stated that the use of full-motion video of the anatomy dissection software was easy and useful for students and improved the experiences of the students in the dissection classes.

According to Ribaupierre and Wilson (2012), the use of 3D images in anatomy education and according to Henkel (2010), the use of the interactive displays was perceived positively by the students. Moreover, Reynolds, McDonald and Sherriff (2011), when they compared the perceptions of the students in face-to-

face learning, online learning and blended learning methods, they found that the students developed more positive perception towards the blended teaching method than their perceptions of the other kinds of learning.

By examining the studies, it is clear that the use of blended learning has been increasing. In the literature, it was found that students generally developed positive perceptions towards the blended learning environments (Donnelly, 2010). On the other hand, Shahoumian, Parchoma, and Hanson (2014) found that no matter how well BLE is designed, factors such as emotional and affective issues might hinder the stability and flexibility of the blended learning. A study on the availability of the blended learning environment in solving the problems of face-to-face anatomy classes, such as the lack of materials and crowded lessons etc., would contribute to the literature.

### ***Purpose***

The anatomy course included in medical education at the undergraduate level is the very foundation of medical education and must be known in all the classes and fields of specialization. One of the best methods to learn human anatomy is to perform cadaver dissections. According to the instructors of the anatomy class, the number of students per cadaver in the cadaver dissection courses should be between 6 and 10 so that the course can be effective and efficient. This number could be increased to 20 depending on the operation. However, this number is 30 or more in the Medical Colleges of Turkey, due to the insufficient number of cadavers and academicians. Therefore, the students are not able to analyze the cadaver in detail and the teacher-student communication decreases. In addition, the students do not have the opportunity to repeat the cadaver laboratory.

Deveci, Ocak and Çolak (2012) argue that in solving the problems encountered in anatomy education, the use of online media along with face-to-face learning enables the students to have access to the materials at will, to plan and steer their own learning, to evaluate themselves and to increase the student-student and student-teacher communication through forums. Visuals and 3D materials increase the quality of anatomy education and attract the medical students' attention.

Hereby, the present study aims to put forward the perceptions of the students about the online course designed in line with the blended learning environment. To that end, a learning environment was created where cadaver dissection shoots and related 3-D images were used by the students during independent study hours. The students taking the anatomy class in this environment can ask questions to the instructor within

this online environment so that the students can further benefit from the cadaver training.

previous incarnations of the anatomy course with traditional methods.

## METHODS

### Context

The anatomy course is mandatory for first- and second-year students of the Faculty of Medicine at Kocaeli University. The number of students taking the anatomy course is 240. The students attend the cadaver laboratory course in one of four sections and there are approximately 60 students in each section. The number of cadavers used for the anatomy course is 1. There are 4 instructors for this course and the number of students per instructor is nearly three times above the average in Turkey. For comparison, in Turkey, while the number of students per instructor teaching the basic sciences in the faculties of medicine is 22.57 on average, the number of students per instructor teaching clinical sciences is 4.45 on average (Sayek, Odabaşı, & Kiper, 2010).

In medical education, students primarily see the theoretical part of the subject in a crowded amphitheater environment, after which students can take the cadaver training related to each subject only once. Lecturer explain the subject using the cadaver, parts of cadaver and models in anatomy lab. Students who cannot understand the course subject do not have the opportunity to repeat it in the laboratory. If the student does not attend the laboratory class, he/she must attend the make-up class and do a significant amount of advance preparation on his or her own. The students who are unable to answer the questions in the make-up class are not allowed to attend the practical exam. In the present study, the blended learning approach was used as balanced utilization of computer supported collaboration and communication tools (forum), self-paced learning tools/materials (website) and learning management systems (LMS) in conjunction with in-class teaching practices (Ocak, 2011).

### Participants

A focus group interview was performed with 15 students selected from 213 students in the second semester during the Academic Year of 2012-2013. Each group consisted of 5 students who got *high, medium and low* scores from the academic success test using the face-to-face technique. This sample was selected because the preliminary information level of the students was appropriate. Moreover, these students could comment on different learning environments since they had taken

### Data collection tool

A semi-structured interview form was designed in order to identify the opinions of the students. The related literature was reviewed while preparing the questions in the interview form and a pool of 15 questions was created. Yes/no questions were avoided and open ended questions asking participants to give detailed information were prepared. The form was given to 2 instructors working in the field and their opinions were solicited. The form was finalized in line with the experts' feedback. As a result of the necessary arrangements, the form was administered to a student group of 8 people outside of the working set. The questions were edited and the form was finalized in line with the pilot application results.

The interview questions used in the study are as follows:

- ✓ *What are the most positive aspects of this learning environment (blended learning method)? Why?*
- ✓ *What are the most negative aspects of the learning environment? Why?*
- ✓ *In what ways might the visuality of the learning environment have affected your learning? From which point(s) of view did the images of the cadaver in the website improve your learning?*
- ✓ *What are the problems you encounter when using the blended learning environment?*
- ✓ *Would you like to take courses using the blended learning method in the future? Why?*
- ✓ *What were your expectations for this course at the beginning of the semester and to what extend did the BLE meet them?*

### Research model

The subjects in the anatomy course are divided according to anatomical systems of the body. The online section of the anatomy course included the following:

- ✓ *The purpose of the course*
- ✓ *The user entry and user guide*
- ✓ *Lecturing (with images and animations)*
- ✓ *3D animations*
- ✓ *The movies on the cadaver dissection taken in the anatomy laboratory about the "Digestive System and Metabolism"*
- ✓ *The case discussion part (where the students can discuss the problems with each other or with the instructor)*
- ✓ *The contact page*

