

Effectiveness of Blended Cooperative Learning Environment in Biology Teaching: Classroom Community Sense, Academic Achievement and Satisfaction

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Abstract

The aim of this study was to examine the effect of Blended Cooperative Learning Environment (BCLE) in biology teaching on students' classroom community sense, their academic achievement and on their levels of satisfaction. In the study, quantitative and qualitative research methods were used together. The study was carried out with 30 students in 2012-2013 academic year and with 31 students in 2013-2014 academic year taking the course of "Seed Plants Systematics" in the Department of Biology Education in a state university in Turkey. The results obtained revealed that the students' classroom community sense developed and that they had a high level of academic achievement and satisfaction. The results were discussed considering the literature, and related suggestions were put forward.

Keywords: blended learning, cooperative learning, innovative learning environment, moodle, new generation learners

1. Introduction

Today, as a result of the rapid changes in technology, there are several differences between the course materials used in the past and those used today. The first of these differences is the change in the roles of teachers and students followed by the physical changes in classrooms and schools. In the 21st century, the blackboard used in the past has been replaced by the smart board, the projector and portable computers. The changes and differences between the past and the present have moved from the educational approach in which information is regarded as an object transferred from the teacher to the student towards the educational approach in which students structure the information together under the guidance of the teacher (Elmas, Demirdöğen & Geban, 2012; Keser, 2005).

Ng (2012) named the generation growing with technology as "net generation". It was also claimed that new generation can use different learning strategies compared to previous generations. Malita & Martin (2010) point out that students of new generation are willing to use social media and mobile apps in the courses and make internet projects involving multi-media tools. Today, there are increasing national attempts to organize the learning environments in a way to meet the needs of this new generation (El-Deghaidy & Nouby, 2008). In Turkey, FATİH Project (Movement of Increasing Opportunities and Improving Technology) can be given as an example for this. Within the scope of this project, all classrooms are being equipped with a smart board, projector and cable internet connection; all teachers and students are being given a tablet pc; and the project is planned to be finished in a period of five years. With this project, 40 thousands of schools and 620 thousands of classrooms will be provided with information technologies, and the necessary trainings for effective use of these technologies will be given (MEB, 2011).

As can be seen, instructional strategies based only on in-class activities are not appropriate to the new generation any longer (Perez-Marin, SantaCruz & Gomez, 2012). Today, people can learn in different ways like participating in online discussions, searching the related websites, reflecting via their blogs and listening to podcasts. It is also reported that it is becoming more and more difficult for teachers to discriminate between face-to-face and online methods of instruction; that they will use both together; and that it would be wrong to call a classroom online and the other offline (So & Bonk, 2010). The fact that one of these methods overlaps the other reminds of blended learning.

1.1 Blended Learning

Studies revealed that activities carried out via the internet do not satisfy students alone and that there are certain deficiencies. Especially, the lack of face-to-face interaction is emphasized (Bonk & Graham, 2005). Blended learning

approach, which aims at combining the advantages of both face-to-face learning and online learning environments, has gained great importance in recent years.

Blended learning is the combination of the strong advantageous sides of web-based learning and face-to-face learning (Horton, 2002; Osguthorpe & Graham, 2003). Garnham and Kaleta (2002) defines blended learning as a learning environment in which an important part of learning activities is transferred into an online environment and in which the time spent in classroom is decreased.

Those using the blended learning approach base their choice on the following assumption: there are a lot of benefits of online learning besides the benefits of face-to-face interaction between student-student and student-teacher. In blended learning, the purpose is to establish a balance between online learning and face-to-face learning. The balance between face-to-face learning and online learning changes depending on the course. Due to basic characteristics of certain courses, face-to-face learning can be more popular, while in some other courses, online learning is used more. Still in another course, both methods of instruction can be used equally (Osguthorpe & Graham, 2003). There should be a clear relationship between the methods used in blended learning. The lesson should not look like different activities gathered by force. Different methods applied should complement one another. For instance, theoretical aspects in a lesson can be presented on face-to-face basis, and visual aspects can be taught online (Preceel, Alkalai & Alberton, 2009; Silwerwood, 2007).

