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Comparison of pre-service mathematics teachers' views on blended learning and distance learning applications

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Abstract

The blended learning (BL) model eliminates the disadvantageous aspects of distance education and traditional education models and combines the beneficial elements in the light of studies in the literature to ensure higher quality and more efficient education. In this context, examining pre-service teachers' approaches to new teaching models used with technology is thought to be important. For this reason, in this study, the views of pre-service mathematics teachers on BL were examined by comparing them with distance learning (DL). The case study method, one of the qualitative research approaches, was used in this study. The study group consists of 26 senior students from a state university's primary school mathematics teaching department in Turkey's Western Black Sea Region. The data collection tool of the study was a semi-structured interview form (SSIF) consisting of eight questions, each aimed at determining pre-service teachers' views on the teaching practices based on BL and DL approaches. The data analysis was made through content analysis, one of the qualitative data analysis techniques. BL and DL approaches were compared in various categories. None of the pre-service teachers expressed a negative view on the BL approach. Their views have been grouped under the time, method, motivation, attention and focus, learning and feedback, communication and interaction, access to resources, technology, and cost categories. In general, pre-service teachers found BL-based implementation more positive than DL-based one. The number of views expressed in each category for the BL approach is quite higher than that in each category for the DL approach.

Keywords: Pre-service teacher, blended learning (BL), distance learning (DL), views

1. Introduction

1.1. Introduce the problem

Developments in science and technology have differentiated the education and training approaches and the methods used, learning environments, and course materials (Alvarez, Moreno, Orduna, Pascual, & San Vicente, 2015). The concepts of distance

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education, distance learning (DL), online learning, learning from the Web, e-education, and e-learning have emerged from different education models (Karakaya & Aksoy, 2005). One of these models is the distance education model. According to Garrison, Anderson, and Archer (2003), distance education is a model where the learner and teacher can reach each other through the internet, and multiple people can simultaneously be active in the environment. Accordingly, the concept of distance education is defined as an education model where the educator and the learner are in different places, and learning and teaching activities are carried out at any time through ICT (Aşkar, 2003; İşman, 2011; USDLA, 2021; Verduin & Clark, 1994). Today, many universities provide education through the internet to respond to students' changing needs (Akdemir & Koszalka, 2008, cited in Akdemir, 2011).

Today, the learning environment in distance education is provided over a network connection created using various software. Distance education occurs synchronously and asynchronously over this network connection, defined as the "Learning Management System" (Nichols, 2003). The basic components of distance education are the learning management system, e-content, virtual classroom, and assessment (Demir, 2014; Nichols, 2003). Each of these components has its unique characteristics. There is a spiral structure between these components, and success in distance education depends on a well-structured spiral structure (Demir, 2014). With this system, students have many opportunities in the learning environment, including adding, editing, and sharing learning materials such as animation, video, presentations, creating virtual classrooms, and discussing (Nichols, 2003). Synchronous education, which is defined as a virtual classroom system where teachers and students are together in various ways (Işık, Karacı, Özkaraca, & Biroğul, 2010), can bring the discussion atmosphere of traditional classroom environments to the education environment. However, it is necessary to have the appropriate technological infrastructure in such educational environments, and the parties must have sufficient technological knowledge (Özkaraca, 2005). On the other hand, asynchronous education is an education platform where the student can start and end education whenever and wherever they want, independently of the teacher (Işık et al., 2010). The course contents are prepared in advance and delivered to the students via the internet or the "Learning Management System" network in this education platform. The most remarkable disadvantage of asynchronous education is the delayed interaction and communication between the parties (Yorgancı, 2014). Considering the advantages and disadvantages of synchronous and asynchronous education together, it is clear that conducting them in a complementary way will create more efficient learning environments (Duran, Önal, & Kurtuluş, 2006; Hrastinski, 2008, cited in Yorgancı, 2014; Yorgancı, 2014).

Distance education has many advantages, including supporting autonomy and self-learning, being flexible in terms of time and location, and attracting learners' attention more than traditional teaching methods. Moreover, distance education provides suitable learning environments for learners with special needs in education (ex. Arkorful & Abaidoo, 2015; Dumford & Miller, 2018; Naidu, 2019; Sadeghi, 2019; Santana de Oliveira, Torres Penedo, & Pereira, 2018). On the other hand, distance education also has

disadvantages such as the lack of teacher control over the teaching situations, difficulties in the discipline and organization of students, difficulties in communication between learners and the teacher, and the reflection of possible technical skill deficiencies to the lessons (Gossenheimer, Bem, Carneiro, & de Castro, 2017; Naidu, 2019). Therefore, it is understood that a misplanned distance education will be less likely to provide a better education than traditional education, causing various pedagogical problems and communication and interaction problems. Studies show that one of the problems experienced in distance education environments is related to students' lack of a sense of community (McMillan & Chavis, 1986; Ilgaz & Aşkar, 2009; Öztürk, 2009; Öztürk & Deryakulu, 2011). According to McMillan and Chavis (1986), the sense of community is defined as a common belief that the needs of individuals will be met through their relationships, having a feeling for each member and group, and having a sense of belonging (cited in Yıldız, 2016). If students fail to have a sense of community and belonging in distance education environments, they get largely isolated from the system (Kang, Liew, Kim, & Jung, 2011; Öztürk & Deryakulu, 2011). According to Ilgaz and Aşkar (2009), the sense of community directly affects students' participation in distance education activities. In this context, the participation of the students who have a low sense of community in the activities would also be low.

Traditional education is an educational approach in which teaching techniques such as question-answer, lectures, and discussion are used under the leadership of the teacher. The teacher decides the flow of the lesson, measurement, and evaluation methods, and the student and the teacher have to be present at the same place at the same time (Nicholson, 2002). In this approach, the teacher is responsible for transferring knowledge to the student, and it is very difficult for the student to question, research, and produce knowledge (Gürses, 2010). In traditional education, learning as the whole classroom is essential; it is generally accepted that all individuals have equal qualifications, equal learning times, and similar personal characteristics. It is assumed that a particular subject will be learned in a certain period (Duruhan, 2004). In this context, it is clear that the sole use of traditional teaching methods will not be sufficient to develop 21st-century skills. Because during the teacher-centered performance of traditional teaching methods, students generally fail to participate and remain passive recipients in the lesson, and learning is based only on repetition and memorization. In such teaching environments, students often fail to practice. Therefore, it can negatively affect students' lives inside and outside the school (Duruhan, 2004).

Distance and traditional teaching methods have their unique advantages and disadvantages. In today's education and training approach, individuals should possess twenty-first-century skills. Defining a model that combines the advantages of all available teaching methods would be one way to achieve this. One of these models is blended learning (BL). Although the lack of a clear definition of BL (Clark & Mayer, 2003), it is expressed as a type of education that combines various traditional education models by using distance education and all kinds of technology (Akkoyunlu & Yılmaz Soylu, 2006). In BL, which is created by combining face-to-face traditional teaching methods and technology-based teaching methods, instructors interact with their students

without being in the same environment through ICT, carry out the instructions and present their materials (Graham & Dzuiban, 2008; cited in Pesen, 2014).