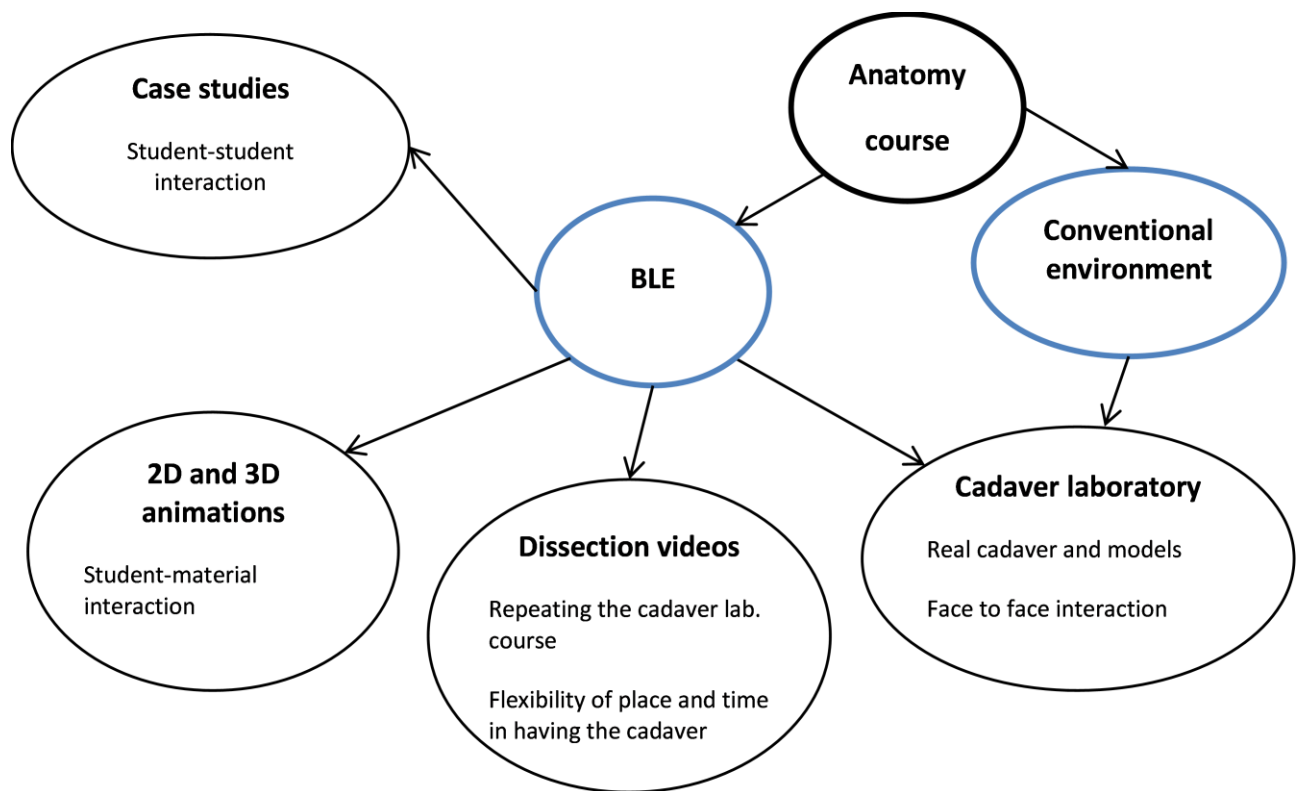


Figure 1. Research model

In the design of the online section of the course, Dreamweaver CS3, the PHP programming language, JavaScript and Fireworks CS3 for pictures were utilized. Case discussion questions were prepared by the lecturer. The online learning environment was designed entirely by the researchers. Students logged in to the online system where the user name, password, login date and time, and the addresses of pages visited were kept in the database.

The course subjects were designed based on the multi-media design principles of Mayer (2001). These principles are multimedia, spatial contiguity, temporal contiguity, coherence, modality, redundancy, and individual differences. The students can have an access to the system both on and off of the university campus. The course model prepared for the anatomy course is given in Figure 1.

The research includes some subjects stated in the "digestive system and metabolism" committee that takes 4 weeks. 7 hours of the 12 hour anatomy class were used for the face-to-face teaching and 5 hours were used for online teaching. Because of the course objectives, 5 hours of teaching were allocated to online section of the course. Also, in order to ensure that the students spent 5 hours in online system, the students' navigation log was recorded. Topics of digestive system and metabolism were carried out online and as follows:

- ✓ *Systema digestorium (digestive system)*
  - *Introduction*
  - *Gaster (stomach)*
  - *Instestium Tenue (small intestine)*
  - *Peritonum*
  - *Instestinum Crassum (large intestine)*
  - *Rektum and Canalis Analis*
  - *Uriner (urinary tract)*

Faculty members carried out the practical aspects (involving the cadavers, models and cadaver parts) with face-to-face learning in the anatomy laboratory. The study was carried out for 4 weeks. Figure 2 shows a subject with 2D animation that can be seen on the website; Figure 3 shows a subject model that has the images of the real cadaver items (ps) and Figure 4 shows the case studies that the students can discuss with each other or with the instructor of the course.

The videos where the instructor was lecturing in the e-learning environment were shot in the laboratory the students use for the cadaver dissection using real cadavers, organs and models. The 2D images seen on the website and the 3D animations provided through outsourcing were obtained from the Primal Pictures platform. Primal pictures 3D human anatomy software is the most complete, detailed and accurate 3D model of human anatomy (Primal pictures, 2014). The Primal Pictures platform was selected due to the quality of the pictures and 3D images and accessibility.





Figure 2. A subject example including a 2D animation on the website



Figure 3. A subject example with images of the real cadaver parts (ps) on the website



Figure 4. The case discussion part

**Table 1.** The Frequencies of the Positive and Negative Views of the Students about BLE

Variable	Positive		Negative		Total	
	F	%	F	%	F	%
Visuality	19	48,7	20	51,3	39	24,7
Content	23	67,6	11	32,4	34	21,5
Effective learning	19	90,5	2	9,5	21	13,3
Expectations from BLE	8	50	8	50	16	10,1
Accessibility	7	53,8	6	46,2	13	8,2
Motivation	6	46,2	7	53,8	13	8,2
New perspective for students	11	100	0	0	11	7
Continuity	10	90,9	1	9,1	11	7
<i>Total</i>	<i>103</i>	<i>65</i>	<i>55</i>	<i>35</i>	<i>158</i>	<i>100</i>

**Data analysis**

A focus group interview was administered and the participants' voices were recorded. The focus group interview is defined "a series of discussions planned carefully before in order to have a perception on a pre-determined subject in a moderate and non-threatening environment"(p.152) (Yıldırım & Simsek, 2008). In focus group interviews, the data is produced as a result of the interaction among participants. This feature is the distinctive aspect of the focus group interviews. From these interviews, the students' experiences, opinions, views, emotions, and satisfaction about blended learning environment were collected. The interview results were analyzed in the NVIVO program using the content analysis technique.

Conceptual coding was performed based on the data obtained from the students' views and 8 main themes emerged from the data analysis (visuality, content, effective learning, expectations from blended learning, accessibility, motivation, new perspective for the students, and continuity).

During the content analysis, the students' views were transferred to the data analysis software program (QSR Nvivo 10.0) and the similar data were divided into significant parts and the concepts obtained from the data were coded. In total, 8 codes were created. After the coding and categorization, the analysis was examined to check the distribution of the students' views to the codes and themes created and to recheck the consistency with the codes and themes.

In the presentation of the codes and themes, the students' views were given by using exact quotations from interviews. The statements of the students were written by assigning a number to each student (student 1= S1, student 2= S2, etc.). Finally, similarities and differences were presented from the findings.

**FINDINGS**

While presenting the findings, the examples from the categories with the highest frequency were included in order to state the common opinion. The positive and negative views of the students were divided into groups in terms of visuality, content, effective learning, expectations from blended learning, accessibility, motivation, new aspect for the students, and continuity.

Table 1 shows the frequencies of the positive and negative views of the students about BLE. Accordingly, it was found that the content (F=23) of the learning environment were beneficial; the environment made learning permanent and easy (F=19); it provided a different point of view to students (F=11); the students wanted to take some courses with BLE like histology (F=10); BLE met the expectations of the students in general (F=8); the access to the materials at will was important for the students (F=7); and it increased the motivation of the students (F=6). On the other hand, it was found that the content should be further increased and improved (F=11), the videos should be shot more closely and in further detail and there should be more videos (F=20) and the opportunities for communication with the instructor should be increased.

**Visuality**

24.7% of the codes show the views of the students on the visuality of the blended learning environment. 48.7% (F=19) positive and 51.3% (F=20) negative answers were found for visuality in the interviews (Figure 5).