Moskal, Dzibuan & Hartman (2013) states that blended learning has several advantages such as decreasing the work load of faculty members, pioneering courses have an advanced design, effective participation of students and rich learning outcomes. Besides all, it is also reported that communication and interaction between students themselves and with the teacher increase as well (Joliffe, Ritter & Stevens, 2001).

American Society for Training and Development defined blended learning as one of the top ten trends in the knowledge delivery industry (Rooney, 2003; cited in Graham, 2006). Young (2002) states that the blended learning model is the best and unique trend ever in higher education and that blended courses given in higher education will constitute 80-90% of all in near future.

El-Deghaidy & Nouby (2008) point out that in determining the effectiveness of blended learning, learning contents provided only in online learning environment cause no difference in learning. They add that the cooperative learning approach was thus used and there should be in-depth research on blended learning environments, which include increased online and face-to-face interaction.

1.2 Cooperative Learning

Cooperative learning involves students working together in small groups to accomplish shared goals (Gillies, 2007). Typically, cooperative groups are heterogeneous in membership, especially in terms of achievement, motivation and task orientation. They meet regularly for the duration of the class (Johnson & Johnson, 2009). Group members should know that the cooperative group is a whole and that each member is responsible for the success or failure of the group. Since students can study with all the students instead of studying with the same student, they recognize that all students have different abilities and characteristics. As there is constant dialogue and sharing in class, students participate more in lessons. During group work, even though some students have difficulty understanding the subjects, students will help each other in the group to solve the problem (Dillenburg, 1999; Fenton, 1992). There are a lot of techniques in cooperative learning, yet in the present study, the STAD (Student Team Achievement Division) technique was used. Xu & Liming (2010) and Chen, Wang & Shih (2011) in their studies, emphasize that the STAD technique is useful and effective for the web aided collaborative learning environments.

STAD is a cooperative learning technique that has been extensively researched and assessed especially on academic achievements, attitudes, social interactions and interpersonal relationships (Bernaus & Gardner, 2008; Tarim & Akdeniz, 2008). According to Slavin (1990), if a teacher starts using the cooperative learning method for the first time, it will be more beneficial to start with the STAD technique since its applicability is easier than the other techniques of cooperative learning method. In this technique, learning teams of 4-5 members are formed heterogeneously. The lesson starts with a presentation by the teacher, and students then study until making sure that all the team mates have fully learnt the lesson. At the end of the course students' individual exam scores are calculated. According to criteria previously determined, team scores are determined. After evaluating the team scores, the most successful team is awarded.

In recent years, a number of researchers adopt the computer or Internet technologies as one of the key features of cooperative learning (Garrison & Anderson, 2003; Hoppe 2007, McInerney & Roberts, 2004; So & Bonk, 2010).

1.3 Blended Cooperative Learning Environment

The environment which included synchronous-asynchronous activities in the Internet environment and face-to-face cooperative activities in classroom environment is called "blended cooperative learning environment (BCLE)"

(El-Deghaidy & Nouby, 2008).

Avgerinou (2008) defines blended cooperative learning environment (BCLE) as “learning environment in which students try to fulfill the assigned tasks in groups with the support of computer-aided or web-based applications.”

El-Deghaidy & Nouby (2008), in their study, mentions three types of interaction in BCLE: Social, content and teacher. The first interaction type is the teacher that allows face-to-face interaction and active learning for a social environment. In addition, the teacher can plan and manage the learning parts and chooses appropriate communication tools before establishing communication with students. The second interaction type is content. Content is related to cognitive interaction regarding the skills and concepts presented in the course module. And the last type; social interaction refers to students’ ability to perceive themselves as a community supporting positive interdependence. Such an interaction in the learning process occurs when students achieve cooperative tasks and share the sources. Previous studies revealed that individuals’ interactions play an important role in learning (Mortera-Gutiérrez, 2006; Muirhead, 2000).