Oh (2006) explained the relationship of the BL approach with distance education, online instruction, and classroom instruction as in Figure 1.

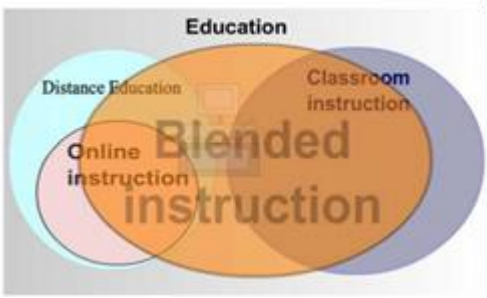

Figure 1. Interrelationships among instructional delivery modes (Source: Oh, 2006)

According to Oh's (2006) definition seen in Figure 1, distance education includes online instruction, but classroom instruction does not intersect with distance education. On the other hand, BL (Blended Instruction) is defined as a large set with its characteristics and some components of online instruction, distance education, and classroom instruction. Accordingly, a well-designed BL model offers the advantages of online and classroom instruction, creating a more effective learning environment (Akkuş & Keskin, 2016; Drafffan & Rainger, 2006, cited in Pesen, 2014). In the BL approach, removing the negative aspects of online and classroom instruction models and taking their positive and advantageous aspects is very important. Otherwise, various problems may arise in practices performed according to the BL approach. Some educators do not adopt the BL approach, criticizing that educators are not properly equipped with technology and that educational institutions do not have sufficient infrastructure (Carr, 2013, cited in Akkuş & Keskin, 2016).

There is no fixed, predetermined method, technique, approach, or materials for creating a BL environment. Moreover, BL does not have strict and hard rules; the instructor can make the desired blending according to the learning needs (Carman, 2005, cited in Johnson, 2013). According to Finn and Bucceri (2004), BL offers students e-learning environments where they can learn at their own pace, regardless of place, time, and duration, by combining the advantages of face-to-face and distance education. Students who have difficulty in communicating in the classroom can communicate more easily in the electronic environment (Akkoyunlu & Yılmaz Soylu, 2006). Online or web-based learning provides flexibility and efficiency, whereas face-to-face education meets students' social interaction needs. It is important to establish a proper balance between distance education and face-to-face education in organizing BL environments (Akkoyunlu & Yılmaz Soylu, 2006). Students' characteristics, the availability of online resources, teaching objectives, and instructor play important roles in establishing this balance (Ostguthorpe & Graham, 2003). For example, the frequency of teacher-student meetings, the presentation of the lesson, and meetings in a discussion environment are important

factors in establishing this balance (Akkoyunlu & Yılmaz Soylu, 2006). There are six objectives to consider in the design of BL environments (Osguthorpe & Graham, 2003). These are; (1) Pedagogical richness, (2) Access to knowledge, (3) Social interaction, (4) Personal Agency-Learner control, (5) Cost-effectiveness, and (6) Ease of revision. On the other hand, BL has started to be widely used in higher education institutions because of the absence of time and place restrictions and the ease of access to virtual resources (Geçer, 2013; Oliver & Trigwell, 2005; Picciano & Dziuban, 2007, cited in Balaman, 2016).

Cottrell and Robinson (2003) and Garrison and Kanuka (2004) reported that courses performed in BL environments increase academic achievement, and students are satisfied with such learning environments. One of the results of Taradi, Taradi, Radic, and Pokrajac's (2005) study is that students want to relive their experiences in BL environments. At the end of the study, based on three different approaches - face-to-face, blended, and completely online-, Rovai and Jordan (2004) reported that the students in the BL environment were more successful. In the study in which the effects of online learning and BL applications on academic achievement and student satisfaction were examined (Usta, 2007), it was found that the students who participated in the BL applications were more successful than the other group. Similarly, Demirkol (2012), Ekici and Karaman (2011), and Yıldız (2011) concluded in their studies that BL significantly increased student achievement compared to traditional learning methods. Akkuş and Keskin (2016) and Pesen and Oral (2016) examined the effect of the BL on pre-service teachers' academic achievement and motivation levels. Pre-service teachers stated that BL creates a fun and enjoyable learning environment; they can participate more in the subject in the BL environment; they can repeat the course whenever wanted; they are satisfied with the sharing they make online; they can easily access information; and face-to-face education environment has advantages such as body language, human factor, self-expression in a natural environment. Many studies in the literature examined the effects of BL on students' achievement (Aksoğan, 2011; Delialioğlu, 2004; Demirer, 2009; Garrison & Kanuka, 2004; Rovai & Jordan, 2004; Ünsal, 2007; Weibelzahl & Dowling, 2007, cited in Pesen & Oral, 2016), the permanence of learning (Aksoğan, 2011; Ünsal, 2007) and motivation (Akbaba, 2006; Aygün, 2011; Balaman & Tüysüz, 2011; Pesen & Oral, 2016; Sarıtepeci, 2012). However, there is no study in the literature examining the similarities and differences between BL and DL approaches from pre-service mathematics teachers' views. It is thought that examining the views of pre-service mathematics teachers on BL by comparing it with DL is important in today's world, where discovering and applying new technological developments and new methods in teaching is important. This study aimed to reflect the contributions of the relations between BL, DL, and traditional learning approaches to teaching from the perspective of pre-service mathematics teachers and to reveal the similar and different aspects of these approaches. From this point of view, it is thought that this study will contribute to the literature.

1.2. Purpose of the Study and Sub-Problems

This study examined and compared the effect of teaching the course (Algebra Teaching Course) with BL and DL approaches on pre-service teachers' views on these approaches. For this purpose, the views of two groups in which the BL and DL approaches were implemented (=BL group and DL group) were compared, revealing their similarities and different aspects from pre-service teachers' views. Accordingly, the following sub-problems were addressed in the study.

1. What are the views of pre-service teachers in the BL group on BL?
2. What are the views of pre-service teachers in the DL group on DL?
3. According to the pre-service teachers ' views, what are the similarities and differences between BL and DL approaches?

1.3. Importance of Study

BL is a new education model based on constructivist theory; it is defined by combining the advantageous aspects of distance education models and traditional teaching approaches, fitting today's technological developments. This model eliminates the disadvantages of distance education and traditional education models in the light of studies in the literature and increases the quality and efficiency of the education. Technological developments in the 21st century we live in allowed us to use different teaching models in education. It is a common thought that educational institutions, teachers, and pre-service teachers play important roles in shaping our future. In this context, examining how pre-service teachers approach new teaching models used with technology was thought to be important. BL is one of the models that can be used in contemporary educational environments. Therefore, this study examines pre-service mathematics teachers' views on BL by comparing them with DL. The main purpose of this study is to reveal the shortcomings and positive aspects of BL in line with the views of pre-service mathematics teachers and contribute to future studies in this context.