In previous studies, student feedback regarding blended learning environment has been generally positive. Yang, Zhang and Bridges (2012) identified in a study performed in dentistry, visualizing teeth with blended learning environment and found that students perceived the learning environment positively and indicated that visualization of the learning materials was attractive. Similarly, Inwood and Ahmad (2005), in their

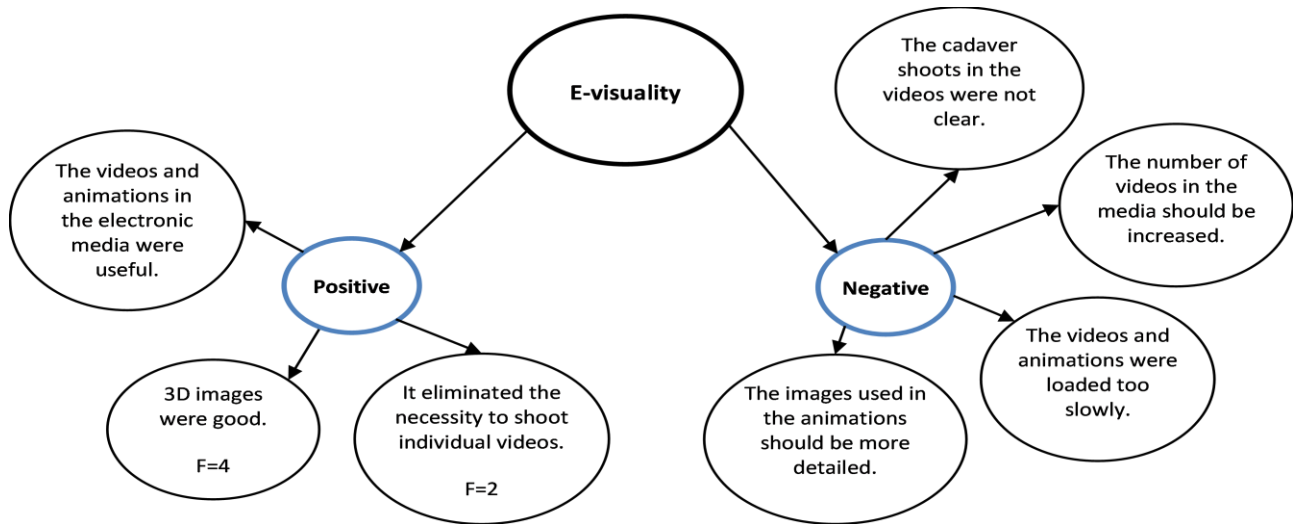


Figure 5. Views on the e-images included in BLE

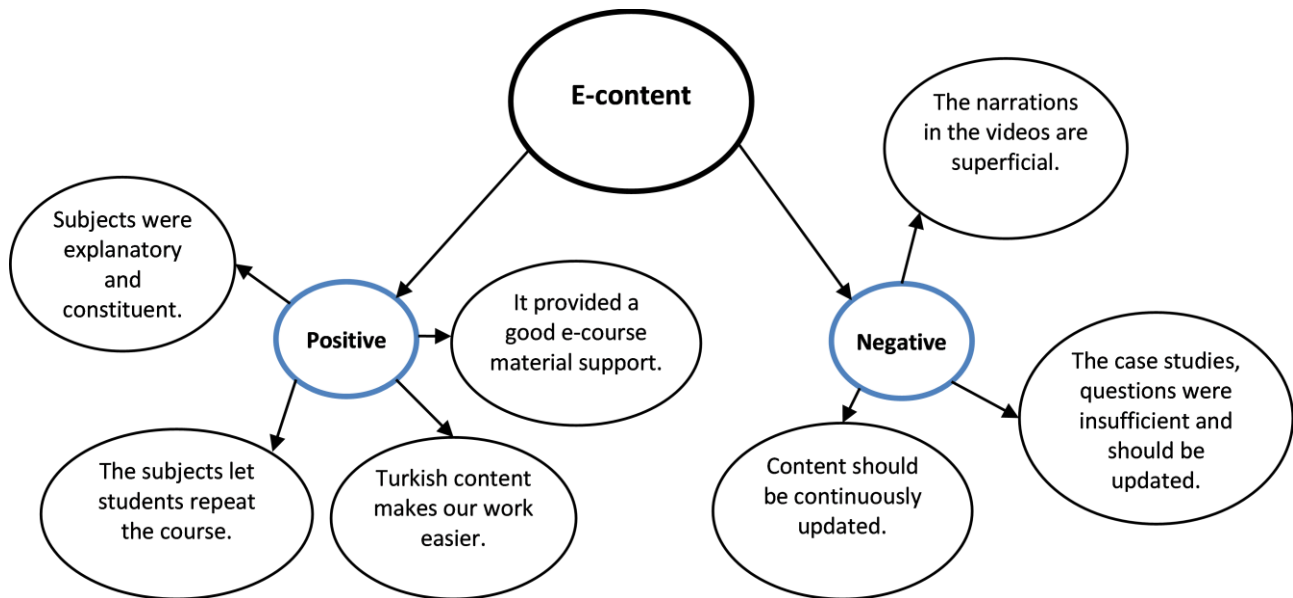


Figure 6. Views on the e-content of the blended learning environment

study, reported that students found dissection videos useful and indicated that this kind of experience enhanced their learning experiences. In the current study, much of the feedback about the visuality was also positive. The students' opinions indicated that the videos and animations in BLE were useful for them in general and it could be a solution to the problems of not being able to see the cadaver closely and not being able to listen to the instructor in a meaningful way due to the crowded laboratory atmosphere (F=13). Some examples of the positive views are as follows:

*I really like 3D animations and images. Especially, rotating the image and 3D images are really lasting in one's memory. That's why I like them. I like the notes on the images. For example, when we click on the image, a bubble including general information comes out and we could reach the*

*necessary theoretical information clicking on the bubble to have more detailed information. 3D was something that I really liked. I had the opportunity to see the real human structures rewinding and forwarding during the cadaver video. Therefore, we could see the structures on a real human cadaver rather than a model. (S10)*

Responses to the 3D images used were good (F=4) and it eliminated the necessity to shoot individual videos (F=2). Some of the answers related to 3D animations are as follows:

*Videos were good. One of my favorite features is that it directs you to another website that has 3D animations. It is an additional feature that it has 3Ds. (S6)*

*We take anatomy in order to know the human body. So, to see it on a cadaver rather than models is so useful and since*



*our laboratory time is limited and we are a crowded group, we do not have the opportunity to see everything closely. (S5)*

On the other hand, the students stated that the cadaver shoots in the videos were not clear and should be shot at a shorter distance (F=9) and the number of videos should be increased (F=6). The videos and animations loaded too slowly (F=3), and the photos used in the animations should be more detailed (F=2). Some of the students' negative views in terms of visuality are as follows:

*There were some problems in the videos. The cadaver was not clear. This was because of the shoot. The cadaver was put a little bit far away in the cadaver shooting. It was difficult to be focused. It was not shot at a short distance. (S2)*

*It was not so clear where the instructor was pointing out. (S5)*

*If there were videos for each subject that we discuss in the laboratory, I believe many people will benefit from that. (S13)*

*There were some deficiencies in the images. There should have been more detailed images that were more related to the topic in the pictures. The pictures were superficial. (S11)*

The students remarked that they found the visual materials in BLE good and useful, they liked the videos and it could be a solution to the problems of crowded atmosphere and shooting individual videos; however, they recommended that the videos be shot at a shorter distance and there should be a more detailed narration and more videos.

## Content

21.5% of the codes show the views of the students about the e-content of the blended learning environment. 67.6% (F=23) positive and 32.4% (F=11) negative answers were found for e-content in the interviews (Figure 6).

When the students' views on the content of BLE were analyzed, the students stated that the subjects were explanatory and constituent (F=10); the subjects let students repeat the course (F=9); there were no Turkish animations and videos for anatomy courses available elsewhere online, the inclusion of which made learning much easier for them (F=2), and it provided a good e-course material support (F=2). Some of the views are as follows:

*It was great to have a look at and repeat the courses again. (S5)*

*The texts summarize the subject. Just like the teacher's notes. They are well-stated and associated with clinics, etc. (S1)*

*For example, when we click on the image, a bubble including general information comes out and we could reach the necessary theoretical information clicking on the bubble to have more detailed information. It had intensive theoretical*

*information. No insufficiencies in the visual and theoretical part. (S10)*

*It is difficult to translate from English for a user. It is so good for us that it is in Turkish. (S1)*

However, the students stated that the video lecture was a bit superficial whereas the version delivered in the laboratory course was more detailed (F=6); the questions in the case studies in the forum were insufficient and should be updated (F=3) and the content also should be continuously updated (F=2). Some of the negative views are as follows:

*Video should have been more detailed. The theoretical information was not detailed. It was superficial. There was some incomplete information. (S11)*

*There could have been more detailed videos for practice. (S6)*

*The fixed content is the worst aspect of. It should have been updated. I saw the same whenever I entered the system. Especially, there were 5 questions in the case studies and they never changed. It would have made more sense if it had been a multiple-choice test. It would be better if there were some updates in questions and applications. Since our education is based on answering questions, if these questions are updated, like adding a question each day, that will increase the entry into the website. (S10)*

In general, it is possible to draw the conclusion that the content of BLE is beneficial for the students. In conjunction with this result, Khogali et al. (2011), in their study, reported that students found animation, video, and self-assessment sections more useful, but indicated that a discussion forum should be included in an online learning content. While some of these issues have been addressed in the current study, namely the inclusion of the case studies for discussion, students' comments indicate that the content remains too stagnant for their liking.

