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The Effect of the Online Flipped Learning Model in Higher Education: Examination of Students' Engagement, Views and Experiences

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Abstract: This study analyzed the effect of online flipped learning model (OFLM) on university students' online learning environment engagement. In addition, students' views about experiences in flipped teaching implementation were examined. The participants consisted of 34 students who were in the 2nd year of a primary school mathematics teaching program at a state university in Türkiye and who enrolled in the Approaches to Learning and Teaching Mathematics course taught online during the COVID-19 pandemic period. Quantitative and qualitative methods were simultaneously used to capture a holistic perspective. The quantitative data were obtained from the student engagement scale, and the qualitative data from the reflective diaries written by the students. The results revealed that OFLM had a positive and significant effect on students' learning environment engagement when compared before and after the implementation process. Considering the factors of engagement scale, a significant increase was identified across the students' behavioral and emotional engagement. However, no significant increase was noted across their cognitive engagement. The positive effect of OFLM on students' engagement was also observed in reflective diaries written by the students during the implementation process. In this regard, the majority of the students reported that OFLM provided effective and active teaching, they had a lot of fun during the process, and their interest increased in the lesson. The qualitative results confirmed those of quantitative and revealed the reasons for the significant increase in students' engagement. The results of the present study yield strong evidence for the flipped learning to improve student engagement. This study harmonizes that flipped learning can be applied effectively in online education, and thus increasing students' learning environment engagement.

Keywords: Online learning, flipped learning model, student engagement, elementary mathematics, pre-service teacher

Highlights

What is already known about this topic:

- Student engagement is a very effective factor on variables such as students' motivation, course attendance and academic success.
- How to ensure engagement in the online environment is one of the main concerns.
- The online flipped learning model is a promising strategy that can be used to solve the educational problems in distance education.

What this paper contributes:

- Online flipped learning has a positive and significant effect on the engagement.
- Participants think that online flipped teaching is an effective and active way of teaching.
- The participants stated that the negative aspect of online flipped teaching are that technical problems, time and effort require, and therefore it is a tiring application.

Implications for theory, practice and/or policy:

- Planning a flexible application in accordance with individual characteristics in flipped education will lead to more positive results.
- If longitudinal studies are carried out in long-term studies, the effect of time factor on commitment in online flipped teaching can be revealed.

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Introduction

With the advances in information and communication technologies, especially in recent years, distance education is in an effort to integrate into education through different purposes and resources. While these developments continued, the main agenda of education swiftly became distance education with the COVID-19 pandemic. Face-to-face education had to be suspended in higher institutions, as in other education levels due to the COVID-19 pandemic all over the world, and distance education was the only solution to prevent the interruption of education. This sudden and compulsory transition to distance education has led to hot discussions on various issues such as teaching, learning, educational administration and teaching effectiveness in distance education (Ma, 2020).

Numerous studies on distance education conducted before the pandemic and particularly after the COVID-19 revealed that university students encountered problems in distance education and had negative views towards the learning process (Adnan & Anwar, 2020; Aguilera-Hermida, 2020; Dhawan, 2020; Parkes et al., 2014; Simonova et al., 2021; Song et al., 2004). The main concerns raised by the students were identified as lack of interaction with other students and instructors, lack of possibilities of receiving immediate feedback, lack of a sense of belonging to a community, low learning efficiency due to complicated communication processes and technical difficulties in an online format (Xin, et al., 2015). Aguilera-Hermida (2020) noted that university students' motivation, self-efficacy and cognitive engagement decreased after the transition to distance education with the COVID-19 pandemic and only their use of technology increased. On the other, Bolliger and Martin (2018) suggested that online learning is an educational option that offers flexibility and convenience to learners, the main issues of concern prevail with keeping students motivated and ensuring their engagement in the online setting, as in face-to-face education. All the above-mentioned studies indicate a need for good online education planning in order to overcome all these difficulties during the online education process. As Bozkurt and Sharma (2021) states, educators should consider putting learning interactions at the center of planning, designing and presenting online learning, being aware of the fact that interactions in the learning process help students learn and affect their satisfaction.

UNESCO (2020) stressed that individual differences should be taken into account and blended learning approaches that will support both synchronous and asynchronous learning as well as appropriate learning platforms should be utilized to plan effectively in online education. Besides, learning periods should be differentiated according to students' self-regulation skills, and learning processes should be monitored. Even if students participate in online courses in distance education, this does not mean that they benefit from teaching as they should (Greener, 2020), and alternative teaching approaches such as engaging and collaborative learning that ensure active participation should be incorporated in planning (Ma, 2020; Marshall & Kostka, 2020). At that point, it is likely that an entire online flipped learning model, which is structured by utilizing the theoretical foundations of the traditional flipped learning model, is a promising strategy that can be used to promote active learning in distance education (Hew et al., 2020; Liu et al., 2020; Ma, 2020; Marshall and Kostka, 2020; Tang et al., 2020; Yen, 2020).