Also there are some risks connected with the BCLE such as; not all kinds of information presented on the internet are correct and reliable; not all students have internet access; lack of the educational software etc. (Avgerinou, 2008; So & Bonk, 2010; Tsai, 2012).

Abedin, Danesgar & D’Ambra (2010) claimed that the concept of “classroom community” is in the center of learning especially in computer/web-aided cooperative learning environments.

1.4 Classroom Community Sense

A number of researchers point to the importance of classroom community sense for an effective, traditional, online or blended learning environment (Hung & Yuen, 2010; Summers et al., 2005).

According to the definition of classroom community sense, students feel themselves as a member of the group. In addition, it is also defined as sense of belonging that occurs thanks to the feelings of confidence and connectedness among members. Thus, when students feel themselves as part of a group or a community, they will be more willing to participate actively in group works and discussions and to support the other members of the group (Rovai, 2001; Wang, 2008).

Studies demonstrate that a strong classroom community sense helps establish and develop positive interdependence between group members, leads to social support, learning support, commitment to group goals, cooperation and information sharing between group members and thus results in satisfaction in learning experiences (Kirschnher, 2002; Romiszowski & Mason, 2004; Rovai, 2001; Rovai, 2002). In addition, it is claimed that inefficient interaction of students with other students and with faculty members may lead to low learning outcomes and school drop-out and that these negative results are likely to occur due to the feeling of isolation caused by low classroom community sense (Rovai & Jordan, 2004). Walker (2008) points out that students have a strong classroom community sense attend the lessons more and are more successful in computer/web-aided cooperative learning environments.

E-learning researchers state that one of the basic difficulties experienced in practice is the lack of classroom community sense between the community members and suggest course designers to conduct applications in a way to increase the classroom community sense (Barbour & Ploug, 2009).

In the application process, the coordination of both the cooperative learning activities and the interaction in online and face-to-face environments is quite important. Telling the students that they will work together does not mean that cooperative will occur (Johnson & Johnson, 1999). If efficient coordination is achieved, group members will make equal contribution to fulfill the task. Cooperative learning environment should allow group members to fulfill their tasks more productively (Wang, 2009). Determining when to use face-to-face or online activities in blended learning environments is a complex process. In literature, there is no clear answer to how this combination will be achieved and whether computers will be used before, during or after the lessons. This combination depends on the course.

Besides such factors as practitioners’ competency and efficiency of technological opportunities, the features of the online platform used effect the quality of the environment as well (Rovai & Jordan, 2004). The online platform to be used should serve as storage for course materials, provide additional channels for communication and keep users’ sign-in records (Perez-Marin, SantaCruz & Gomez, 2012). Moodle could be an appropriate choice providing these features. Moodle, with its open-source code (free of charge), run on most operating systems and provide support for a number of languages. It is also favored by several universities. In the present study, as an online environment, Moodle was used. It could be stated that Moodle is quite effective not only in in-class web-aided cooperative applications but also in out-of-class online interactions. The students participating in this study frequently mentioned the advantages of this web environment.

1.5 Purpose

In literature, there is quite a limited research conducted in higher education on blended cooperative learning environment and on classroom community sense in blended learning environments (El-Deghaidy & Nouby, 2008; Rovai & Jordan, 2004). Therefore, this study could be said to make important contributions to the related fields in literature. In addition, the study is expected to act as an example for new-generation applications in higher education biology teaching and as a guide for future studies with its results.

The purpose of the present study was to investigate the effect of BCLE in biology teaching on students' classroom community sense, on their academic achievements and on their satisfaction levels. For this purpose, the following research questions were directed in the study:

- Does BCLE have effect on students' classroom community sense?
- Does BCLE have effect on students' academic achievement?
- What are students' satisfaction levels (views about) in BCLE?