2. Method

2.1. Design of the study

The case study method, one of the qualitative research approaches, was used in this study. In the case study method, one aspect of the investigated subject is examined in depth (Merriam, 2013; Yıldırım & Şimşek, 2018), and this method enables the exploration of a bounded system using different data collection tools (McMillian & Schumacher, 2010). Qualitative case studies investigate one or more cases in-depth with a holistic approach. They examine how the factors related to the situation affect the situation and how they are affected by the situation (Yıldırım & Şimşek, 2018). In this

study, which was carried out on two different pre-service teacher groups, pre-service teachers' views on BL were determined and compared with their views on DL; thus, the similarities and differences of both approaches were revealed. The case study method was preferred in this study to examine pre-service teachers' views on these approaches in detail.

2.2. Participants

The study group consisted of 26 pre-service teachers studying in the 3rd grade of a state university's primary school mathematics teaching department in Turkey's Western Black Sea Region. 10 of these pre-service teachers were in the BL group, and 16 were in the DL group. Both groups had one year of experience in distance education. Thus, they were familiar with the Learning Management System, where the university carries out its distance education activities, and they know how the system works. Pre-service teachers have chosen their groups voluntarily.

2.3. Data collection tool

A semi-structured interview form (SSIF) was used to determine pre-service teachers' views on the applications performed with BL and DL approaches. The questions in the SSIF were prepared using the survey questions of Uluyol and Karadeniz (2009) and the additional questions prepared by the researcher, in line with the views of experts. An 8-question SSIF was prepared for the pre-service teachers in the BL and DL group, and they were asked to give their answers with written explanations. After receiving their views, one-to-one interviews were held with 3 pre-service teachers from both groups. The rationale behind this is to maximize the variety of data in the study and ensure participant confirmation. The qualitative data were analyzed by content analysis after classifying them with the codes and categories created by the researcher and a faculty member. The questions in the SSIF are given in Table 1.

Table 1. SSIF questions for BL and DL groups

Question No	Questions about BL	Question No	Questions about DL
1	What are your views on the BL environment?	1	What are your views on the DL environment?
2	What support did you receive in your interaction with the course instructor?	2	What support did you receive in your interaction with the course instructor?
3	What gains have you acquired from the algebra teaching course instructed by BL?	3	What gains have you acquired from the algebra teaching course instructed by DL?
4	Did you encounter any problems during the process? If so, what are they? How did you solve your problems?	4	Did you encounter any problems during the process? If so, what are they? How did you solve your problems?

5	What are your views on supporting other courses in the faculty with BL?	5	What are your views on supporting other courses in the faculty with DL?
6	Please add anything you want to add about the process (views, requests, and deficiencies).	6	Please add anything you want to add about the process (views, requests, and deficiencies).

2.4. Implementation

Apart from distance education applications, no other action was taken for the pre-service teachers in the DL group. In both groups, the implementation continued for 12 weeks, 3 hours a week, according to the gains specified in the "Algebra Teaching" course syllabus. Teaching practices in groups are given below.

2.4.1. DL Practices

The courses were instructed synchronously and asynchronously through the "Learning Management System" set by the university to be used in distance education. The implementation was made in the "Algebra Teaching" course. Live lessons were conducted via the link provided by the LMS, and pre-service teachers' questions were answered during the lesson. Pre-service teachers were allowed to ask questions and discuss in the lessons. Live lessons were recorded and shared over the system. In this way, pre-service teachers who could not attend the live lessons or wanted to listen to the lesson again used the given link. Before the live lessons, documents related to the lesson's content, asynchronous videos, various files, and assignments that would facilitate learning were shared via links. Thus, pre-service teachers had the opportunity to make preliminary preparations and work on the subject before participating in the live sessions. Pre-service teachers were given various assignments and asked to submit them within the specified time after the live lesson. The course's responsible instructor examined homework and gave feedback. Thus, the subjects or details that pre-service teachers failed to understand were repeated with different examples to make them understand the subject. At the end of the process, pre-service teachers' views on the courses conducted by DL were taken.

2.4.2. BL Practices

A part of the course was conducted online in the BL group, and another part was conducted face-to-face in the classroom environment. At the beginning of the semester, the weekly 3-hour course was generally 2 hours online and 1 hour face-to-face. With the progress of the courses, 2 hours of face-to-face and 1 hour online classes were held per week according to the needs of the students. Before starting the lessons, pre-service teachers were informed about the BL approach and its implementation. The implementation process was explained in detail. The BL environment was enriched using multiple methods (Osguthorpe & Graham, 2003). In this study, additional exercises, materials and activities were used to enhance the BL environment (Bersin, 2004, cited in

Johnson, 2013). For this purpose, various practical activities, group discussions, and in-class discussions were held with pre-service teachers in a face-to-face education environment. LMS was used in the synchronous and asynchronous teaching process in the online environment for the times out of face-to-face training. Pre-service teachers used LMS to easily access lecture notes, homework, live lecture videos, various course documents, related links, make various online sharing, download, upload, and make online discussions. In this study, strict rules were not followed in the BL environment, and the pre-service teachers' status, learning speed, and needs were considered. Thus, pre-service teachers did not have to stick to any pattern or plan while taking responsibility for their own learning with their studies and the homework they could do at their own pace (Bersin, 2004, cited in Johnson, 2013). According to Futch (2005), pre-service teachers can work more before and after the lesson in the BL environment, which paves the way for creating higher quality projects. In this study, online and face-to-face activities were prepared and implemented in a way complementing each other.

2.5. Data analysis

Qualitative data analysis techniques were used in the analysis of the data. The obtained data were analyzed by content analysis using codes and categories created independently by the researcher and a faculty member. Content analysis is summarizing the parts of a text with fewer words systematically, within the framework of certain rules (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2013).

2.6. Validity and reliability analysis

The questions in the SSIF were prepared using the survey questions of Uluyol and Karadeniz (2009) and the additional questions prepared by the researcher, in line with the views of experts. For the reliability of the study, the percentage of agreement of the codes created by the researcher and a faculty member was calculated with the formula Agreement/ (Agreement + Disagreement) x 100 (Miles & Huberman, 1994) and found 0.96. A full consensus has been achieved by coming together for the difference.

3. Results

In this section, the findings obtained from pre-service teachers' views on BL and DL and the similarities and differences of both approaches are shown in tables.

3.1. Findings from pre-service teachers' views on BL

The findings obtained from pre-service teachers' views on BL are given in Table 2 and Table 3, with the codes, categories, and frequencies. No negative views were expressed for BL.

3.1.1. Findings from pre-service teachers' positive views on BL

Regarding Table 2 and Table 3, pre-service teachers' views on the BL approach concentrate on time, method, motivation, attention and focus, learning and getting feedback, communication and interaction, access to resources, technology, and cost categories.