Literature

Online Flipped Learning

The basic notion of flipped learning model (FLM) is that "the teacher delivers the lectures before the class through videos and other types of materials in order to free up the in-class time for active learning activities in the classroom" (Lo & Hew, 2017; Murphy et al., 2016). FLM refers to combining of the face-to-face and the distance education (Hayırsever & Orhan, 2018). In the distance education part of FLM, students learn the fundamental content about the course thanks to the technological access provided by their teachers before the class. Thanks to the temporal and spatial flexibility offered by distance education, the content can be arranged according to the learning speeds and levels of the students. The

face-to-face education part includes activities based on active learning approach for students to learn the subject in-depth in the classroom. (Boz-Yaman & Sezen-Yüksel, 2017).

Flipped Learning Network (FLN) (2014) explained the four pillars of FLM. (1) Flexible environment refers to providing students with spaces about where and when they learn. (2) Learning culture emphasizes active learning in accordance with students' learning styles and self-assessment of their own learning. (3) Intentional content signifies the student-centered design of relevant content by teachers to foster and facilitate students' learning outside of the classroom. (4) Professional educator implicates that the teacher plans the learning process effectively, make effective observations inside and outside the classroom, and provide feedback relevant in the moment. Only if FLM is implemented by considering these components, have students more opportunities in various subjects such as accessing extensive educational resources, active engagement in the lesson, and interaction with their peers and teacher (Gilboy et al., 2015; McLean, et al., 2016). As proven in many literature review studies on flipped learning, FLM has positive effects on educational outcomes such as students' motivation, academic success and self-learning, critical thinking and their problem solving skills (Akçayır & Akçayır, 2018; Lag et al., 2019; Tan et al., 2017; Yıldırım Yakar, 2021). Similarly, in a systematic review study conducted by Ashraf et al. (2021), it was revealed that blended learning improves students' self-regulation, satisfaction and participation in learning from an affective perspective, and also supports students' academic performance in different subject areas from a behavioral perspective.

Flipped learning is a submodel of blended learning that aims to link traditional face-to-face teaching to online educational activities with the engagement of students and teachers (Singh, 2003). In this vein, flipped learning is a model that has a wide range of design possibilities and that can be easily adapted to various teaching environments (Graham et al., 2013). Marshall and Kostka (2020) concluded that the pillars of FLM are applicable to distance education in line with conventional face-to-face education. Teachers hold many options for creating a flexible environment by determining how to learn in the asynchronous and synchronous sessions. In addition, intentional content pillar asks teachers to diversify the materials and make them more engaged and differentiated for each student in the asynchronous and synchronous settings. Finally, professional educator pillar outlines how teachers provide formative and summative feedback to students in both synchronous and asynchronous settings. Taken together, FLM has become a promising model in the discussions on how to boost online education, especially during the COVID-19 pandemic, where conventional education was interrupted (Tang et al., 2020).

Flipped Learning Model

Since FLM (Guraya, 2020), one of the most prominent education approaches during the COVID-19 pandemic, also uses online resources for teaching, it is believed that its combination with online teaching may open up a new blended learning model and increase the effectiveness of online learning (Tang et al., 2020). Hence, the online flipped learning model (OFLM), the combination of the convenience and flexibility of the online environment with the dynamic environment and effect of flipped learning, is regarded as an innovative and effective way of teaching (Knapp, 2018; Shih & Tsai, 2017). Contrary to the conventional flipped learning model where online self-learning and face-to-face classroom education coexist, OFLM asks students to meet in an online environment rather than physically (Stohr et al., 2020). As in the conventional flipped classroom model, OFLM enables students to come to the lesson prepared by completing the activities before the lesson (watching video lessons, completing asynchronous learning activities, etc.), and thus, they can benefit from active and cooperative learning activities in the simultaneous classroom environment (Lin et al., 2019).

The relevant literature highlights that effective and efficient online learning depends on constructive and regular communication with students (Lambrinidis, 2014; Stone, 2017; Vincenzes & Drew, 2017), which is also a notion of FLM referring to interactive and engaging course design and presentation (DoDevlin & McKay, 2016; Park & Choi, 2009). This is confirmed by studies on the integration of flipped learning

into distance education during the COVID-19 pandemic (Hew et al., 2020; Khodaei et al., 2022; Lo, 2022; Ma & Luo, 2022; Tang et al., 2020). The results of these studies assured that participants in fully online flipped classrooms perform as effectively as those in conventional flipped learning classrooms (Hew et al., 2020), students in an online flipped class have a very positive perception towards this method (Lo, 2022; Ma & Luo, 2022), OFLM improves students' learning, attention and evaluation of lessons (Tang et al., 2020) and that students' metacognitive awareness and readiness for self-directed learning change significantly after the implementation (Khodaei et al., 2022).

Being a new educational approach, the literature lacks studies on showing OFLM's effect and how it can be applied (Hew et al., 2020). Stohr et al. (2020) emphasized the importance of adapting the flipped learning-based teaching, which is mostly researched in conventional face-to-face education, to the online environment and to analyze the reflections of a course design on distance education from different perspectives.

Student Engagement

The literature argues that no matter which teaching method is applied in online learning, student engagement, which is one of the primary components of effective teaching and which is critical for learning, should be ensured. Because student engagement, a key indicator of successfully completing a course, is closely related to course design and learning experiences (Barkley, 2010; Lin et al., 2019; Soffer & Cohen, 2019).