2. Method

In order to clarify the research questions, mixed method design was employed in this study.

2.1 Study Group

The study was carried out with 30 students taking the course of "Seed Plants Systematics" in the department of biology education in a state university in 2012-2013 academic year. These students constituted the experimental group. The same course was conducted using traditional methods with 31 students (20 female; 11 male) in 2013-2014 academic year. And these students constituted the control group. The achievement test was applied to both groups as pretest and posttest.

2.2 Data Collection Tools

2.2.1 Classroom Community Index (CCI)

The scale developed by Rovai (2002) measures to what extent students perceive themselves as part of the group. The scale has an appropriate structure for the measurement of classroom community sense in web-aided higher education courses. Students receiving a lower score from the scale are likely to feel that they are isolated from the group and tend to drop the course. In all classrooms where the opposite is true, a strong classroom community is thought to facilitate the interaction between members (Öztürk, 2009; Rovai, 2002).

The Likert-type scale originally made up of 20 items was adapted into Turkish, and its validity-reliability analyses were conducted by Öztürk (2009). As a result of the factor analysis, seven items were excluded from the scale due to lower .30 item-factor correlation. So, a scale of 13 items (6 negative, 7 positive) with the sub-dimensions of "learning" (7 items; 5 negative, 2 positive) and "connectedness" (6 items; 1 negative, 5 positive) was obtained. The Cronbach Alpha reliability coefficients were calculated for the whole scale as .85; for F1 as .84; and for F2 as .77. In the present study, the reliability coefficients were calculated as .86, .81 and .78, respectively. The lowest score to be produced by the scale was 13, and the highest was 65.

2.2.2 The Achievement Test

The achievement test appropriate to the knowledge and comprehension steps in the cognitive domain was developed considering the gains within the "Seed Plants Systematics" course. First of all, 40 question test was prepared and applied to the 50 students who had taken this course. As a result of item analysis, 30 questions have been included within the scope of the test. In addition, the achievement test was examined by 2 biology teachers and 2 faculty members in the department of biology education at a university. In line with the suggestions of the experts, the necessary corrections were made, and the achievement test was finalized. For the evaluation of the multiple-choice questions prepared, no point was given to the wrong responses, while the correct responses received a point of 1. The Cronbach's Alpha internal consistency coefficient was calculated as 0.85. Also, average item difficulty and item discrimination indices was calculated as 0.48 and 0.43, respectively.

2.2.3 The Scale of Learners' Views on BCLE

This scale was obtained by combining the cooperative learning dimension of "A Scale for Student Views about Web-Aided Cooperative Learning" developed by Demirbağ (2009) and "Blended Learning View Scale" developed by Akkoyunlu and Yılmaz-Soylu (2006). The scale included 64 items. The students were asked to rate each item on a scale ranging from 1-10. The sub-dimensions of the scale were ease of use the web environment, online environment, content, face-to-face environment, blended learning model, evaluation and cooperation. The scores to be received from the scale were accepted as "1-5: Low", "5.01-7: Medium", "7.01-10: High". Item analysis and item discrimination indices were

used to address the validity of the items on the scale by the mentioned researchers. Average item discrimination indices was 0.54. For the whole scale, The Cronbach's Alpha internal consistency coefficient was calculated as 0.94. As for the sub-dimensions, the coefficients were calculated as .87, .88, .77, .91, .91, .86 and .94, respectively.

In addition, besides the items found in the scale applied to determine the students' views about BCLE, interview questions were prepared and used to allow them report their own thoughts.

2.3 Procedure

The study was performed in the course of "Seed Plants Systematics" in the Spring Term of 2012-2013 and 2013-2014 academic years. The application was applied in four course-hours a week, and the process continued for 15 weeks. In order to shape the online element of BCLE, a website was created using Moodle LMS (figure 1). Also, the Student Team Achievement Division (STAD) technique was used from the cooperative learning techniques. While creating the cooperative learning groups, it was provided to have a heterogenous distribution. For that purpose, based on the students' achievement grades in the fall term course of "Seedless Plants Systematics", the order of students' achievement grades was defined. These grades were consider when determining the members of the groups. In addition, considering the students' gender, they were divided six groups with five students in each. The students were given information about the group rules, and the students were asked to name their groups.