Table 2. Pre-service teachers' positive views on BL (1)

Time (f)
- Allocates time for oneself (8), Allocates time for research and homework (5)
- Time spent at school decreases (7), Allocates time for self-study (6)
- Connecting to online courses from anywhere prevents waste of time (9)

Method (f)
- Opportunity to do face-to-face and online lessons (10)
- Using different methods together to complement each other (8)
- Using research and inquiry-based methods (5)
- Making in-class discussions (7), A different and interesting method (3)
- The deficiencies that may occur in online lessons are compensated with face-to-face lessons (6)

Motivation, attention, and focus(f)
- Increased motivation (7), Feeling comfortable, not worrying (5)
- Facilitating attention and focusing by establishing eye contact (6)
- Elimination of focus, study, and unwillingness problems (7)
- Being happy and expressing oneself more easily (6)

Learning and getting feedback (f)
- Easy and fun learning (4), Contributing to academic and professional development (7)
- Learning by doing is more permanent (16)
- A better understanding of the lesson with the richness of methods (7)
- Encouragement of the instructor (3)
- Instant feedback facilitates learning (8)
- Learning to learn independently of time, place, and teacher (4)

Table 3. Pre-service teachers' positive views on BL (2)

Comunication and interaction(f)
- More and stronger communication (10),
- Creation of an efficient learning environment (8)
- Opportunity to express oneself easily and ask questions in a comfortable classroom environment (8)
- Interactive lectures facilitate learning (6),
- Communicating comfortably with the teacher (9)
- Making discussions in face-to-face and online course environments (7)
- Feeling not isolated from the lesson with the face-to-face lessons, feeling a sense of belonging to the environment (5)
- Not alienating from the lesson and the environment (4)
- Establishing verbal and non-verbal communication (2)

Access to resources (f)
- Access to live lecture videos, documents, and various resources from LMS easily and at any time (10)

- Face-to-face lessons are effective in overcoming difficulties (12)

Technology (f)

- Utilizing technology (6), An increase in the technology usage skill (13)
- Combining classroom learning with technology (4)

Cost (f)

- Spending less (6)

Regarding Table 3, pre-service teachers stated that communication in the BL environment is more effective than in distance education; the comfortable classroom environment provides opportunities for asking questions and expressing oneself; establishing communication facilitates understanding the lesson. Moreover, pre-service teachers also stated that they are not isolated from the lesson in such learning environments; they feel a sense of belonging; they are not alienated from the lesson and the environment; productive course environments are created by establishing verbal and nonverbal communication.

3.1.2. Findings from pre-service teachers' views on instructor support in the BL environment

Table 4 includes pre-service teachers' views on instructor support in the BL process.

Table 4. Pre-service teachers' views on instructor support in the BL environment

Creating an efficient lesson and classroom environment (f)

- Increased our motivation (10)
- Created a classroom environment where we could express ourselves comfortably (7)
- Gave face-to-face and online lessons (8)
- Created a discussion environment in the classroom (6)
- Provided the opportunity to work in small groups (5)

Helping learning and teaching (f)

- Identified our deficiencies and ununderstood topics by observing very well (4)
- Gave clear, understandable, and explanatory answers to our questions (6)
- Put much effort into us understanding the subjects (7)
- Facilitated learning by using different methods (6)
- Provided and facilitated our access to resources (9)
- Gave quick feedback on our work and homework (7)
- Noticed and completed our deficiencies (5)

Communication (f)

- Communicated well (10), Made eye contact (4)
- Communicated verbally and non-verbally (3)

Guidance (f)

- Guided and helped us to take responsibility for learning (5)

- Helped us gain academic development and professional competence (8)
- He/she was fair, caring, respectful, and disciplined (6)
- Taught interactive lessons with a wealth of methods (8)

Table 4 shows that the pre-service teachers received the instructor's support in creating an efficient lesson and classroom environment, helping to learning and teaching, communication, and guidance. The most mentioned statements are that the instructor increased their motivation towards the lesson by making eye contact, communicating verbally and non-verbally, giving good and quick feedback on their work, and conducting interactive lessons using different methods.

3.1.3. Findings from pre-service teachers' views on the gains thought to be acquired in the BL environment

Table 5 shows pre-service teachers' views on the gains acquired from BL practices. Accordingly, pre-service teachers' gains are grouped under cognitive and affective dimensions. All pre-service teachers stated that they acquired algebra teaching content knowledge, pedagogical content knowledge, and teaching profession knowledge in the BL process. In addition, pre-service teachers stated that they did not feel like strangers in the BL environment and expressed themselves quite comfortably, which is very important.

Table 5. Pre-service teachers' views on the gains thought to be acquired in the BL environment

Cognitive Gains (f)
- Algebra teaching and pedagogical content knowledge (10)
- Knowledge of accessing and using resources (7)
- Teaching profession knowledge (8)
- Permanence of learning (7)
- Knowledge of using different methods together (5)
- Knowledge and skill of using technology (6)
- Recognizing and completing the knowledge gaps (3)

Affective Gains (f)
- Taking the responsibility of self-learning (4)
- Gaining the habit of self-studying (5)
- Understanding the importance of making observations in the lesson (3)
- Understanding the importance of creating comfortable classroom environments where the learning is facilitated (6)
- Feeling a sense of belonging to the lesson environment and expressing oneself comfortably (7)

3.1.4. Findings from pre-service teachers' views on the difficulties encountered in the BL process and their solutions

Table 6 shows whether the pre-service teachers encountered any difficulties/problems in the BL process and their views on the solutions to the problems. Accordingly, the majority of the pre-service teachers stated that they did not encounter any problems; very few of them stated that they encountered a problem but were able to solve it. Pre-service teachers who had problems with the internet and online lessons stated that they made up for their deficiencies by watching the live lesson videos in the LMS and face-to-face lessons.

Table 6. Pre-service teachers' views on the difficulties encountered in the BL process and their solutions

Not Encountering Difficulties/Problems (f)
• I did not encounter any difficulty/problem(7)
Encountering Difficulties/Problems (f)
• I had technical problems with the internet in online classes (3)
Solutions to Problems
• I have completed my deficiencies in face-to-face lessons (2)
• I had access to the live lesson videos through LMS whenever I wanted, and I worked on my deficiencies by watching the live lessons again and again (3)

3.1.5. Findings from pre-service teachers' views on supporting other courses in the faculty with BL

In Table 7, pre-service teachers' views on supporting other courses in the faculty with BL are displayed. Accordingly, all pre-service teachers stated that they are in favor of using BL in other courses in the faculty. They stated that in BL, the negativities experienced in face-to-face and online courses are compensated by the other. Thus, learning is more permanent, and the efficiency they get from the course increases.

Table 7. Pre-service teachers' views on supporting other courses in the faculty with BL

BL should be used in other courses (10): Reasons (f):
• The negativities experienced in face-to-face and online lessons are compensated by the other (10)
• Combines face-to-face instruction with new technologies (4)
• A method suitable for 21st-century technologies (3)
• Increases the efficiency and interest in the course (14)
• Permanent learning (7), More interaction and communication (10)

- Learning with fun (2), Diversified resources (7)

3.2. Findings from pre-service teachers' views on DL

The findings obtained from pre-service teachers' views on DL are shown in Table 8 with the codes, categories, and frequencies.

3.2.1. Findings from pre-service teachers' positive and negative views on DL

Pre-service teachers' views on DL were evaluated in two categories, i.e., positive and negative, and they are given in Table 8.