Referring to the quality of the effort that students expend to perform well (Richardson & Newby, 2006), engagement is generally defined in three ways as behavioral, emotional and cognitive. Behavioral engagement includes students' involvement in academic, social, or extracurricular activities and observable behaviors. Emotional engagement encompasses experiencing various feelings such as belonging, trust, and anxiety towards teachers, classmates and the learning environment. Finally, cognitive engagement includes students' willingness to exert the effort to understand the subject and skills (Fredricks et al., 2004). This study draws the picture on examining student engagement in three ways including cognitive, emotional and behavioral dimensions.

Aim and Significance of the Study

Student engagement has been growing popularity in studies (Fredricks et al., 2004, Fredricks et al., 2005) owing to being an effective factor on variables such as student engagement, motivation, attendance and academic achievement (Bates & Khasawneh, 2007; Meyer, 2014). The number of studies analyzing the potential of instructional designs through using educational technologies to increase student engagement is increasing especially in higher education (Bond, 2020). Various studies examining the effect of conventional flipped learning on student engagement found evidence of increased engagement (Chen, Lui, & Martinelli, 2017; Cronhjort et al., 2018; Hava, 2021; Jamaludin & Osman, 2014; Lo & Hew, 2021; Steen-Utheim, & Foldnes, 2018). Besides, the related literature holds a limited number of studies on examining the effect of FLM, which is used entirely in the online learning environment, on student engagement (Chan et al., 2021; Lee et al., 2021; Lin et al., 2019; Phillips & O'Flaherty, 2019; Riel, 2021). Unlike the current study, these studies did not discuss student engagement as a whole with its emotional, behavioral and cognitive dimensions, but analyzed from different perspectives, especially in terms of student satisfaction. These studies were carried out with university students, as in the present study. To exemplify, Lin et al. (2019) noted that flipped learning activities are successfully applicable to a completely online course. This study suggests that students who examined video recordings in online flipped teaching were more engaged in simultaneous learning activities and achieved higher course success. Moreover, students with high readiness and attendance to synchronous classes on time have more frequent and active interactions with their peers and instructors. Phillips and O'Flaherty (2019) examined the engagement of students who received online

flipped education compared to those with both online and face-to-face education. The results demonstrated that flipped learning provides more opportunities for students to participate more deeply in the learning process and develop higher order thinking skills. Riel (2021) compared the effect of online flipped teaching model and traditional face-to-face course-based teaching on student engagement, and as a result, online flipped teaching was identified to increase student engagement more.

As mentioned above, few studies were conducted to provide sufficient evidence regarding the direct effect of OFLM on students' emotional, behavioral and cognitive engagement. Thus, this study, whose focus is the effect of flipped instructional design on student engagement in online education, will contribute to fill the gap in the literature. Another significant aspect of the present study is that the participants were primary school mathematics teaching students who had to take some of their courses through compulsory distance education due to the COVID-19 pandemic. The results of the current study are expected to shed light onto the improvement studies that can be held about distance education since problems related to the university students' adoption of online teaching and their attention in these lessons have been identified (Tang et al., 2020). Increasing engagement in an online learning environment where students' attrition rate is higher compared to conventional face-to-face education is critical for educators whose goal is to ensure effective education (Angelino et al., 2007). Based on this idea, the present study is expected to guide educators who are concerned about whether flipped instructional design can be applied online as well as the possible outcomes of the application. Hence, this study is an attempt to reveal the effect of online teaching-based flipped learning model on student engagement and students' experiences with this online teaching approach. In service of this aim, answers to the following research questions were sought:

- RQ1. What is the effect of the online flipped learning model on the primary school mathematics teaching students' engagement?
- RQ2. What are the primary school mathematics teaching students' views and experiences with the online flipped learning process?

Methodology

Research Model/Design

This study deployed the embedded mixed method (Creswell, 2012), in which the quantitative and qualitative data is used to support the other. In the quantitative phase of the study, one group pre-test-post-test weak experimental design was used to examine the change in students' learning environment engagement after the online flipped teaching implementation. In order to support this experimental design, the case study design was employed to comprehend the students' experiences and thoughts during the implementation process. Case studies attempt to consider human activities, whose precise boundaries are difficult to draw, in their real world and seek the evidences in the environment to get the best answers to specific research questions (Gilham, 2000). In this regard, qualitative data were collected throughout the implementation process by requesting students to fill in reflective diaries on a weekly basis.

Data Collecting Tools

Student Engagement Scale

The "Student Engagement Scale" developed by Sun and Rueda (2012) and adapted into Turkish by Ergün and Usluel (2015) was employed to determine students' engagement to the online learning environment. The tool holds a total of 19 items and three factors: emotional, cognitive and behavioral engagement in the original scale. The instrument used a five-point Likert rating strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5). The scores that can be obtained from the scale vary between 19 and 95. The Turkish adaptation of the scale was

administered to 398 students studying in different departments at the Faculty of Education. The confirmatory factor analysis results suggested that the model fits at a satisfactory level and 19 items of the scale also fit with the factors in the original form. The Cronbach's alpha value was calculated as 0.90 for the entire scale. On the basis of factor scores, the Cronbach's alpha value was calculated as .62 for behavioral engagement (5 items), .90 for emotional engagement (6 items) and .86 for cognitive engagement (8 items), respectively.