Figure 1. Course screen

Before the application started, the pre-tests were performed, and the students were given a training on the BCLE. First of all, they were informed about the BCLE. After, the website was introduced, and the students learnt how to be enrolled the website and what to consider while following the activities. During the lessons, it was tried to provide a balance between face-to-face and online environments. Before coming to class, the students had the chance to be prepared for the lesson by reviewing the summary of the subject, its presentation, the videos and animations as well as other web sites via the web site. First, in face-to-face environment, the lesson was simply presented by the instructor (author). As the students were already prepared for the lesson, the focus was mostly on the web-supported activities. There was a laptop or tablet pc in each group. The students performed the online activities with the help of these. After the simple presentation, the worksheets previously prepared were distributed to the groups. The worksheets included not only questions that required researching but also web activities (creating dictionary entry, drag and drop activities, adding photographs about plants and so on) (figure 2). As for the out-of-class activities, the students performed online quizzes. Also, the activities were assessed in the forum section. At the end of each topic, the students' personal development scores and the group scores were calculated and announced. In the result of the application, the winner group was awarded with the certificate.

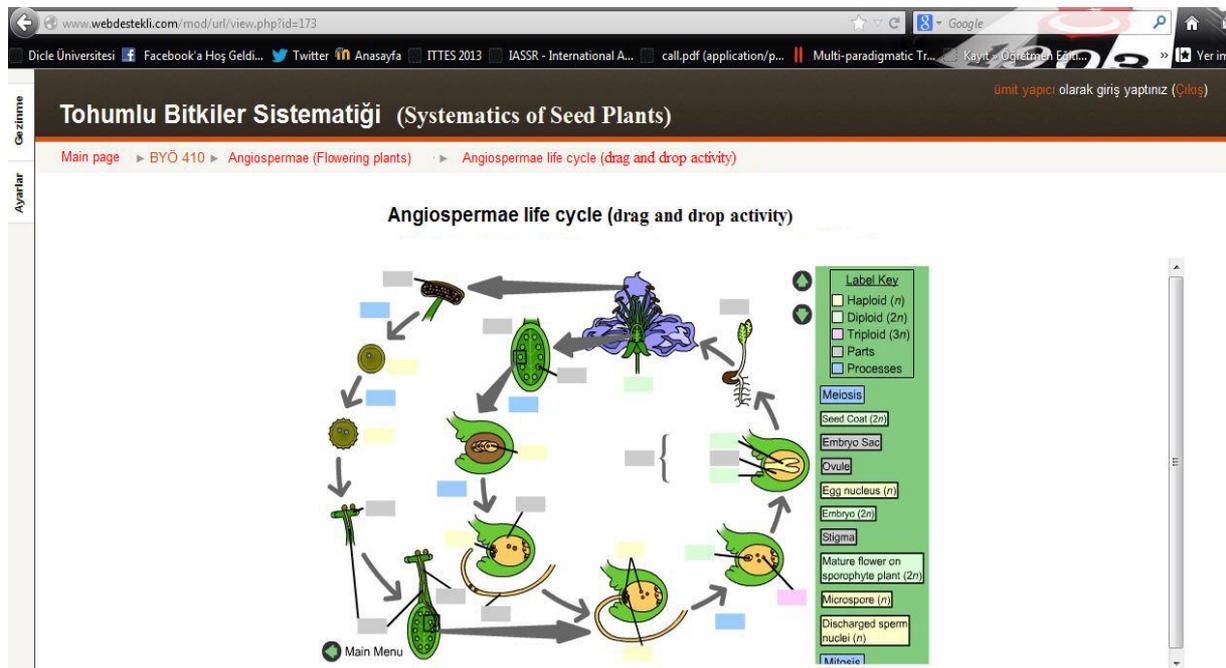


Figure 2. Sample Activity Screen (drag and drop activity)

In the control group, the lessons were taught with the question-answer and discussion methods accompanied by PowerPoint presentations in the classroom environment. Instruction process in both learning environment has been carried out by the same instructor.