## Effective learning environment

13.3% of the codes show the views of the students on the effect of the blended learning environment. 90.5% (F=19) positive and 9.5% (F=2) negative answers were identified in the interview (Figure 7).

When the findings on the effective learning of BLE were analyzed, students stated that the images made learning long-lasting (F=7); made learning easy for the students (F=7); and helped the students get prepared before the class (F=2). Some of the views are as follows:

*The cadaver images had an additional contribution in my learning. There was something that stuck in the mind. I think it is useful. Especially, rotating the image and 3D images is really long-lasting. (S10)*

*I have watched it from the video. It made my learning memorable. The videos had an influence on my learning. (S9)*

*I was looking at there before studying the laboratory. I outlined the subject in my mind. It stuck in my mind. Then*

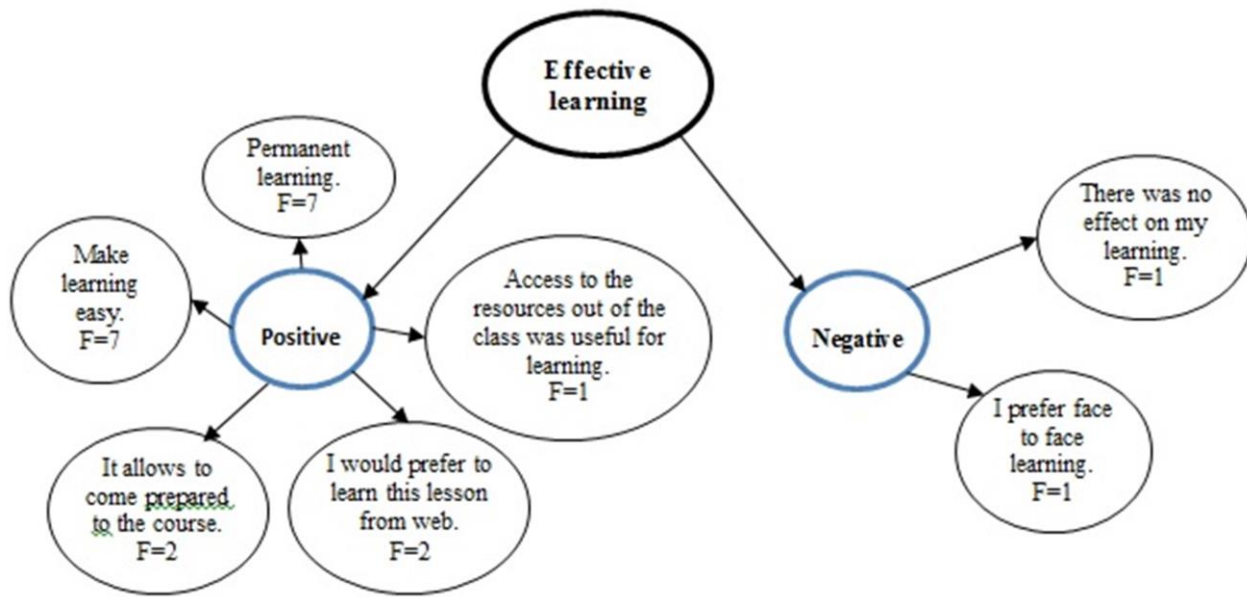


Figure 7. Views on the effects on studying in BLE

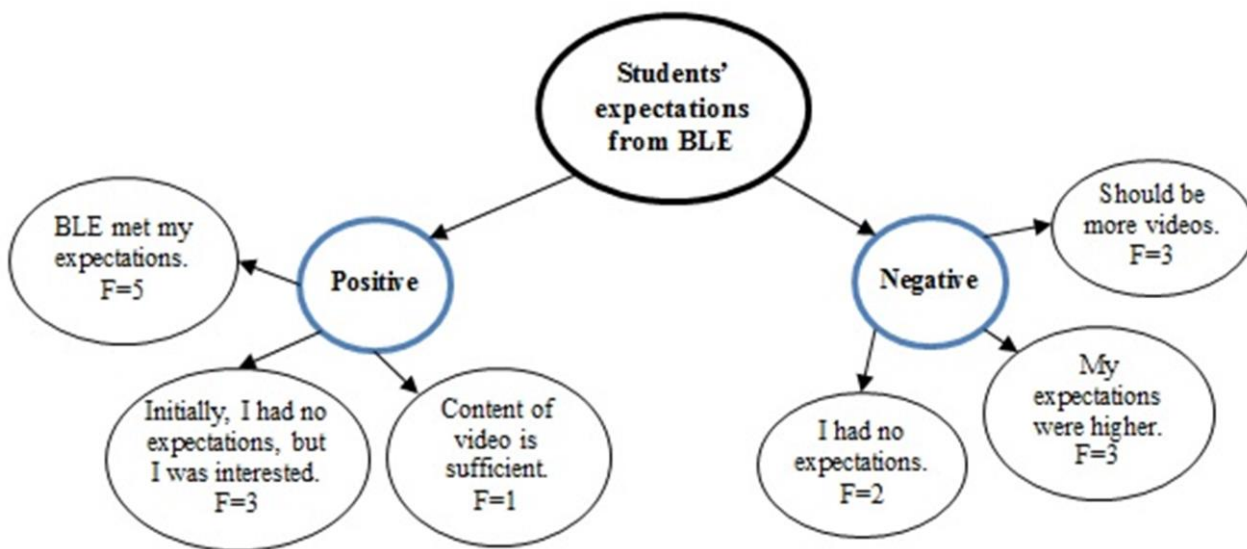


Figure 8. The students' expectations from BLE

*I was studying for the laboratory. It was useful for me for that reason. (S11)*

The students preferred learning the course online since the crowded setting decreased the laboratory's effectiveness (F=2) and access to the resources out of the class was useful for their learning (F=1).

*It was like a course for us. It is like we are taking a class for 1 or 2 more hours at home. From this point, it was very useful. (S2)*

Regarding the negative responses, one of the students said that it did not have any influence on learning, while another one said that he/she preferred

face-to-face learning. One of the negative views is as follows:

*I am more like a person who likes to use paper, pen and blackboard. I want to feel what I do under my control. These are of course visual courses but many people are studying them not by just looking at them. They use papers and pencils. I would prefer paper and pen and concrete materials rather than virtual environments. (S1)*

Prior research predicted largely positive responses regarding the effectiveness of the blended learning environment. Ribaupiere and Wilson (2012) and Nicholson, Chalk, Funnell, and Daniel (2006) reported that with the 3D images, students have a better

understanding of the relationships among anatomical structures and 3D images increase student achievement. Also, Inwood and Ahmad (2005) stated that the dissection videos promote students' learning. The present study supports the idea of effective learning environment that blended courses bring different learning approaches; however, it also reiterates that there will always be some students who significantly prefer a physical learning environment over a virtual one.