Table 8. Pre-service teachers' positive and negative views on DL

Category	**Positive views**	**Negative views**
Codes	**Sub-codes (f)**	**Sub-codes (f)**
Time	Ability to manage time (1)	Working at the computer for long periods(5)
	Prevention of wasting time (4)	Failing to spare time for social activities (9)
Location	Connecting to the lesson from the desired location (10)	Being in the home environment makes it difficult to focus on the lesson (2)
		The learning environment is virtual (2)
Motivation/ Interest/ Focus/Attention	-	Decreased motivation/decreased interest(10)
		Failure to focus on the lesson and studying (10)
		Failure to concentrate (6)
Learning	Learning in own pace (2)	Insufficient feedback on studies (1)
	Self-learning (6), Permanent learning (2)	The increased necessity of self-study (2)
	Self-learning (6), Self-study (4)	Taking responsibility for own learning (4)
	Live lesson/rewatch opportunity (6)	Too many assignments and limited time (6)
Communication/ Interaction	-	Very poor communication and experiencing communication problems (9)
		Insufficient interaction for group work (8)
Technology	Reaching a good level in using technology (5)	Internet-related problems (6)
	Increase in technological knowledge and skills (7)	Failure to ask enough questions due to problems connecting to the lesson (4)
Health	-	Head, neck, and back pain and eye defects due to long periods of listening and studying at the computer (13)
		Being stressed and anxious (3)
		Sitting still for a long time (3)
		Physical and psychological fatigue (8)

Access to resources	Easy access to course materials, presentations, various documents, lecture notes from the system (7) Diversity of sources (5) Access to synchronous and asynchronous videos (6) Access to the university's online library(3)	-
Personal	Increase in research skill (5) Increase in the sense of responsibility (2) Increase in self-control and self-regulation skills (2) Gaining the ability to produce alternative solutions (3)	Failure to express oneself comfortably (5) Failure to feel oneself in the classroom (4) Getting away from the lesson (5) Being misunderstood occasionally (1)
Cost	Less spending/Low cost (5)	-
General	Distance education is suitable for short-term training (2) Distance education should be given along with face-to-face education (16) Communication and interaction is stronger in a face-to-face classroom environment (13) There is more active participation in the face-to-face classroom environment (10) Motivation is higher in face-to-face education (12)	

The review of Table 8 as a whole shows that pre-service teachers' views on DL are mostly concentrated under the negative views. The categories of positive views are time, location, learning, technology, access to resources, personal, and cost; negative views are under time, location, motivation/interest/focus/attention, learning, communication/interaction, technology, health, and personal categories. It is noteworthy that there is no positive view on motivation/interest/focus/attention, communication/interaction, and health categories. Those who had positive views stated that DL could be used as a method in the lessons because it allows them to take responsibility for their learning and work individually. However, the general view of pre-service teachers on DL was that distance education should be given along with face-to-face education, and distance education is suitable for short-term training. Pre-service teachers who expressed their views in this direction stated that active participation/ motivation and communication/interaction are higher in the face-to-face classroom.

3.2.2. Findings from pre-service teachers' views on instructor support in the DL environment

Table 9 shows pre-service teachers' views on instructor support in the DL process. These positive views are grouped under the codes of creating an efficient lesson and classroom environment, helping learning and teaching, communication, and guidance.

Table 9. Pre-service teachers' views on instructor support in the DL environment

Creating an efficient lesson and classroom environment (f)
• Tried to increase our motivation (5), Performed live lessons (9)
• Created a classroom discussion environment/we could express our ideas comfortably (4)
Helping learning and teaching
• Gave clear, understandable, and explanatory answers to our questions (5)
• Provided resources and facilitated our access to resources (8)
• Put much effort into us understanding the subjects, instructed the lesson clearly and understandably (10)
• Tried to give feedback on our works and homework (2),
• Completed our deficiencies (3), Tried to make the lesson efficient with different presentations (3)
Communication
• Established communication but in-class communication and interaction were poor (4)
Guidance
• Showed ways of accessing information/Helped to search for resources (6).
• He/she was sympathetic (6), Shared his/her knowledge and experience (2)
• Helped our professional development (4)

Due to some unique disadvantages of distance education, pre-service teachers stated that instructor support was insufficient to overcome the difficulties they experienced. Pre-service teachers, who were satisfied with the instructor's communication, stated that they failed to communicate sufficiently with their friends and the instructor in the virtual classroom environment and that the interaction was weak.

3.2.3. Findings from pre-service teachers' views on the gains thought to be acquired in the DL environment

Table 10. Pre-service teachers' views on the gains thought to be acquired in the DL environment

Cognitive Gains (f)
•Algebra teaching content knowledge (16)
Algebraic and functional thinking, meanings of the concept of variables, algebraic expressions, identity, equality, equation, inequality, patterns, misconceptions encountered in algebra teaching, learning difficulties and their solutions, associating algebra with daily life
•Algebra teaching pedagogical content knowledge (13)
Approaching students in algebra teaching, using appropriate methods, techniques, and concrete and abstract materials, preparing effective lesson plans and appropriate activities,

and using technology in teaching algebra

The findings obtained from pre-service teachers' views on the gains thought to be acquired in the DL environment are given in Table 10. Accordingly, pre-service teachers stated that they acquired gains only in the cognitive dimension of the course in the DL environment.

3.2.4. Findings from pre-service teachers' views on the difficulties encountered in the DL process and their solutions

Table 11 includes pre-service teachers' views on the difficulties/problems they encountered in the DL process and their solutions.

Table 11. Pre-service teachers' views on the difficulties encountered in the DL process and their solutions

Not Encountering Difficulties/Problems (f)
- I did not encounter any difficulty/problem (7)

Encountering Difficulties/Problems (f)
- Internet-related problems (9): failing to attend some classes due to power cuts and technological problems and motivation decrease resulting from this, difficult to make up missed classes
- Insufficient communication, failure to perform group work, and failure to get enough efficiency from homework (8)
- Sickness (1)
- Experiencing health problems resulting from long working hours in front of a computer (8)

Solutions to Problems
- Failure to find any solution (5)
- Making additional lessons for those who could not attend the course(9)
- Watching the lessons again through LMS (8)

Regarding Table 11, 7 of 16 pre-service teachers did not encounter any problems in the process, but 9 of them faced various problems, and 5 could not find any solution. On the other hand, most pre-service teachers in the BL group have stated that they did not encounter any problems during the process or solve the problems by using the advantages of face-to-face and online instruction. These views of the BL group pre-service teachers are in line with DL group pre-service teachers' views that it would be appropriate to give face-to-face and online instruction together.

3.2.5. Findings from pre-service teachers' views on supporting other courses in the faculty with DL

Table 12 contains pre-service teachers' views on using DL in other courses in the faculty. According to Table 12, 14 pre-service teachers stated that DL should not be used as a teaching method in other courses in the faculty, and 10 of them suggested not to use DL in applied courses. All pre-service teachers stated that DL should be supported by face-to-face education; 2 pre-service teachers stated that it could be used in theoretical courses

for a short period. Although pre-service teachers have positive views on DL (See Table 8), they generally state that DL should not be used as a teaching method alone.