2.4 Data Analysis

The results of the Kolmogorov-Smirnov Z test analysis showed that the data comply with the parametric tests ($p > .05$). So, for the analysis of the quantitative data, descriptive statistics, independent samples t-test, paired samples t-test were used. As for the qualitative data, content analysis was applied. The significance level has been taken to be 0.05.

3. Results

3.1 Results Regarding the First Sub-problem

In order to reveal whether there was a difference between the students' pre-test and post-test scores for the classroom community index (CCI), paired samples t-test was conducted. The results obtained are presented in Table 1.

Table 1. Paired samples t-test results of the experimental group regarding the CCI

Experimental Group	n	M	SD	Df	t	p
Pre-test	30	42.67	11.11	29	-2.17	.038*
Post-test		48.60	8.24			

* $p < .05$

When Table 1 is examined, it is seen that there was a significant difference ($t_{(29)} = -2.17$, $p < .05$) between the pre-test scores ($M = 42.67$) and post-test scores ($M = 48.60$) of the students in the study group for the CCI. Depending on this, it could be stated that the activities carried out led to a positive change in the participants' classroom community senses.

3.2 Results Regarding the Second Sub-problem

In order to reveal whether there was a difference between the groups' pre-test and post-test scores for the achievement test, independent samples t-test was conducted. The results obtained are presented in Table 2.

Table 2. Independent samples t-test results of the groups' achievement test scores

Tests	Groups	n	M	SD	dF	t	p
Pretest	Experimental	30	9.73	1.50	59	.15	.87
	Control	31	9.40	1.38			
Posttest	Experimental	30	18.33	1.37	59	2.87	.00*
	Control	31	13.50	.98			

* $p < .05$

When Table 2 is examined, it is seen that there was no significant difference ($t_{(59)} = 0.15$, $p > .05$) between the achievement test pretest scores of the experimental group (9.73) and the control group (9.40). Depending on this, it could be stated that the students in the experimental and control groups had similar levels of knowledge before the application was started. There was a significant difference ($t_{(59)} = 2.87$, $p < .05$) between the achievement test posttest scores of the experimental group (18.33) and the control group (13.50) in favor of the experimental group. Also, effect size was large ($d = 0.75$) (Thalheimer & Cook, 2002). Depending on this result, it could be stated that the activities carried out on the basis of BCL were more effective on students' achievement than the traditional teaching method.

3.3 Results Regarding the Third Sub-problem

Table 3 presents the findings regarding the "The Scale of Learners' Views on BCLE" in general and regarding its sub-dimensions.

Table 3. Descriptive statistics of the views about the BCLE

Sub-Dimensions	n	Min	Max	M	SD
Ease of Use the Web Environment	30	4.71	10.00	7.90	1.719
Online Environment		3.43	10.00	7.58	1.834
Content		5.00	10.00	8.07	1.213
Face-to-Face Environment		1.00	10.00	8.31	1.694
Blended Learning Model		4.93	10.00	8.01	1.424
Evaluation		3.75	10.00	8.39	1.474
Cooperation		2.57	10.00	7.82	1.633
General		5.01	9.75	8.01	1.309

When Table 3 is examined, it is seen that the general mean of the students' views about the BCLE was 8.01. Therefore, it could be stated that the participants had a high level of positive views about the BCLE. When the students' views about the sub-dimensions of the BCLE were examined, it was seen that the highest mean scores belonged to "evaluation" (8.39), "face-to-face environment" (8.31), "content" (8.07), "blended learning model" (8.01), "ease of use the web environment" (7.90), "cooperation" (7.82) and "online environment" (7.58), respectively. Consequently, it could be stated that the students had a high level of positive views about all the sub-dimensions.