### Expectations from the blended learning environment

10.1% of the codes show the views of the students on the expectations from the blended learning environment. 50% (F=8) of the expectations codes are positive and 50% (F=8) of the codes are negative (Figure 8).

When the students' answers were analyzed, it was found that some of the students stated the blended learning environment met their expectations (F=5), although they did not have any expectations at first when introduced to the learning environment. One of the most important expectations seemed to be that the online sources would support their current classroom anatomy education. The students mostly engaged with videos. Flexibility and the rewind feature of the videos attracted the students. However, lack of awareness toward online learning contributed to a low positive expectation level.

*At first, I did not have any expectations. I cannot say I took it so seriously. But when I first took it, I was really impressed and liked it. Well, I accept that I do not study enough but this website is one of the most important factors in my success. There was something that stuck in the mind. I think it is useful for me. (S10)*

*I wish there were more videos. It met a significant part of my expectations. That would be great to have such a resource at our hands. It may be a good resource not just for our faculty but for other faculties as well. (S11)*

Additionally, the environment attracted their attention (F=3) and the content of the videos was sufficient (F=1).

*I was expecting something simpler from a pilot application. But the website was better than I expected. Overall, it was beyond my expectations. (S5)*

*Anatomy is based on memorization and it is a difficult course for me. In fact, many of the medical courses are like that. I did not have any expectations from the instructors or courses. I liked this system. I was pleased when I saw it. I used it. And I like it. I hope it continues. (S9)*

*Video content was enough. (S4)*

On the other hand, some of the students stated their expectations were higher (F=3); and two students said

they did not have any expectations (F=2) and there should be more videos (F=3).

*I had higher expectations. I wish the animations had been more realistic and vivid. (S11)*

*I had more expectations for videos. But since we could not see the videos clearly, it did not meet my expectations for that point. Overall, it was beyond my expectations. (S5)*

*I expected it to be more detailed. The texts do not make so much sense for us. I would use it if it were more useful. (S7)*

*I wish there would more videos. (S11)*

It is possible to conclude that blended anatomy course meets the expectations of the students and attracts their attention in general, particularly when considering that many students had no expectations at all prior to engaging in this course. In a similar study with blended learning, Paechter, Majer and Macher (2010) indicated that students expressed that they found a better learning environment compared to the characteristics of other courses. The blended course provided more flexibility in the choice of learning strategies and met expectations as to gaining knowledge about the subject, internet usage skills, and knowledge sharing with peers.

### Accessibility

8.2% of the codes indicate the views of the students on the accessibility to the blended learning environment. 53.8% (F=7) positive and 46.2% (F=6) negative answers were found on the accessibility issue (Figure 9).

The students stated that it was good for them to have direct access to the sources when they need them regardless of place and time (F=7); on the other hand, not all the students had internet connection (F=3). Some of the students' positive views are as follows:

*It is good to have easy access. "That was really great to have a look at and repeat the courses again. (S5)*

*It is good that it is always accessible. (S7)*

They also stated that the website should be accessible on the website of the faculty (F=1); the website should be open to anybody (F=1) and it should be even accessible on the search engines (F=1). Some of the students' negative views are as follows:

*Some people have internet access but some people do not. I have these facilities but not all the people may have them. It is a problem not being able to reach it through a search engine. There should be a direct connection on the website of the school or the faculty. And the password should be removed. The website should be open to everybody. I think even non-affiliated people should be able to see the website. (S1)*

*I stay at a dormitory. I could not use it since we do not have internet connection at the dormitory. And I could not try it since I am not attending the school regularly. (S13)*

That the majority of the responses to this aspect of the blended learning environment were positive has

been foreshadowed in previous studies. Potomkova, Mihal and Cihalik (2006), in a literature review study, identified that students, because of the reasons such as accessibility, ease of use, freedom of navigation and high medical image quality, preferred a web-based tutorials more than the traditional methods. The present study also argues that it is beneficial for the students to have direct access to the sources when they need them regardless of place and time, as it allows the students greater autonomy in directing their own learning.

**Motivation**

8.2% of the codes indicate the views of the students on motivation for the blended learning. 46.2% (F=6) of the codes are positive and 53.8% (F=7) of the codes are negative (Figure 10).

On reviewing the students' comments, many students stated that they liked the blended anatomy course (F=3); the case studies in the forums were useful (F=2); and that the blended environment reduced the monotony (F=1). Some of students' views are as