Reflective Diary

This study also used the reflective diary as a data collection tool to determine the students' experiences and views in the online flipped learning process. Reflective diaries offer students to convey their individual feelings, thoughts and experiences regarding the learning process or its content (Wilson & Jan, 1993). Questions that will enable students to reflect can be asked or they can be left free in diary writing depending on the situation (Moon, 2006). In the present study, students were requested to fill in reflective diaries by responding the following questions. The first 3 of these questions were asked each week of the three-week implementation, the 4th question was asked only in the 1st and 2nd weeks, and the 5th question was only in the 3rd week.

The questions in the reflective diary are as following;
1. What studies were completed this week? Which of these did you consider yourself insufficient or sufficient? If you think you did incomplete work, what was the situation or situations causing it?
2. How did you feel emotionally in your experience this week?
3. How do you evaluate this week's practice? (Positive or negative)
4. What do you plan to do in the next week's practice?
5. What were the positive or negative sides of these courses, which we taught through the use of the flipped learning model, compared to other online courses?

Data Collection Process

Necessary permissions were initially obtained from the university where the trial would be carried out and where the researcher worked as a faculty member. Google Form including the Student Engagement Scale was prepared before starting the implementation to collect the quantitative data. The link of Google Forms was sent to the students enrolled in the course via e-mail, and they were provided to answer as a pre-test. Following the online flipped teaching implementation that lasted for three weeks, the Student Engagement Scale was administered to the students as a post-test with the same method. Similarly, reflective diaries were administered to the students through Google forms. They were sent to the students three times in total during the online flipped teaching implementation process.

Study Group

The study was conducted with students studying in the second year of the primary school mathematics teaching program at a medium-sized state university in Türkiye. Approximately 40% of the courses in each program were taught online due to the COVID-19 outbreak during the fall semester of the 2021-2022 academic year. The participants consisted of 37 students who regularly attended live classes among 47 students that were enrolled in the Approaches to Learning and Teaching Mathematics (ALTM) course, which was taught completely online with compulsory attendance. However, the study was finalized with the participation of 34 students (26 females, 8 males) since 3 students did not respond the pre-test or post-test. These students have not previously experienced flipped learning in both face-to-face and online courses. The reason why the study was carried out in the ALTM course is that the flipped learning model (FLM) will be introduced to the students as an alternative teaching approach within the scope of this course and it is appropriate to design the weekly course contents with ALTM.

Data Analysis

Quantitative data obtained from the online learning environment engagement scale were transferred to an Excel file and the data list was entered into the SPSS 20 program to analyze the elicited data. Some students were excluded from the sample due to the lack of pretest or posttest data. The presence of multivariate outliers in the responses was examined separately for the Mahalanobis distance and for the pre- and post-implementation, and no problem was observed in the response of any student. The total scores obtained from the pre- and post-test and the factors' total scores were converted into standard Z scores to examine univariate outliers. The results suggested that all Z scores were in the range of ± 3 and there were no extreme values. Besides, this study analyzed whether the data met the normality assumptions. Considering the total scores of 34 individuals who participated in the pre- and post-test, the number of individuals was over 30, the skewness and kurtosis coefficients were in the range of ± 1, and the division of the skewness and kurtosis coefficients by the standard errors was in the range of ± 1.96. Data demonstrated a normal distribution since the Kolmogorov-Smirnov test was insignificant ($p>.05$) and the total score histogram graphs showed normal distribution. Therefore, paired samples t-test was employed to analyze whether the difference between the mean of the pre- and post-test scores was significant.

The qualitative data were obtained from the reflective diaries that the students filled out on Goggle Forms at the end of each week during the 3-week implementation period. Content analysis was used during qualitative data analysis. The reflective diaries were read and coded several times. Moreover, the researcher repeated the coding with an interval of approximately one week to ensure reliability. The views of the experts in the field of measurement and evaluation were taken into account in case of conflict in coding.

Research Procedures

The study was carried out within the scope of Approaches to Learning and Teaching Mathematics (ALTM) course in the third semester of the primary education mathematics teaching program. The teaching process was conducted with distance education via the learning management system (LMS) and Zoom, an online conference tool, due to the COVID-19 pandemic. The objective of this course, which is taught synchronously for 2 hours a week, is to foster students to learn and evaluate new approaches that can be applied in mathematics education.

"Multiple representations and their use in mathematics teaching", "problem-based teaching method and application samples" and "mathematics teaching through discovery learning technique" were planned and taught in accordance with flipped learning method for the three-week (11th, 12th and 13th weeks of the course period) experimental implementation. Table 1 depicts the learning outcomes of these subjects.

Table 1. Topics and learning outcomes within the scope of the implementation

Week	Subject	Learning outcomes
1st	Multiple representations and their use in mathematics teaching	-Knows multiple representation types. -Explains the importance of representations for mathematics education. -Designs a mathematics teaching activity with representations.
2nd	Problem-based teaching method and application samples	-Knows different approaches related to problem and problem solving. -Knows the types of problems and problem solving strategies. -Designs a problem-based course teaching.
3rd	Mathematics teaching through discovery learning technique	-Explains the method of teaching mathematics through discovery. -Applies teaching through discovery to the subject area of mathematics.