In order to allow the students report their views about the application, semi-structured interview technique was applied to students. The questions directed and the sample responses given were as follows:

What do you think the advantages of BCLE are?

"Everybody was more active since we undertook our own learning responsibilities."(S)

"I established communication more easily both with my friends and my teacher. I have learnt more about my friends and shared more opinions with each other. We started respecting each other's opinions."(O)

"At the beginning of the study, I didn't want to be in the same group with some of my friends, but we started to get along quite well thanks to the group work." (Ç)

"It provided more entertaining and more permanent learning." (M)

"We can do individual work, and cooperative work reinforces our knowledge."(S)

"I can learn during the lessons in line with our own learning pace. I can reinforce my knowledge in class by being prepared in advance for the lessons. I can easily remember what I have learnt, and I don't have difficulty revising the things I learnt in class."(G)

"On the website, I can reach the details that I can not find in books. The slides, animations, videos made the lesson more entertaining." (V)

"It is fairly productive to use both the web environment and the class environment. I prefer this method to traditional ones."(E)

"I tried hard to reach the information. Thus, that information was valuable for me" (C)

What do you think the disadvantages of BCLE are?

"Since it included too many applications, the lessons were a bit tiring." (R)

"As I don't have Internet access at home, I felt as if my friends were ahead of me in terms of knowledge about the lessons." (A)

"I don't like working with computers at all, but I just had to do so for the lessons." (H)

What are your suggestions regarding BCLE?

"This application should be used in other courses as well, and preservice teachers should be trained on this."(S)

“The visual richness of the website could be increased, and entertaining applications like puzzles can be included.”

(E)

“The faculty member should provide fairly good guidance; otherwise, the environment can not so effective.” (O)

4. Discussion

The purpose of this study was to examine the effect of the BCLE on the students' classroom community sense, on their levels of academic achievement and on their satisfaction levels in biology teaching. For this purpose, the BCLE formed was applied in the course of “Seed Plants Systematics” during one academic term.

According to the findings obtained in the study, it was seen that the students' classroom community sense was developed in BCLE. Based on our observations and on the students' views, it could be stated that the students' classroom community sense was developed because they worked in cooperative groups; they were responsible for each other's learning; they started getting along well even with their friends whom they previously did not have close relationships with; they respected each other's opinions; their communication both with the faculty member and with their friends increased; and because they kept learning out of class on online basis. So (2009) stated that face-to-face discussions should not be ignored; that students should continue their discussions in the online environment as well; and that computer-aided cooperative learning tools should thus be designed for effective integration of face-to-face and online interaction. Black, Dawson & Priem (2008) reported that development of classroom community sense will have effect on students' satisfaction levels, their learning and on the permanence of their learning. According to So & Bonk (2010), blended learning environments provide great flexibility and opportunities to develop students' classroom community sense. Rovai & Jordan (2004) investigated the effect of blended learning, traditional learning and online learning environments in higher education on classroom community sense. The researchers found that blended learning environment, when compared to the others, led to a higher level of classroom community sense. In addition, there are still other studies reporting the development of classroom community sense (Barbour & Plog, 2009; Summers et al., 2005; Wang, 2009).