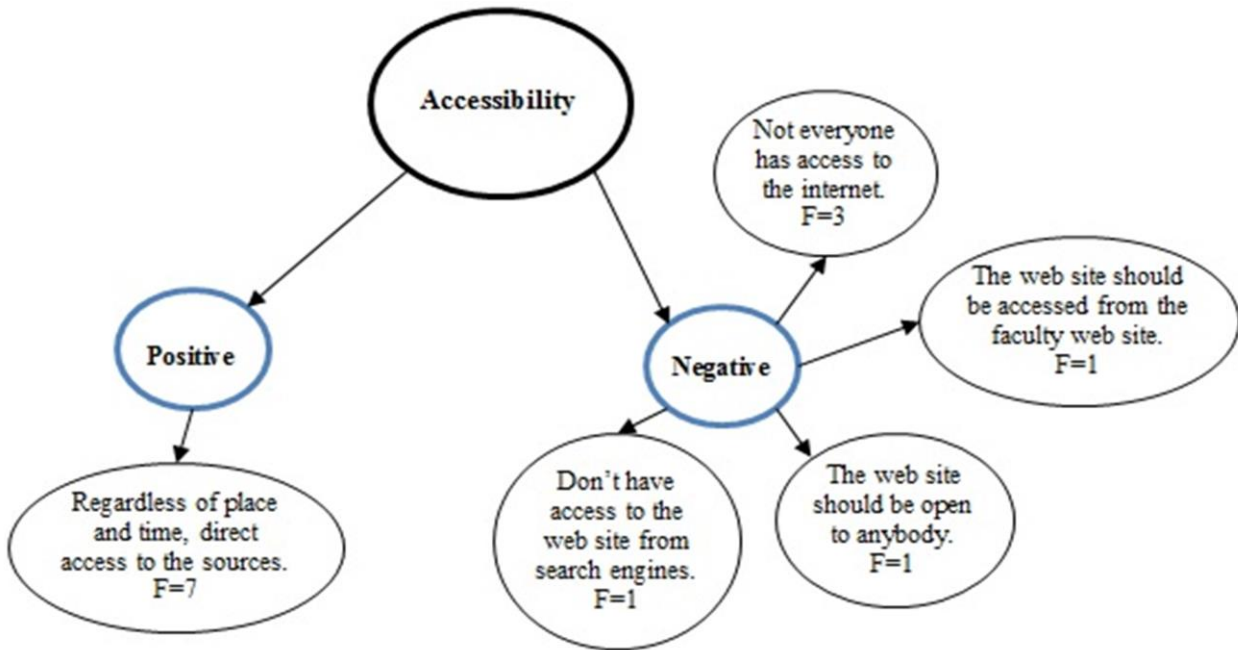


Figure 9. Views on the accessibility to the BLE

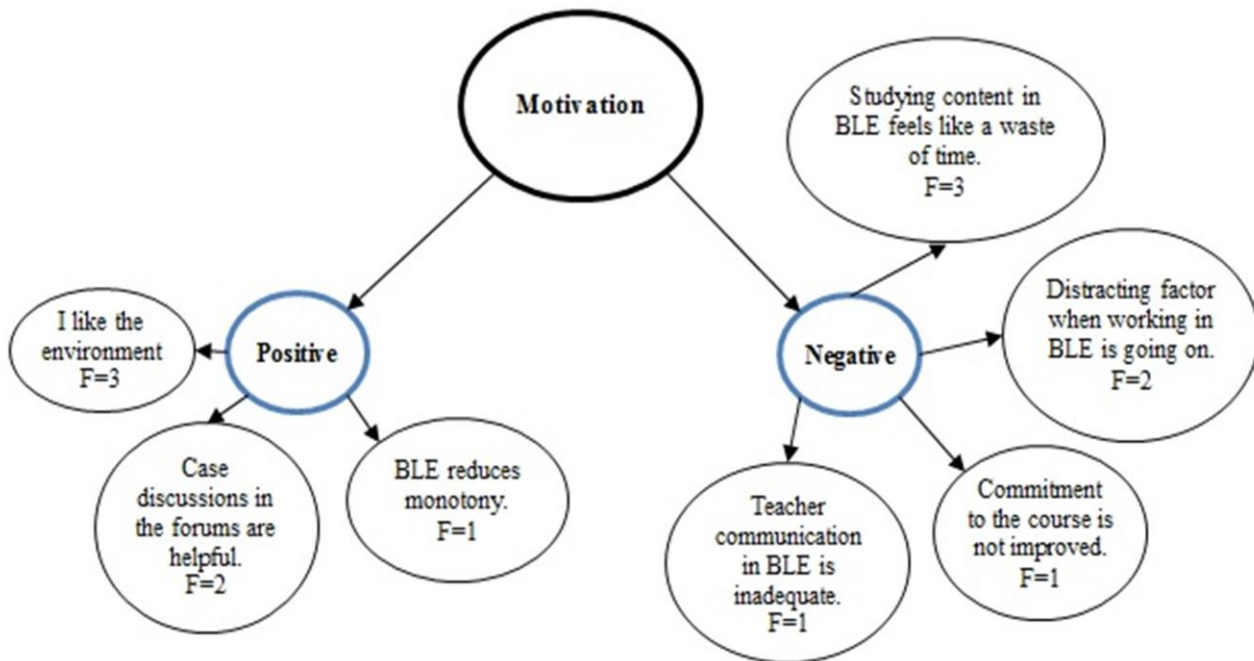


Figure 10. Views of the students on motivation in BLE



follows:

*That would be great for repeating. The course subjects are just like the teacher's notes. They are well-stated and associated with clinics, etc. That's good for us. (S1)*

*It is good for satisfaction. That would be great if the deficiencies were removed and the system was opened to everybody. I wish it would have the neuro-anatomy subjects. The case study subjects were good. (S2)*

*I think case study discussion was the most important part. We will become doctors. It is good that the course notes are supported with case studies. I understand why I learn a subject thanks to the case study discussions. Actually, it is a very useful part. That would be great to discuss over a forum. The bubble that comes to the screen when we click is good. It saves us from being monotonous. It is fun. (S9)*

On the other hand, some responses indicated that studying the content of the blended course was like a waste of time (F=3); and there were distractions while studying in BLE (F=2).

*We already hear them at school and then read them in the books. There is nothing that attracts us additionally. Except the 3D. (S10)*

*But when I am on the web, both the system and Facebook are open. I am chatting down there. And the news is on the other side. I want to see the face of a person when he/she makes a joke. I do not think there will be communication. (S2)*

In addition, they had insufficient communication with the instructor in BLE (F=1) and having a sense of belonging towards the lesson was no longer available (F=1).

*When I am on the computer alone, I cannot be connected (concentrating) since there are a lot of distractions (like chat websites) other than the website I am on. For example, I am lying down after a while. We are more comfortable in such an environment; we do not have any responsibility, so I am easily distracted. (S5)*

According to earlier studies conducted by Boudinot and Bradley (2001) and Woltering et al. (2009), the use of blended learning in medical education increase students' motivation, satisfaction and the level of learning achievements. Similarly, the present study found that the blended learning environment increased the motivation for many of the students; however, the distractions to which a blended learning environment is vulnerable was a major hindrance for many students' motivation.

### **New perspective for the students**

7% of the codes show the views of the students on the blended learning environment as a new learning

approach. 11 positive answers were found in the interview (Figure 11).

When the views of the students were analyzed; it was found that the students stated the learning environment was a useful and different application (F=5); the use of images in learning was appealing (F=2) and the images were good quality (F=2), and it is an opportunity that they could take the course at home (F=2). Some of the positive views are as follows:

*In general, it is good. It is good to practice like that. (S3)*

*It is really good to combine theoretical and practical information. (S5)*

*I find it useful in terms of images. An image is an image. We may not understand what we read. Some of them are the things that we have never seen in our lives before. We see something that many people cannot even imagine. It is advantageous to have such images. (S1)*

*It is good that have videos and 3Ds. (S11)*

*It would be better to take them online if we did not come to the laboratory. (S7)*

Prior studies have also examined student reactions to new and innovative ways of learning. In a study by Heinze and Procter (2004), students stated that blended learning is a good support and resource for themselves, it is suitable for different types of learning, it provides flexibility and reduces the necessity of attendance. In general, the students in the present study implied that the blended learning environment was a functional and versatile environment. BLE allowed the students to study with images and to have access to these images wherever they wanted.

### **Continuity**

7% of the codes show the views of the students on taking another course in the blended learning environment. 90.9% (F=10) positive and 9.1% (F=1) negative answers were found regarding continuity with blended anatomy class (Figure 12).

When the answers of the students were analyzed, the students stated they would like to take histology (F=8), embryology (F=1), pathology and microbiology (F=1) courses with the BLE and one of the students said BLE was unnecessary for other courses except anatomy and histology. Some of the positive views are as follows:

*In my opinion, it would be so helpful to use the tissues, lam and lamella chain that we discuss in histology online in terms of visuality. (S1)*

*We would like to take such classes if they were in detail. I would like to take them in anatomy and histology courses. This is because there are no images in other courses. (S7)*