The students were informed about the flipped learning approach the week before the implementation. Afterwards, the activities to be carried out within the scope of the online flipped learning, what the students would learn in these activities, what their responsibilities were and how the evaluation would be made were explained in detail. The contribution of the maximum 36 points that can be obtained from these three-week activities to the final grade of the course was determined as 36% (the final exam is max. 64 points). Students' interest was kept alive during the implementation process thanks to the impact of the activities on the course grade. Table 2 displays the weekly planned pre-lesson activities, in-class activities and the evaluation score of each activity.

Table 2. Activities and their scoring

Pre-lesson preparation activities (8 points)	**In-class activities (participation in live class 2 points)**	**After class activity (2 points)**
- Watching videos uploaded to LMS (2 points) -Participating in the discussion in LMS forum (2 points) -Completing the given tasks and uploading them to LMS (4 points)	- Discussing the weekly tasks before the lesson in groups of 3 or 4 randomly created in the zoom breakroom application for approximately 25 minutes, - Participation of the course administrator as a listener in the groups, - Termination of groups, - The general evaluation of each group discussion is shared with the class by at least one student and the class discussion is made in the remaining time.	- Completing reflective diaries via Google forms (2 points)

As is seen in Table 2, the students carried out pre-lesson preparation activities through LMS. The subject videos that students watched before the lesson were prepared on Zoom by the instructor of the lesson. These preparatory videos and sample resources for students to read (articles, thesis, etc.) were uploaded to LMS. Besides, a forum was started in LMS, enabling students to ask questions regarding the subject and share their ideas. The synchronous processing of the lessons was carried out in 3 sessions of 40 minutes each via Zoom. The videos of the live lessons were uploaded to the LMS at the end of the lesson so that the students could watch it once more again. The students wrote their reflective diaries on Google forms after the lesson. The instructor of the course shared with the students how and when these activities would be carried out, and monitored the status of the activities and gave directions. Interaction was ensured between the tasks and the student and the instructor during the process.
Pre-service teachers showed more interest than estimated in pre-lesson activities during the three-week implementation period. Table 3 suggests the pre-lesson activities of the implementation process and the numerical data related to the students' interaction with them.

Table 3. Numerical data related to students' interactions with pre-lesson activities

1st week			
Video 1	**Video 2**		**Forum**
Title: Multiple representation types Duration: 16:57 min Number of students watching:47 Number of views:139	Title: Importance and use of Multiple Representations Duration: 21:03 min Number of students watching: 47 Number of views:129		Number of students who wrote: 35 Number of views: 716
Task 1		**Task 2**	
Subject: Students' evaluation of emphasizing multiple representations in secondary school numbers and operations learning outcomes through examining the Mathematics Curriculum. Number of students uploading:41		Subject: Creating an example for the use of multiple representations to provide conceptual learning about ratio and proportion in secondary school mathematics teaching. Number of students uploading: 40	
2nd week			
Video 1	**Video 2**	**Video 3**	**Forum**
Title: What is the problem? Duration: 14:12 min Number of students watching: 45 Number of views:104	Title: What is problem solving? Duration: 09:40 min Number of students watching:42 Number of views:94	Title: Problem solving strategies Duration: 12:26 min Number of students watching:42 Number of views:84	Number of students who wrote: 31 Number of views: 571

Task 1 Subject: Students report the inclusion of sample problem situations related to the problem-solving stages of Polya (1) and the inclusion of non-routine problems in the questions at the end-of-topic evaluation sections (2) by reviewing a unit in the 6th grade mathematics textbook uploaded to ALMS Number of students uploading: 40	**Task 2** Subject: Students determine a learning outcome in secondary school mathematics and create a problem that can be used for this (1), and sample solution of this problem with two different strategies and according to Polya's problem-solving stages Number of students uploading: 39

3rd week

Video 1	**Video 2**	**Forum**
Title: Teaching mathematics through discovery Duration: 09:02 min Number of students watching: 45 Number of views:73	Title: Sample activities for discovery learning Duration: 14:58 min Number of students watching: 44 Number of views:87	Number of students who wrote: 32 Number of views: 498

Task 1 Subject: Students' evaluation of whether there are activities that enable learning through discovery by examining a unit in the 6th grade mathematics textbook. Number of students uploading: 37	**Task 2** Subject: Students prepare an activity that enables learning through discovery on a given mathematics topic (for example, multiplication with decimals) Number of students uploading: 38

As in Table 3, a slight decrease was identified in the numerical values of participation, which is an indicator of the interaction between the students and the activities, towards the last week.

Findings and Discussions

Findings related to the first research question

This study aims at revealing as to whether a significant difference was identified across the students' online learning environment engagement regarding OFLM. Therefore, paired samples t-test was used to determine the difference across the pretest and posttest mean scores related to "student engagement scale". Table 4 shows the arithmetic mean, standard deviation, skewness, kurtosis, minimum and maximum values of the scores students had in the pre-test and post-test.