Table 12. Pre-service teachers' views on supporting other courses in the faculty with DL

DL should not be used in other courses (f)
• It should not be used as a teaching method alone (14)
• It should not be used in applied courses (10)
DL should be used in other courses (f)
• DL should be supported by face-to-face education (16)
• It can be used for a short time in theoretical and verbal courses (2)

According to Table 12, all 16 pre-service teachers who participated in DL practices had previously face-to-face and online course experiences; they thought that the implementation made with the DL approach had more disadvantages than advantages, and they were not satisfied with it in general.

3.3. Comparison of similar and different aspects of BL and DL approaches according to pre-service teachers' views

The first and second sub-problems of the study addressed the findings obtained from the views of BL and DL groups about these approaches from various perspectives. In this part of the study, pre-service teachers' positive and negative views on both approaches were compared through frequencies in Table 13. The absence of any views is indicated by (-) in Table13.

Table 13. Categories, sub-categories, and frequencies of pre-service teachers' views on BL and DL approaches

		BL(n=10)		**DL(n=16)**	
Category	**Sub- Category**	**Positive (f)**	**Negative(f)**	**Positive (f)**	**Negative(f)**
General Views	Time	35	-	5	14
	Location	9	-	10	4
	Method	39	-	-	-
	Motivation/Attention/Focus	31	-	-	26
	Learning/Getting Feedback	45	-	26	13
	Communication/Interaction	59	-	-	17
	Access to Resources	22	-	21	-
	Technology	19	-	12	10
	Cost	6	-	5	-
	Health	-	-	-	27
	Personal	-	-	12	15
	Total f	**265**	**-**	**91**	**126**
Views on Instructor Support	Creating an efficient lesson and classroom environment	36	-	18	-
	Helping learning and teaching	44	-	31	-
	Communication	17	-	4	-
	Guidance	27	-	18	-

		Total f	**124**	**-**	**71**	**-**
Views on the gains thought to be acquired from the course	Cognitive Dimension		46		29	-
	Affective Dimension		25	-	-	-
		Total f	**71**	**-**	**29**	**-**
Views on encountering problems and their solutions	No problem encountered		7	-	7	-
	Encountered problem/Solved		3	-	17	
	Encountered problem/Not solved		-	-	-	5
		Total f	**10**	**-**	**24**	**5**
Views on using the teaching method in other courses	Should not be used		-	-	-	24
	Should be used		57	-	2	-
	They should be used together		-	-	16	-
		Total f	**57**	**-**	**18**	**24**

Regarding Table 13, the views on BL and DL are grouped under the categories of "general views, views on instructor support, views on the gains thought to be acquired from the course, views on encountering problems and their solutions, and views on using the teaching method in other courses." Accordingly, none of the pre-service teachers in the BL group stated a negative view for the BL approach. In addition, from Table 13, it is seen that the number of positive views (460) for the BL approach in the "general opinions, opinions about the support of the instructor, the opinions about the gains that are thought to be taken from the support" is higher than the number of positive opinions in these categories (191) for the DL approach. There are 39 positive views for BL in the method sub-category, while there is no positive or negative view for DL. For BL, pre-service teachers stated 57 positive views, saying that BL eliminates each other's disadvantages because of the possibility of performing face-to-face and online lessons; it would be good to use it in all lessons. For DL, on the other hand, pre-service teachers stated that they want to establish face-to-face communication with the instructor and their friends and express themselves comfortably. In this context, it can be concluded from these findings that using BL as a teaching approach is more advantageous than DL. There is no view for BL in the "Health" and "Personal" sub-categories. In contrast, there are 27 negative views in the "Health" sub-category for DL, 15 negative views, and 12 positive views in the "Personal" sub-category. Regarding DL, some pre-service teachers considered gaining self-confidence through individual and independent studying as an advantage. In contrast, others stated that they studied harder and that all learning responsibility belonged to them and saw this as a disadvantage. This finding should be discussed in detail. Both groups have positive views on the "Access to Resources" sub-category. All BL group pre-service teachers expressed positive views for BL in the "Learning/Getting Feedback" and "Technology" sub-categories, whereas the DL group generally expressed negative views on DL.

Regarding the " Views on Instructor Support" in Table 13, pre-service teachers in both groups expressed positive views, and there is no negative view. However, the number of positive views for BL is higher than for DL. Accordingly, based on the pre-service teachers' views, it can be said that instructor support is higher in BL than in DL. Similarly, there are 71 positive views for BL and 29 positive views for DL in the “views on the gains thought to be acquired from the course" category. There is no negative view in either group. However, it is understood from Table 13 that pre-service teachers think that they acquired more gains in the BL process than in the DL. Regarding the “Views on encountering problems and their solutions" category, 7 out of 10 BL group pre-service teachers did not encounter any problems, and 3 solved the problem/difficulty. For DL, 7 out of 16 pre-service teachers stated that they did not encounter difficulties/problems, the rest encountered problems, and 5 of them could not find a solution to the problems. In this context, it can be said that the BL approach helps to solve the problems effectively faced by pre-service teachers in the learning process.

Table 14 shows the frequencies of the views and the frequency/number of pre-service teachers ratios in different categories for both approaches. Similarly, Table 15 shows the frequencies of the views and the frequency/number of pre-service teachers ratios for the problems encountered for both approaches, whether the solution has been found, and whether the approaches should be used in other courses. The reason for showing the ratio frequency/number of pre-service teachers is having a different number of pre-service teachers in each group. It was decided to create this data to prevent misleading or incomplete interpretations and show more detailed information. In this way, more accurate comments could be made by comparing the ratios in each group. Tables 14 and 15 were created using the data in Table 13.

Table 14. The frequencies of the views and frequency/number of pre-service teachers ratios in the groups

Learning Approach	**BL (n=10)**		**DL (n=16)**			
	Positive		**Positive**		**Nagative**	
Category	**Σf**	**Σf/n**	**Σf**	**Σf/n**	**Σf**	**Σf/n**
General Views	265	26.5	91	5.7	126	7.9
Views on Instructor Support	124	12.4	71	4.4	-	-
Views on the gains thought to be acquired from the course	71	7.1	29	1.7	-	-
Total	460	46	191	11.8	126	7.9

According to Table 14, the ratio of positive views to the number of pre-service teachers is 46 for BL; the ratio of positive views to the number of pre-service teachers is 11.8, and the ratio of negative views to the number of pre-service teachers is 7.9 for DL. There are no negative views in the "Views on Instructor Support" and "Views on the gains thought

to be acquired from the course" categories in both groups. However, the frequency/number of pre-service teacher ratios in these two categories (4.4 and 1.7 for DL & 12.4 and 7.1 for BL) show that positive views are remarkably lower in the DL group than BL.

In Table15, the frequencies of the views and the frequency/number of pre-service teachers ratios are given for the sub-categories of "Problems & Solution to Problems" ("No problem," "Had problem/Solved," "Had problem/Not Solved") and "Using BL/DL as a learning approach" ("Should be used," "Sometimes should be used," "Should not be used" and "Should be used along with face-to-face education") for both approaches.