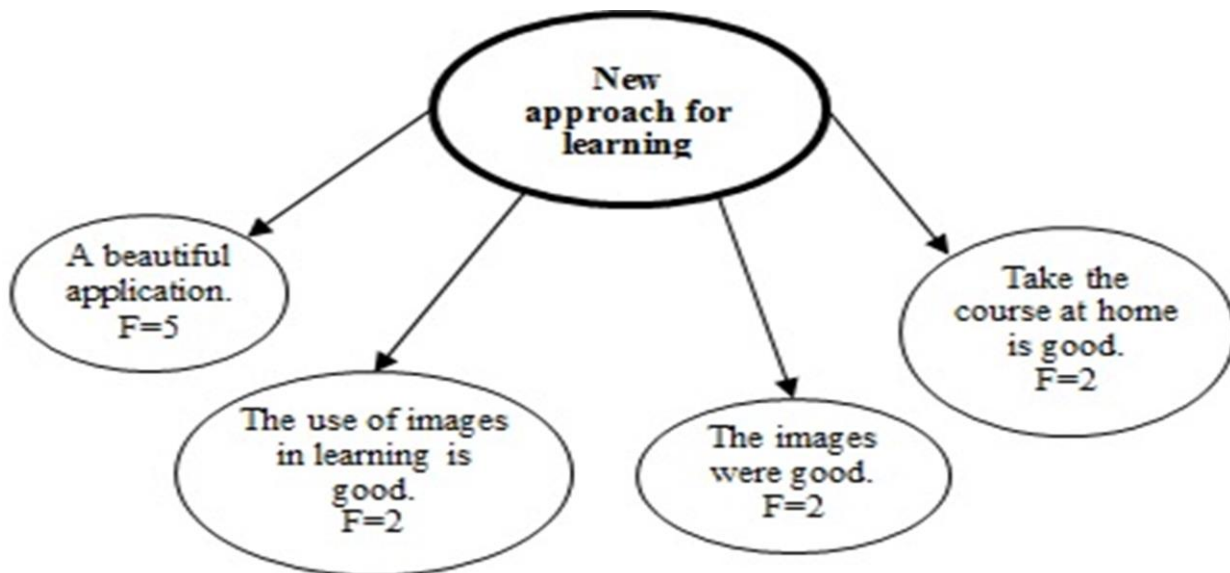


Figure 11. Views of the students as a new learning approach

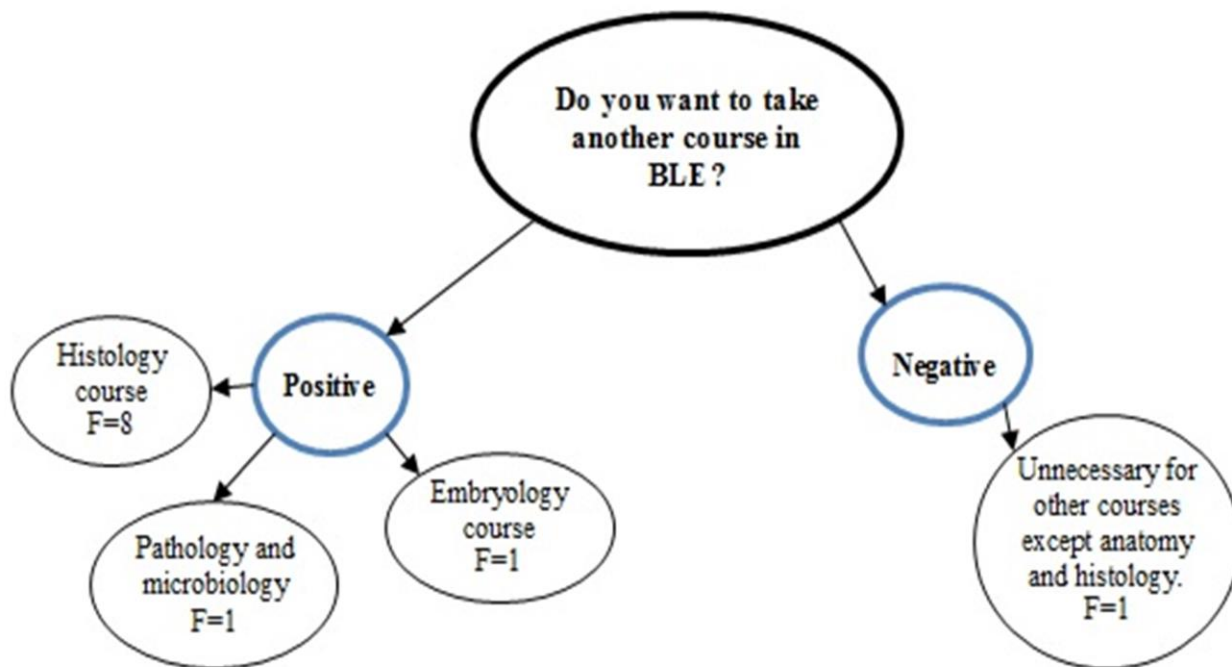


Figure 12. Students' views on taking another course with BLE

*I would like to take embryology. This is because the course subjects have a 3D structure. It could be supported by especially 3D animations since it talks about the cell development. (S10)*

*It would be helpful since it is a different source. I would like to take it. It can be done in pathology as well. Microbiology is possible. (S11)*

Some of the students' negative views are as follows:

*It does not make any sense to me for theoretical courses other than anatomy and histology to be given in this environment. (S1)*

Following anatomy, histology is the course that most students identified as a desirable candidate for a blended

learning environment. Khalil, Kirkley and Kibble (2013), in their work for an interactive electronic laboratory manual of histology course, found that the blended environment provided to students facilitated active and collaborative learning and reinforced learning in the classroom environment, and that students were able to monitor their own learning. Upon examining additional research, it was revealed that blended learning method has been implemented in subjects such as dentistry (Bains, Reynolds, McDonald, & Sherriff, 2011; Yang, Zhang, & Bridges, 2012), dermatology (Silva, Souza, Filho, Medeiros, & Criado, 2011), cardiovascular system

(Khogali et al., 2011) and showed that good results were obtained.

## DISCUSSION AND CONCLUSION

The purpose of this study was to put forward the perceptions of the students about the online course designed in line with the precepts of a blended learning environment. We obtained 8 themes regarding teaching an anatomy course with the blended approach. Subsequently, the students' views were classified in 8 dimensions. The results of the study showed that the visual elements of the blended learning environment were useful and convenient and provided a novel learning approach. Students also indicated that they would like to take other courses with BLE, the environment met their expectations, it was important to have access to 2D and 3D materials, and their motivation was increased. The students also stated that the content should be further increased and improved, that the videos should be shot more closely and in further detail, that there should be a greater quantity of videos, and that the communication with the instructor should be increased.

Given the studies (Zihni, Turhan, & Çan, 2012; Gürpınar, Zayım, Başarıcı, Gündüz, Asar, & Oğuz, 2009), instead of examining factors (access, motivation, materials etc.) together, the literature shows the factors directly focusing on blended anatomy education are analyzed individually. For example, in the blended problem-based learning study by Woltering et al. (2009), access and motivation issues are found to be discussed in detail. The students defined the environment as realistic, explanatory and practical and stated that remembering the diseases became easier. The results showed that the learning environment increased students' motivation, helped them learn more systematically and students could reach the sources at their will. When the other studies are analyzed (Khogali et al., 2011; Petersson, Sinkvist, Wang and Smedb, 2009; Schmidt et al., 2011), the students specified that they found the blended learning sources valuable and entertaining; blended sources provided students the opportunity of interaction and various learning opportunities; a great majority of the students were happy and wanted the blended approach to be more widespread; the students could access blended learning environment wherever and whenever they wanted at their own speed; and the students could learn in a cooperative way with their friends as the advantageous of the blended learning environment. Moreover, Bains et al. (2011), in their study on the comparison of face to face learning, online learning and blended learning environments, found that the most positive approach the students displayed was for blended learning. The present study also indicates that students find the

blended learning environment more positive compared to the course books. However, not being able to touch the cadaver and see each detail in the cadaver dissection is a disadvantage (Petersson, Sinkvist, Wang and Smedb, 2009), and the online resources should not be used as a replacement for the conventional courses led by instructors (Schmidt, Reinehr, Leucht, Behrendt, Geiler, and Britsch, 2011). On the other hand, in a different study it was determined that students' social perception is negative for blended learning because they are not yet accustomed to using technology in education (Makhdoom, Khoshhal, Algaidi, Heissam, & Zolaly, 2013).

In conclusion, this study tried to present a blended learning approach in the anatomy class. The medical students' responses to questions about different aspects of the blended anatomy course resulted in classification of eight categories. In this regard, researching the integration and use of the blended learning environment in medical education in different ways and for different time periods seems an important issue. In the present study, the blended learning environment prepared for the anatomy class provided Turkish web material support to students (video, animations, etc.), a tool which otherwise would have been unavailable anywhere else online. The participants had the opportunity to reuse the materials whenever and wherever they wanted, communicated with the instructor outside of the class hours and analyzed the human body in 3D with the animations used. BLE was perceived as a factor that supports the learning by the students. However, the students required convincing about the benefits of the environment and they needed to be guided and led in using the environment. Similar studies that include larger student groups and different courses as well as using qualitative and quantitative methods together can be performed for foundational courses in medical education in the future. The opinions and satisfaction levels of the instructors using the blended learning environment on the environment could be also examined, so as to more fully optimize the potential benefits of new education technology.