Table 4. Student engagement pre-test and post-test scores

Dimension	Test	*N*	$\overline{X}$	Sd	Min	Max	Skewness	Kurtosis
Behavioral engagement	Pre test	34	16,82	2,93	11	23	0, 131	-0,576
	Post test	34	18,32	3,17	10	24	-0,537	-0,592
Emotional engagement	Pre test	34	16,52	5,05	6	25	0,253	-0,385
	Post test	34	18,38	4,84	9	29	-0,360	-0,150
Cognitive engagement	Pre test	34	29,73	3,00	23	35	-0,006	-0,261
	Post test	34	30,05	3,75	22	36	-0,176	-0,762
Total	Pre test	34	63,09	9,117	45	81	0,369	-0,373
	Post test	34	66,76	10,216	44	86	-0,319	-0,564

As in Table 4, the lowest score obtained from the pre-test is 45 and the highest score is 81, while the lowest score obtained from the post-test is 44, and the highest score is 86. Table 4 also reveals that the mean score of the students was X=63.09 before the implementation and X=66.76 after the implementation. Accordingly, an increase of 3.67 points was determined across the mean of the online learning environment engagement scores. Besides, an increase was identified across the behavioral, emotional and cognitive engagement factors in favor of the posttest. This study also examined whether a significant difference was determined between the pre-test and post-test scores through the paired samples t-test, one of the parametric tests, since the data provided the normality assumptions. The results of the t-test are presented in Table 5.

Table 5. T-test results of student engagement scores

Test	n	$\bar{X}$	Sd	sd	t	p
General Pre test- Post test	34	-3,676	8,97	33	2,390	0,023
Behavioral engagement Pre test- Post test	34	-1,500	2,82	33	-3,101	0,004
Emotional engagement Pre test- Post test	34	-1,852	4,44	33	-2,430	0,021
Cognitive engagement Pre test- Post test	34	-0,323	3,59	33	-0,525	0,603

The results of paired samples t-test revealed a significant increase ($t(33)=2.390$, $p<0.05$) in the students' online learning environment engagement after the implementation process. Upon analyzing the differences in terms of factors, a significant difference was noted across the behavioral engagement pre- and post-scores ($p<.05$). The scores obtained from the last implementation were significantly higher than those from the first implementation in terms of the behavioral engagement. The effect size of the difference was calculated as .55, which is moderate. Similarly, the pretest and posttest scores significantly differed across students' emotional engagement ($p<.05$). The scores obtained from the last implementation were significantly higher than those from the first implementation in terms of the emotional engagement. The effect size of the difference was calculated as .41, referring to a small effect. No statistically significant difference was determined across the pre-test and post-test total scores in terms of the cognitive engagement ($p>.05$).

Findings related to the second research question

The present study also attempts to reveal the views of the students who experienced online flipped learning model along with their feelings and thoughts during the implementation process. Hence, content analysis was used to analyze the data obtained from the diaries written by the students at the end of each lesson for three weeks. The codes and the themes were tabulated and interpreted. In addition, direct quotations were presented regarding the themes. Table 6 depicts the codes and frequencies related to the theme of "students' views on online flipped learning".

Table 6. Students' views regarding online flipped learning

Theme	Sub-theme	Codes	Frequencies			
			1st week	2nd week	3rd week	Total
Students' views on flipped learning method	Positive evaluation	Instructional method	12	17	16	45
		Allows sharing ideas	5	9	3	17
		I like the method	6	4	6	16
		Activates the student	6	5	-	11
		Allows group work	7	2	-	9
		Provides an environment for discussion	3	5	1	9
		Provides interaction	2	1	4	7
		Enjoyable method	1	1	3	5
		Improves communication	1	3	-	4
		Allows self-assessment	1	2	-	3
		Feeling good	1	-	2	3
		Raises interest	2	-	-	2
		Easy method	-	-	1	1
		Engaging method	1	-	-	1
	Negative evaluation	A method that takes time	4	8	4	16
		A demanding/tiring/heavy method	7	5	2	14
		Having technical difficulties	5	1	-	6
		Stress-inducing method	3	-	-	3
		I did not like the method	2	2	-	4
	Neutral	I think neither positive nor negative	3	-	-	3

As in Table 6, the codes regarding the students' positive views on online flipped learning method were identified as: the method is instructive (45), sharing ideas (17), popular (16), making the student active (11), allows group work (9) and provides a discussion environment (9). As regards the sub-theme of negative views on this method, the highest number of codes were that the method requires a lot of time (16), tiring/heavy (14), and having technical difficulties (6). Some of the students' views were presented as following:

> *"I am pleased to communicate and express my ideas. It makes me feel valuable when our teacher tells my name, when we communicate together and exchange ideas. Actually, we are in the lesson and we are active. This is significant for me to internalize the lesson and make it meaningful."*
>
> *"Since we feel a bit obligated, we listen to the lessons earlier and I think that the topics are consolidated better. Besides, it is an advantage for us to ask about the things we did not understand in the lesson. In a negative sense, being in front of the screen for a long time makes me physically and mentally tired."*
>
> *"This method is, of course, quite efficient compared to the conventional way of teaching. However, the technical problems we have experienced overshadow this "yield". The subject was also very effective and comprehensible."*
>
> *"This week was more fun compared to previous weeks. The discussions we had together improved me a lot."*
>
> *"This week's class was challenging. We had a number of examples about the discovery teaching strategy. I thoroughly grasped discovery teaching strategy. But the lesson took a long time and I was distracted."*
> *"In a negative sense, it took a lot of time, yet in positive sense, it's a very effective method for meaningful learning."*