Another finding of this study was that the BCLE contributed more to the students' achievement than traditional teaching methods did. It could be stated that the students' levels of academic achievement was high because the study included both online and face-to-face activities; the online course-related documents were available; the students were prepared for the lessons; the students had the chance to revise wherever and whenever they wanted; they maintained interaction in the online environment; they studied for the course using a number of resources (summaries, presentations, animations, videos), the students fulfilled the tasks collectively; and because quizzes were administered. Tsai (2012) stated that use of cooperative learning and online activities together will increase the quality of learning. In another study, EL-Deghaidy and Nouby (2008) examined the influence of blended cooperative e-learning environment on preservice teachers' achievements and their attitudes towards e-learning and cooperation. In their study, the researchers used quantitative and qualitative data. In the study conducted with 26 preservice teachers, experimental and control groups were formed. According to the findings obtained, the posttest achievement means of the experimental group preservice teachers were higher than those of the control group preservice teachers. Van Eijl, Pilot & De Voogd (2005), in their study, compared cooperative and individual learning groups in the blended learning environment. The researchers reported that the cooperative learning group had a higher level of academic achievement means. In literature, there are a number of studies demonstrating the blended learning environments increase academic achievement (Aladejena, 2009; El-Deghaidy & Nouby, 2008; Owston, York & Murtha, 2013; Pereira et. al., 2007; Uluyol & Karadeniz, 2009).

It was seen that the students' satisfaction levels (views) regarding BCLE were highly positive both for the whole scale and for its sub-dimensions. In addition, the interviews revealed a lot of positive views. Besides the factors mentioned in the discussion above regarding classroom community sense and academic achievement, the students also reported that they enjoyed studying in this environment; that the environment was more entertaining than traditional environments; and that use of computer in class increased students' participation. Factors like these could be said to the causes of the increase in the students' satisfaction levels. EL-Deghaidy & Nouby (2008), in their study, examined preservice teachers' views about blended cooperative e-learning environment. It was reported that the preservice teachers were anxious at the beginning but got accustomed to and satisfied with the environment in time. It was also pointed out the application carried out was quite beneficial for future teachers and that it should be used in other courses as well. Vesisenaho et al. (2010), in their study titled “Blended learning with everyday technologies to activate students' collaborative learning”, used the blended cooperative learning environment supported with web 2.0 tools in biology teaching. In the study, the students' views were examined qualitatively and quantitatively. The results revealed that the participants had quite positive views. They especially reported that computer use in class was fairly effective and that applications like this should be carried out at schools. In addition to these studies supporting the findings obtained in the present study, there

are other studies reporting high levels of satisfaction in web/computer-aided cooperative learning environments (Dewiyanti et al., 2007; Van Eijl, Pilot & De Voogd, 2005; Liaw, Chen & Huang, 2008; Tsai, 2012). In literature, in a number of studies, it was found that students had higher levels of satisfaction with blended learning environments when compared to both traditional teaching and fully online teaching (Castle & McGuire, 2010; Dziuban, Hartman & Moskal, 2004; Eng et.al., 2009; Farley, Jain & Thomson, 2011; Lilje & Peat, 2007; Rovai & Jordan, 2004).

5. Conclusion

Blended learning is undoubtedly one of the most popular learning approaches. It is assumed that in future, a great majority of both formal and informal learnings will be blended. It is also claimed that cooperation and international changes supplement blended learning (Moskal, Dziuban & Hartman, 2013; So & Bonk, 2010). It is necessary to reorganize the learning environments for new generation learners. The study conducted can be an example for such environments. With its results, the present study is thought to contribute to the related literature in terms of blended learning, BCLE, web/computer-aided cooperative learning environments, classroom community sense and biology teaching in higher education. Considering the results obtained, the following suggestions can be put forward:

- The faculty member to carry out the application should have efficient computer and Internet literacy.
- The faculty member should follow the process well and establish coordination.
- As the online environment, such LMS as Moodle should be used.
- Entertaining applications like puzzles should be included in the website.
- In-class interaction should be maintained online out of class, which will contribute to the development of classroom community sense.
- The fact that not all students have Internet access is an important problem for such applications. Precautions to overcome this deficiency could be taken (for instance, increasing the computer-Internet facilities in the university campus).
- With the improvement of the technological conditions within the scope of FATİH project, applications like this can be carried out in high schools.
- Similar studies can be conducted with different designs and with a larger research sample, and the results to be obtained can be compared.
- BCLE could be compared with traditional cooperative learning environments.

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