A Case Study on Flipped Classroom Application in Statistics Teaching: Student Views on the Effectiveness of Flipped Classroom[*]

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ABSTRACT

Our goal was to apply a case study on flipped learning in an undergraduate blended course. The student views were collected through a semi-structured interview form. Participants were 143 sophomore teacher candidates (96 female and 47 male) in a mid-size public university in Turkey, registered in a statistics course on MOODLE. The contents of the course included the data processing procedure and five main analyses (t tests, ANOVA, regression, Chi Square and factor analysis). The students were assigned to complete one example of the each analysis in a portfolio as the course project. There were computer presentations for each topic, sample data and detailed explanations of the projects as well as sample analyses in the form of screenshots from SPSS. The semi-structured interview items were focused on students' overall views (the views on videos, the pros and cons of video use, to what extent the expectations from the course were fulfilled, and students' satisfaction levels). The results indicated that students favored flipped classroom environment over other activities that took place in the course. According to their statements, videos were much used and liked. The cons of flipped classroom application for students were reported as not having a computer/smart phone or proper internet connection to access to LMS. According to students' statements, the course offered more than their expectations, they used to consider statistics challenging and were very satisfied with their resulting performance in the course. Finally, they regarded the course useful, suggested sparing more time for application, having less topics for the project, more visual representations of the topics and videos for all the SPSS analyses covered in the course.

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İstatistik Öğretimi Üzerine Bir Eylem Araştırması: Ters-Yüz Öğrenmenin Etkiliğine İlişkin Öğrenci Görüşleri[*]

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ÖZET

Amacımız, ters yüz öğrenme üzerine lisans düzeyindeki istatistik dersinde bir eylem araştırması yapmaktır. Öğrenci görüşleri yarı yapılandırılmış bir görüşme formu ile toplanmıştır. Katılımcılar, Türkiye'deki orta büyüklükte bir kamu üniversitesinde öğrenimlerine devam eden, MOODLE üzerinden istatistik dersine kayıtlı 143 3. sınıf öğretmen adayından (96 kadın ve 47 erkek) oluşmaktadır. Ders kapsamında altı temel veri analizi uygulaması (veri işleme, t testi, ANOVA, regresyon, Ki Kare ve faktör analizi) öğretmen adaylarına proje ödevi olarak verilmiştir. Her bir analiz için açıklayıcı slaytlar, örnek veriler ve projelerin ayrıntılı açıklamasının yanı sıra SPSS'den ekran görüntüsü alınarak oluşturulmuş örnek analizler dersin MOODLE'ında bulunmaktaydı. Yarı yapılandırılmış görüşme soruları öğrencilerin ders hakkındaki genel görüşlerini, ders videoları hakkındaki olumlu ve olumsuz düşüncelerini, dersten beklentilerinin ne derece karşılandığına dair düşüncelerini ve öğrencilerin dersten memnuniyet düzeylerini belirlemeye yönelik sorulardan oluşmaktadır. Sonuç olarak öğrencilerin ters yüz öğrenme aktivitelerini, dersin içeriğindeki diğer aktivitelere göre daha çok sevdikleri görülmüştür. Görüşmelerde belirttikleri üzere analizlerin videolarını beğenerek ve proje ödevlerini yaparken kullanmışlardır. Ters yüz öğrenmenin olumsuz yönü olarak da her zaman LMS'ye erişmek için bilgisayar / akıllı telefon veya uygun internet bağlantısı bulamama problemlerinden bahsetmişlerdir. Öğrencilere göre, ders bekledikelerinden içerik olarak daha zengindi. Dersin başında istatistiği zor bir ders olarak görmelerine rağmen dersteki performanslarından memnun olduklarını belirmişlerdir. Dersin kendileri için genel olarak yararlı olduğunu ancak uygulamalar için daha fazla zaman verilmesini, proje ödevindeki konu sayısının azaltılmasını, dersin konuları hakkında daha fazla görsel sunumların olmasını ve SPSS'deki analizler için daha fazla video olmasını önermişlerdir.