Table 7. Students' feelings and thoughts during online flipped learning process

Theme	Sub-theme	Codes	Frequency			
			1st week	2nd week	3rd week	Total
Students' views and thoughts	Positive feelings and thoughts	I felt good	10	11	11	32
		I felt accomplished/enlightened	3	9	5	14
		I was willing/interested	2	5	6	13
		I was excited	9	3	-	12
		I had fun	4	5	2	11
		I was happy	2	3	5	10
		My self-confidence increased	2	2	4	8
		I was active	4	3	-	7
		I felt free	1	-	5	6
		I think I'm used to it	-	3	3	6
		I wondered	5	1	-	6
		I felt responsible	1	2	1	4
		I socialized	1	1	2	4
		My professional (teaching) awareness has increased	-	1	3	4
		I felt valuable	-	1	-	1
	Negative feelings and thoughts	I was nervous/tense/stressed	9	4	1	14
		I felt tired	5	6	-	11
		I was cognitively inadequate	5	4	1	10
		I was sorry	2	2	3	5

Table 7 displays codes and frequencies related to the theme of " Students' feelings and thoughts". As is seen in Table 7, students experienced a wide variety of feelings and thoughts during the implementation process. Furthermore, their feelings and thoughts were found to be mostly positive. Among these, the code with the highest number was I felt good (f=32). This was followed by the codes "I felt accomplished/enlightened (14), I was willing/interested (13), I was excited (12), I had fun (11), I was happy (10), and my self-confidence increased (8)". Accordingly, the feelings of excitement and curiosity expressed by the students who experienced the implementation process for the first time in the first week gradually disappeared. However, the codes of relaxation, getting used to the process, and professional awareness were emphasized in the last week more than the first two weeks. As for the students' negative feelings and thoughts, four different codes emerged. 14 views were reported for the code "I was nervous/tense/stressed", 11 for the code "I felt tired", 10 for the code "I was cognitively inadequate", and 5 for the code "I was sad". Students who stated that they felt sad indicated that they could not do their homework or could not attend the lesson due to internet problems.

Here are some excerpts regarding the students' feelings and thoughts:

> *"We switched from the conventional teaching method to the flipped teaching method. I felt that I was more active in the lesson. Pre-class preparation takes effort."*
>
> *"I was a little excited as I experienced it for the first time. I thought about how we can do it. It was stressful."*
>
> *"It was another tiring and unhappy week because our internet problem still continues, there is no internet in and around the dormitory. Therefore, it is a tiring process to study."*
>
> *"I feel better this time, I think I got used to it a bit."*
>
> *"The experience this week was fun, I enjoyed it more when I noticed the similarities between my friends' and our ideas."*
>
> *"I felt emotionally learning active this week. I think that preparing activities in line with the assigned tasks reinforces my learning."*

Discussion

Students' engagement has a dynamic and situational structure that is applicable to the different situations that manifest in the process. It is difficult to reveal the complexity of the structure with measurements by using a single instrument in a narrow-angled snapshot (Kahu, 2013). Therefore, this study examined learning environment engagement through simultaneous use of quantitative and qualitative in order to capture a holistic perspective. In this regard, the findings have contributed to the relevant literature with high generalizability.

Students' engagement levels were measured with a 5-point Likert-type scale in the quantitative part of the study. The findings suggested that the mean score of the students was above 3 in each of the behavioral (X=3.66), emotional (X=3.06) and cognitive (X=3.75) engagement after the implementation and an increase was observed compared to pre-implementation period. On comparing the pre-test and post-test scores related to the Student Engagement Scale, online flipped learning was noted to have a positive and significant effect on students' engagement. As regards the factors of engagement, a significant increase was identified across the students' behavioral and emotional engagement in favor of the post-test scores. However, the partial increase in the post-test scores was insignificant in terms of the students' cognitive engagement.

There is no such a study specifically published on determining students' engagement levels in online flipped learning environment. Some studies are built on examining the flipped learning model in face-to-face education and students' engagement levels with their behavioral, emotional and cognitive structures as in the current study (Filiz, 2018; Hava, 2021; Jamaludin & Osman, 2014; Merlin-Knoblich et al., 2019; Subramaniam & Muniandy, 2019). These studies revealed high score means in relation to the students' engagement levels after the flipped learning implementation. Jamaludin and Osman (2014) used a 7-point Likert type scale and concluded that the means of the students' cognitive, emotional and behavioral engagement structures were above 5. In the studies conducted by Subramaniam and Muniandy (2019) and Merlin-Knoblich et al. (2019) using a 4-point likert-type scale, and those of Hava (2021) and Filiz (2018) using 5-point likert-type scales, the students' mean scores were found to be above 3 for each engagement structure. Except for Filiz's (2018) study, all the above-mentioned studies only measured students' engagement levels after the implementation. The study carried out by Filiz (2018) shows the most consistency with the current study in terms of methodological and elicited results. Filiz (2018) analyzed the effect of pre-service teachers' experiences in flipped learning environments on their online learning engagement through using the scale developed by Ergun and Koçak-Usluel (2015). The results suggested that the pre-service teachers' engagement significantly increased after the implementation. As to the factors of student engagement, a significant increase was noted across the pre-service teachers' behavioral, emotional and cognitive engagement. Hence, the results of this study, except for cognitive engagement, are congruent with those of the present study. This may be because the implementation was carried out completely online. Various studies (Khalid et al., 2020; Yakar & Yıldırım Yakar, 2021) suggested that university students who had to take distance education became responsible of their own learning and their self-regulated skills were developed. As also proven with this study, the students' cognitive engagement to the online learning environment was high before the implementation. This may be considered as a reason why no significant difference was identified across cognitive engagement after the implementation.