Table 15. The frequencies of the views and frequency/number of pre-service teachers ratios of the views on problems, solutions and using it as a teaching approach

Learning Approach	**BL (n=10)**						**DL (n=16)**					
Sub-category	No problem		Had problem/Solved		Had problem/Not Solved		No problem		Had problem/Solved		Had problem/Not Solved	
Category	Σf	Σf/n	Σf	Σf/n	Σf	Σf/n	Σf	Σf/n	Σf	Σf/n	Σf	Σf/n
Problems	7	0.70	3	0.30	-	-	7	0,43	4	0.25	5	0.31
Solution to Problems	-	-	5	0.50	-	-	-	-	17	1.06	5	0.31

Learning Approach	Should be used		Should not be used		Sometimes should be used		Should not be used		Two Approaches Should Be Used Together	
	Σf	Σf/n	Σf	Σf/n	Σf	Σf/n	Σf	Σf/n	Σf	Σf/n
	57	5.7	-	-	2	0.125	24	1.5	16	1

According to Table 15, the ratio of the views stating that no problem was encountered to the number of pre-service teachers is 0.70 for BL; the ratio of views expressing that they encountered difficulties but solved is 0.30. Therefore, all of the 10 pre-service teachers in the BL group did not encounter any problems that could not be solved during the implementation process. On the other hand, the ratio of the views stating that no problem was encountered to the number of pre-service teachers is 0.43 for DL; the ratio of views expressing that they encountered difficulties but solved is 0.25. Moreover, the ratio of the views stating that they encountered a problem and it was not resolved to the number of pre-service teachers is 0.31 for DL. It can be said that these figures are high considering the number of pre-service teachers. Accordingly, pre-service teachers are more satisfied with BL-based instruction than DL-based one. In Table 15, all BL group pre-service teachers recommended using this approach as a teaching method in other courses, with 57 positive views. On the other hand, all DL group pre-service teachers stated that this approach should be used along with face-to-face education, and it should not be used as a teaching method alone, with 24 negative views.

4. Discussion, Conclusion, and Implication

None of the pre-service mathematics teachers in the BL group expressed a negative view for the BL approach. All of the pre-service teachers' views on BL are positive. The views concentrate on time, method, motivation, attention and focus, learning and getting feedback, communication and interaction, access to resources, technology, and cost categories. Pre-service teachers stated that with BL, they could use their time effectively and efficiently, spare time for social activities, overcome any difficulties in learning with the advantages offered by BL, and focus on learning better. They stated that they were not isolated from the course in the BL learning environment; on the contrary, they felt a sense of belonging to the course environment, which increased their motivation. Pre-service teachers also stated that they received significant support from the instructors in creating a productive course environment, helping learning and teaching, communicating, and providing guidance. In this category, pre-service teachers particularly welcomed the instructor's nonverbal communication with eye contact, quick feedback on their work, and different teaching methods used in the lessons. They stated that he/she made it easier to focus on the lesson, focus their attention, and helped to increase their motivation. Pre-service teachers stated that they acquired various cognitive and affective gains through BL. They acquired the “Algebra Teaching" field knowledge, method knowledge, and teaching profession knowledge in the cognitive dimension. They gained the habit of taking responsibility for self-learning and self-studying in the affective dimension. Accordingly, they favored using the BL approach in other courses in the faculty. These views of pre-service teachers, who stated that they obtained learning opportunities by studying individually and independently with BL, are in line with the study results conducted by Finn and Bucceri (2004). The view that online and face-to-face courses in BL eliminate the disadvantages of each other and thus create efficient learning environments is in line with the result of the study conducted by Akkoyunlu & Yılmaz Soylu (2006). Pre-service teachers’ positive views for BL regarding access to resources, time management, strong communication and interaction, and favoring similar practices in other lessons are also supported by the results of other studies on BL (Aycock, Garnham, & Kaleta, 2002; Cottrell & Robinson, 2003; Taradi et al., 2005).

Pre-service teachers who participated in the BL and DL applications did not mention any negative views in the "Views on the gains thought to be acquired from the course” category. However, the number of positive views of BL group pre-service teachers is higher than the DL group. In BL, pre-service teachers stated that they acquired the course gains and gained skills such as working independently and together, learning at their own pace, and learning to learn. On the other hand, although this study was not structured as quantitative research, according to the statements of pre-service teachers, this situation can be seen in their course success. In this context, the positive results of

studies examining student achievement in BL, conducted by Garrison and Kanuka (2004), Rovai and Jordan (2004), Ekici and Karaman (2011), Yıldız (2011), Demirkol (2012), Pesen and Oral (2016) and Usta (2007) are similar to the results of this study.

Pre-service teachers in the BL group stated that their motivation increased, they were able to focus their attention on the lesson by establishing eye contact in face-to-face lessons, they could express themselves, they felt comfortable, had a sense of belonging to the class, and they were happy to be in such a classroom environment. On the other hand, in the DL group, pre-service teachers stated that their motivation decreased, their interest in the lesson decreased, and they could not focus their attention and concentrate on the study because they felt isolated from the lesson. The results of the studies conducted by Akkuş and Keskin (2016) and Pesen and Oral (2016) examining the motivation levels and beliefs of pre-service teachers and university students in BL environments are similar to the results of this study for BL but not for DL.

One of the reasons that pre-service teachers of the DL group have encountered problems accessing the internet was the lack of appropriate technical infrastructure. This outcome also is supported by the results of studies conducted by Özkaraca (2005), Gossenheimer et al. (2017), and Naidu (2019), concluding that problems such as the lack of appropriate technical infrastructure negatively affect distance education. Pre-service teachers stated that there was not enough communication and interaction in the DL group. They complained about not receiving feedback on their homework on time, which affected their course achievement. Yorgancı (2014) stated that one of the most important disadvantages of asynchronous education is delayed interaction and communication. In this context, pre-service teachers' views are parallel to Yorgancı's study results (2014). As a suggestion for this situation, it would be appropriate to conduct synchronous and asynchronous training in a way that complements each other (Duran, Önal, & Kurtuluş, 2006; Hratinski, 2008, cited in Yorgancı, 2014, Yorgancı, 2014). In this study, synchronous and asynchronous training was carried out to complement each other in the DL group. However, it did not satisfy pre-service teachers enough. Because pre-service teachers of the DL group stated that they did not feel a sense of belonging to the course, they could not express themselves fully, fell away, and became alienated from the course. These views are in line with the results of studies in the literature. One of the problems experienced in distance education environments is that students fail to have a sense of community, and various pedagogical-communication problems emerge (McMillan & Chavis, 1986; Ilgaz & Aşkar, 2009; Öztürk, 2009; Öztürk & Deryakulu, 2011). In addition, one of the results of these studies is that students' achievement and performance were affected by this. The views of the pre-service teachers in the DL group were in this direction. Similarly, Kang et al. (2011) and Öztürk and Deryakulu (2011) stated that if students do not have a sense of community and belonging in distance education environments, they are largely isolated from the system. The pre-service teachers in the DL group welcomed the advantages of distance education, such as being

flexible in terms of time and location. Studies in the literature support such views of pre-service teachers (Arkorful & Abaidoo, 2015; Dumford & Miller, 2018; Naidu, 2019; Nicholson, 2002; Sadeghi, 2019; Santana de Oliveira, Torres Penedo, & Pereira, 2018).