## REFERENCES

- Arman, C., Cankur, N. Ş., Çelik, H.H, Ersoy, M., İçke, Ç., Kopuz, C., Özbek, A., & Pınar Atamaz, Y. (2002). *Anatomy Education Working Group, First Period Interm Report*. Sivas, Turkey: Anatomy Association.
- Bains, M., Reynolds, P.A., McDonald, F., & Sherriff, M. (2011). Effectiveness and acceptability of face-to-face, blended and e-Learning: A randomised trial of orthodontic undergraduates. *European Journal of Dental Education*, 15, 110-117. doi:10.1111/j.1600-0579.2010.00651.x.

- Beldarrain, Y. (2006). Distance Education Trends: Integrating new technologies to foster student interaction and collaboration. *Distance Education*, 27(2), 139-153. doi: 10.1080/01587910600789498.
- Boudinot, S.G., & Bradley, B.C. (2001). Online Anatomy Lab (OAL): A Self-Regulated Approach to the Instruction of Human Anatomy. *Interactive Multimedia Electronic Journal of Computer Enhanced Learning*, 3(1), 10. (<http://imej.wfu.edu/articles/2001/1/01/index.asp>)
- Deveci Topal, A., Ocak, M.A., & Çolak, T. (2012). *Student Opinions About to Blended Learning Environment that Prepared for Anatomy Lesson*. 9. Turkish Medical Informatics Conference, Antalya, Turkey.
- Donnelly, R. (2010). Harmonizing technology with interaction in blended problem-based learning. *Computers & Education*, 54, 350–359. doi:10.1016/j.compedu.2009.08.012.
- Graham, C. R. (2006). Blended Learning Systems: Definition, Current Trends, and Future Directions. In C. J. Bonk & C. R. Graham (Ed.), *The Handbook of Blended Learning: Global Perspectives, Local Designs* (pp. 3–21). San Francisco, USA: Pfeiffer Publishing.
- Gürpınar, E., Zayim, N., Başarıcı, İ., Gündüz, F., Asar, M., & Oğuz, İ. (2009). E-learning and problem based learning integration in cardiology education. *Journal of Anatolian Cardiology*, 9, 158-64.
- Heinze, A., & Procter, C. (2004). Reflections on the use of blended learning. *Education in a Changing Environment Conference Proceedings*. Manchester, England.
- Inwood, M. J., & Ahmad, J. (2005). Development of Instructional, Interactive, Multimedia Anatomy Dissection Software: A Student-Led Initiative. *Clinical Anatomy*, 18, 613–617. doi: 10.1002/ca.20140.
- Khalil, M.K., Kirkley, D.L., & Kibble, J.D. (2013). Development and evaluation of an interactive electronic laboratory manual for cooperative learning of medical histology. *Anatomical Science Education*, 6(5), 342-350. doi: 10.1002/ase.1350.
- Khogali, S.E.O., Davies, D.A., Donnan, P.T., Gray, A., Harden, R.M., McDonald, J., Pippard, M.J., Pringle, S.D., & Yu, N. (2011). Integration of E-Learning Resources into a Medical School Curriculum. *Medical Teacher*, 33, 311–318. doi: 10.3109/0142159X.
- Kocaeli University, Faculty of Medicine, Department of Anatomy (2011). Anatomy. Retrieved from <http://tip.kocaeli.edu.tr/index.php?id=34>.
- Makhdoom, N., Khoshhal, K.I., Algaidi, S., Heissam, K., & Zolaly, M.A. (2013). Blended learning' as an effective teaching and learning strategy in clinical medicine: a comparative cross-sectional university-based study. *Journal of Taibah University Medical Sciences*, 8(1), 12-17.
- Mayer (2001). *Multimedia Learning*. Cambridge University Press.
- Nicholson, D.T., Chalk, C., Funnell, R.J., & Daniel, S.J. (2006). Can virtual reality improve anatomy education? A randomised controlled study of a computer-generated three-dimensional anatomical ear model. *Medical Education*, 40, 1081–1087. doi: 10.1111/j.1365-2292.2006.02611.x.
- Ocak, M.A. (2011). Why are faculty members not teaching blended courses? Insights from faculty members. *Computers & Education*, 56, 689-699. doi:10.1016/j.compedu.2010.10.011
- Paechter, M., Maier, B., & Macher, D. (2010). Students' expectations of, and experiences in e-learning: Their relation to learning achievements and course satisfaction. *Computers & Education*, 54, 222–229. doi:10.1016/j.compedu.2009.08.005.
- Petersson, H., Sinkvist, D., Wang, C., & Smedby, Ö. (2009). Web-Based Interactive 3D Visualization as a Tool for Improved Anatomy Learning. *Anatomical Sciences Education*, 2, 61-68. doi: 10.1002/ase.76.
- Potomkova, J., Mihal, V., & Cihalik, C.(2006).Web-based instruction and its impact on the learning activity of medical students: a review. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub*, 150(2), 357-61. doi: 10.5507/bp.2006.055
- Primal pictures, (2014). *Primal pictures 3D human anatomy medical software*. Retrieved from <http://www.primalpictures.com>.
- Ribaupierre, S., & Wilson, T.D. (2012). Construction of a 3-d Anatomical Model for Teaching Temporal Lobectomy. *Computers in Biology and Medicine*, 42, 692–696. doi: 10.1016/j.complbiomed.2012.03.005.
- Sayek, İ., Odabaşı, O., & Kiper, N. (2010). *Turkish Medical Association Undergraduate Medical Education Report*. Ankara, Turkey: Turkish Medical Association Publications.
- Schmidt, C., Reinehr, M., Leucht, O.,Behrendt, N., Geiler, S., & Britsch, S. (2011). MyMiCROscope-Intelligent Virtual Microscopy in a Blended Learning Model at Ulm University. *Annals of Anatomy*, 193(5), 395-402. doi: 10.1016/j.aanat.2011.04.009.
- Shaffer, K., & Small J.E. (2004). Blended learning in medical education: use of an integrated approach with web-based small group modules and didactic instruction for teaching radiologic anatomy. *Academic Radiology*, 11(9), 1059-1070. doi: 0.1016/j.acra.2004.05.018.
- Shahoumian, A., Parchoma, G., & Hanson, J. (2014).Blended Simulation Based Medical Education: A Durable Network for Learning? Proceedings of the 9th International Conference on Networked Learning. Retrieved from <http://www.networkedlearningconference.org.uk/abstracts/pdf/shahoumian.pdf>
- Silva C.S., Souza M.B., Filho R.S.S., Medeiros L.M., & Criado P.R. (2011). E-learning program for medical students in dermatology. *Clinics*, 66(4), 619-622. doi: 10.1590/S1807-59322011000400016.
- The American Heritage Dictionary of the English Language (2014). Fifth Edition, Houghton Mifflin Harcourt Publishing Company
- Ward, J., Gordon, J., Field, M.J., & Lehmann, H.P. (2001). Communication and information technology in medical education. *The Lancet*, 357, 1452. doi: 10.1016/S0140-6736(00)04173-8
- Woltering, V., Herrler, A., Spitzer, K., & Spreckelsen, C. (2009). Blended learning positively affects students' satisfaction and the role of the tutor in the problem-based learning process: results of a mixed-method



- evaluation. *Advances in Health Sciences Education*, 14(5), 725-738. doi: 10.1007/s10459-009-9154-6.
- Yang, Y., Zhang, L., & Bridges, S. (2012). Blended learning in dentistry: 3-D resources for inquiry-based learning. *Knowledge Management & E-Learning: An International Journal*, 4(2), 217-230.
- Yıldırım, A., & Şimşek, H. (2008). *Qualitative Research Methods in Social Sciences*. Ankara, Turkey: Seçkin Publications.
- Zihni, N.B., Turhan, K., & Çan, M.A. (2012). Implementation of web-based distance learning in medical education and to evaluate the effect on student achievement, 9. *Turkish Medical Informatics Conference*, Antalya.