The positive effect determined in the quantitative part of the study was also confirmed with the reflective diaries written by the students during the implementation process. The majority of the students reported that online flipped learning is an effective and active teaching method that allows group work and sharing ideas, that they had fun during the implementation process and their interest in the lesson increased. In one of the online studies confirming the results of the current study (Riel, 2021), preservice teachers pointed out that online flipped learning increased their motivation, offered more opportunities for interaction (student-course content, student-student, student-instructor interaction) and overall a better experience. Lee et al. (2021) concluded that online flipped learning was perceived by prospective teachers as a valuable learning experience that enhances active learning engagement compared to online course formats without any interaction. The present study also announced that online flipped learning, albeit in limited numbers, requires a lot of time and effort, and thus a tiring and stressful practice. Similarly, in the study conducted by Ma and Luo (2022), students found the diversity of platforms used in online flipped learning and online interaction challenging and stressful. The students' negative views may be because a large number of practices were carried out and individual differences and needs were ignored during this process.

As a result, this study found that students' attitudes towards flipped learning, which included classroom discussions and group work, were predominantly positive. Students' views certified that social presence is vital to creating learning environment conducive to online learners to feel connected (Lambrinidis, 2014). These results are also consistent with those of previous studies emphasizing collaboration and group discussions in flipped learning (Lee et al., 2022; Fisher et al., 2018).

The qualitative findings of the current study proposed that the pre-service teachers mostly stressed the concepts of effective teaching, interaction, discussion and group work in relation to the implementation process. Thus, it may be wise to mention that the interaction-based studies carried out during the implementation process and the students' feelings and thoughts such as admiration, success, happiness, excitement, curiosity, interest, self-confidence were effective in increasing their emotional

engagement. Likewise, students had positive feelings towards the lesson and fulfilled their responsibilities such as watching videos and doing homework on time, which would contribute to the end-of-term course grade. This paved the way for explaining the increase in their behavioral engagement.

Likewise, Jamalidin and Osman (2014) stated that students were more emotionally engaged with the learning materials provided in the flipped classroom when they are interested in the class, enjoy learning new things, get involved in the process, and feel good in class. With the formation of emotional engagement, students focus their attention in the lesson as indicators of behavioral engagement, strive to be successful and participate in lesson activities. Similarly, Filiz (2018) pinpointed that the adoption of the model, active participation, sense of benefit, interactive content, discussions, and effort towards learning played a significant role in the increase regarding the pre-service teachers' behavioral, emotional and cognitive engagement. Furthermore, Lai (2021) and Wang (2017)'s studies on behavioral engagement affirm the findings of the current study. Wang (2017) argued that incorporating online interactive activities into flipped learning improves online behavioral engagement. Lai (2021) examined the relationship between interest value, utility value, perceived task difficulty and group interaction with students' behavioral engagement within the context of flipped learning. This study considered interest value as students' perceptions of enjoying, liking and being interested in a lesson, while utility value as students' perceptions towards the usefulness of the implementation. Thus, interest value, utility value and peer group interaction were found to be positively associated with students' behavioral engagement. In addition, the finding in this study that the relationship between the interest value and the students' behavioral participation is weak under conditions of high perceived task difficulty strengthens the possibility that some students' evaluation of the practice as tiring in terms of time and effort had a negative impact on their engagement. In conclusion, qualitative results confirmed those of quantitative and revealed the reasons for the significant increase in students' engagement.

Conclusion and Suggestions

Relevant literature provides sufficient evidence about the effectiveness of the flipped learning model in face-to-face education. The results of the present study yield strong evidence for the flipped learning to improve student engagement. This study harmonizes that flipped learning can be applied effectively in online education, and thus increasing students' learning environment engagement.

This study announced the negative aspects of online flipped learning that were put forward by the students. This learning method requires a lot of time and effort; therefore, it is a tiring practice, and there may be difficulties due to technical problems. If the students had been given flexibility in terms of both time and content by taking into account their individual characteristics, much stronger results could have been possibly obtained. Planning the implementation by taking into account the criticisms in this direction, especially in the studies to be carried out for a longer period of time, will provide more satisfactory results about flipped learning. Online flipped learning was carried out for three weeks in the present study. Further studies may analyze the change that may occur in students' engagement when OFLM is applied for longer weeks. Besides, longitudinal studies may be carried out to examine the effect of the time factor on the students' online flipped learning environment engagement. This study did not delve into the effect of OFLM on student engagement in terms of gender and academic achievement due to the small sample size of 34. Comparing the effect of OFLM on student engagement with a larger sample may contribute to the related literature.

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