The views of pre-service mathematics teachers in the DL group are mostly negative. In addition, contrary to the concepts such as "self-learning," "self-studying," "learning at one's own pace," and "taking responsibility for own learning" adopted by contemporary learning and teaching approaches, the majority of pre-service teachers in DL group complained about performing the actions required by these concepts. They said they worked harder and took their learning responsibility but reflected these as negativities. The reasons for these views can be found in the answers they gave in other categories. The reasons why pre-service teachers complain about concepts such as "self-learning" and "taking responsibility for own learning" are that they have to do research on the computer constantly, they cannot ask questions as they wish, they are mostly misunderstood because they cannot express themselves adequately in online lessons, they cannot communicate properly with each other, and the instructor, they get away from the lesson because they do not feel a sense of belonging to the lesson, and they experience problems with internet access. As a result of all these, they fail to focus on the lesson, and their motivation decreases. In addition, pre-service teachers talked about inactivity, physical fatigue, stress, various joint pains, and being psychologically tired. All these situations may have caused pre-service teachers to fail to understand the purpose and gains of the course properly. In parallel with these pre-service teachers' views, who are not satisfied with the DL practices, they favored not implementing the DL approach in other faculty courses; it may be appropriate to apply it in the theoretical courses for a short time if needed. Pre-service teachers of the DL group stated that they acquired Algebra Teaching content knowledge and pedagogical content knowledge in the DL process. However, they did not mention any gains similar to the gains that BL group pre-service teachers acquired in the affective dimension, which is very interesting. This situation coincides with the criticism stated in DL studies, i.e., DL neglects the affective dimension because it mostly focuses on the technological infrastructure, and there are few studies on this subject.

Pre-service teachers found BL-based implementation more positive than DL-based one. Pre-service teachers did not express negative views on the BL approach in any category. On the contrary, the BL group (527 positive views) expressed 265 views in the "General views," 124 in "Views on Instructor Support," 71 in " Views on the gains thought to be acquired from the course," and 57 in "Views on using the teaching method in other courses" categories, the opinions in these categories are pretty above of the number of views on the DL approach (209 positive views). When these numbers are divided by the number of pre-service teachers in the BL and DL groups, the result in favor of BL gets more apparent (see Table 14). It is possible to list the reasons for the differences between these two approaches by reviewing pre-service teachers' views. As both face-to-face and

online lessons were performed in BL, if a problem occurs, it is solved thanks to the opportunities offered by BL. For BL, pre-service teachers stated that they could communicate face-to-face with their classmates and instructor, do group work together, get instant feedback on their assignments and homework, focus on the lesson better because they express themselves more easily face to face, feel that they belong to the lesson and the class, their motivation is increased, and they work better. On the other hand, regarding DL, pre-service teachers stated that the experienced negativities that caused them to fail to acquire the course gains, decreased their interest and motivation towards the course, and alienated them from the course even though they had easy access to the resources, had the opportunity to follow the lessons synchronously and asynchronously and the resources were diversified. According to the pre-service teachers, the most important problems in DL are access to the internet, technical problems, poor communication, failing to express oneself comfortably in the virtual environment, and the lack of interaction at the desired level. Moreover, the lack of quick feedback on their homework and health problems they experienced can also be named as the reasons for their negative views. In this context, it can be concluded from these findings that using BL as a teaching approach is more advantageous than DL. Some of the pre-service teachers in the DL group did not see gaining self-confidence through studying individually and independently as an advantage. They reflected this as a disadvantage by stating that they had to work more individually and all the responsibility of learning belonged to them, which is also an interesting result. Because the educational approaches of our age aim to enable students to produce knowledge rather than to learn it and integrate their knowledge with skills and abilities to create innovative products, students should learn to learn independently by revealing their abilities and take responsibility for their learning to achieve this. The difficulties experienced by pre-service teachers in adapting to a new learning environment after getting away from the learning environment they are used to and the challenges of the learning process might have caused them to see this situation as a disadvantage. In the BL approach, pre-service teachers saw the use of different methods as an advantage for their success and expressed it with positive views. DL group pre-service teachers' views may result from the lack of a sense of belonging to the lesson and the environment, failure to express themselves fully, alienation from the lesson due to the lack of good communication and interaction, and lack of a sense of belonging to the community. Because, in the BL approach, pre-service teachers stated that they were happy to take the responsibilities of learning and share what they learned with the group and the class. As a result, these negativities in the views expressed for DL were not observed in BL group pre-service teachers.

Regarding the BL and DL approaches, pre-service teachers declared similar and positive views in "Access to resources", "Views on Instructor Support," and "Views on the gains thought to be acquired from the course". However, in the review of both approaches

regarding the acquisition of gains and instructor support, there are more views for BL, and they are dominant. Especially in BL, pre-service teachers stated that they were very satisfied with the verbal and non-verbal communication established by the instructor in face-to-face lessons; consequently, they were better motivated and focused on the lesson. On the other hand, in DL, insufficient communication and interaction is the category in which pre-service teachers expressed the most negative views. They pointed out this deficiency in DL as one of the reasons for their failure in the course. Based on these findings, it can be concluded that the acquired gains and instructor support are better in BL than in DL.

As a result, the study revealed that the pre-service teachers found the BL approach more positive than the DL because of many advantages provided by the BL approach. As the BL approach allows face-to-face and online lessons, they believe they do not have any losses. For the DL approach (see Table 8), most pre-service teachers stated that they faced many challenges and negativities. The numerical data in Table 14 and Table 15 show the disposition of pre-service teachers towards both approaches. In this context, pre-service teachers expressed their views in favor of not using the DL approach in other courses and applied courses and provided clear reasons. On the other hand, BL group pre-service teachers agreed that using the BL approach in all courses would be beneficial and stated they were satisfied with the application. The pre-service teachers in the DL group suggested that online and face-to-face lessons should be conducted together. This suggestion is in line with the views of BL group pre-service teachers. From this, it can be concluded that the BL approach is more advantageous than the DL approach and is preferred by pre-service teachers. Because according to pre-service teachers, BL offers various solutions to overcome the disadvantages of DL. Studies in the literature also support this view.

This study has some limitations. This study was carried out in a state university in Turkey's Western Black Sea Region, in the "Algebra Teaching" course, with 26 pre-service mathematics teachers in the classes where the BL and DL approaches were implemented. It is limited to 12 weeks. Pre-service teachers received distance education for one year before the application, which shows their DL experience and, therefore, their knowledge of LMS. Based on the results of this research, it can be suggested that the BL approach could be used in lessons following our age's learning and teaching approaches. In this case, according to the results of this study, using the BL approach in learning will help pre-service teachers gain many skills such as using technology effectively, using time efficiently, and taking responsibility for learning. It is suggested to apply this study to wider samples in different subjects and courses. It can be applied to teachers and students, and the results can be compared. It is recommended to carry out studies on the BL approach using quantitative methods and analyze its effects on course achievement, motivation, self-efficacy, and skills such as problem-solving.

Acknowledgements

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