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Introduction

Developments in internet and computer technologies provided more educational utilities independent from the time and place for educators in recent years. To enrich educational environments, blended learning has emerged and tied real time and online educational opportunities for effective teaching (Baker 2000; O'Flaherty & Phillips, 2015; Strayer 2009). Flipped classroom is a type of blended learning, using lecture videos for teaching students the course content outside the classroom and learning activities to reinforce them to learn inside the classroom (O'Flaherty & Phillips, 2015). Contrary to the ordinary, in flipped classroom, students view the course content and learn in their own pace, and complete the assignment in the class.

Flipped classroom is applied and has been examined in the last decade in many areas; actuarial techniques (Butt, 2014), algebra (Berrett, 2012), chemistry (cited in Findlay-Thompson and Mombourquet, 2014; Bennett et al., 2012; Bergmann and Sams, 2007), engineering (Arnold-Garza, 2014), introduction to management science (Findlay-Thompson and Mombourquet, 2014), life sciences (Arnold-Garza, 2014), library (Arnold-Garza, 2014), medicine (Hawks, 2014), nursing (Hawks, 2014), pharmacy (Hawks, 2014), programming (Mok, 2014), statistics (Arnold-Garza, 2014), and world civilization (Gaughan, 2014). It is an alternative learning approach that could provide solutions to many learning problems, encountered in traditional classroom teaching. Although it is new, its benefits draw much attention and resulted in a widespread use.

Originally called flipping classes, the method was created in 2007 by Woodland High School teachers Jonathan Bergmann and Aaron Sams. Flipped classrooms provided teacher opportunity to recorded course materials with audio for students who miss the lesson and make it accessible online. This teaching technique was described by Sams and Bergmann (2012) as following the classes at the home from online records created by teacher and then completing the assignments in the classroom. Bishop and Verleger (2013) described the flipped classroom method in two main sections. At the first section, the course materials were recorded and transferred by the instructor using computer and internet technologies, and the second section included students' group activities and doing course assignments together to strengthen the treatment of course lessons (Filiz & Kurt, 2015).

Instructors from divergent nations design and conduct the flipped classroom activities using different techniques demonstrates that there is a need to clarify and explanation of the technique as a teaching approach. In this context, the flipped classroom is considered as a flipped learning approach and it is emphasized that different methods can be used by the teacher (Flipped Learning Network [FLN], 2014). It enables transferring and internalizing information to an application in an interactive learning environment where information receives personally or in groups. In this approach, the teacher is considered as a guide to a large group of students, different from traditional learning environments that small groups are preferred (FLN, 2014). Sams and Bergmann (2014) have argued that flipped learning involves individual learning. Likewise, it provides more personalized learning for students, unlike linear and explicit teaching (Butt, 2014). Thoms (2013) stated that in the flipped classroom method, emphasis was placed on teachers' implementation of the method. The

student's experience is important to gain higher levels of learning. Bornmann (2014) suggests that in contrast to the physical production and distribution of instructional videos, students' level of learning should be more emphasized in education.

Online teaching systems enable students to learn about the course content at any time through the computer presentations, course videos and other course materials on the system uploaded by the lecturer (Basol & Balgalmis, 2016; Basol, Kocadag-Unver & Cigdem, 2017). Well-planned activities in the online system and practices provide students a chance to be ready before the class by their own pace. Online reporting system; blogs, forums and messages were also important to have students participate the course activities, express themselves and share their ideas and comments even from their home with the lecturer and their peers.

Knowing that systematic online teaching activities are so important to effective teaching, first author of the study constructed an interactive learning model and named Beehive Interactive Learning Model. The detailed information about this learning model was given under the next heading.

Beehive Interactive Learning Model

This model developed and implemented by the first author of the study as mentioned above. The name of the beehive comes from the hard work of the instructor and students. There are four main components of the Beehive Interactive Learning Model(BILM) namely; content, instruction, assessment and motivational beliefs (Basol, 2017). According to this model maintaining instruction among teacher-students and student-student is very important. To maintain the instruction even out of the class time the model requires a blended course enriched by the use of flipped classroom activities, online quizzes with instant feedback opportunity (Basol, 2017). To provide these opportunities to students a course portal was designed as a blended Leaning Management System on MOODLE. Students registered to the system with their student ID and then have access to the course portal through Gaziosmanpasa University's Learning Management System (lms.gop.edu.tr).

During the course each week a video related to topic was uploaded to the You Tube Channel. Before the class students watched this video. Than a brief discussion was conducted among students in real classroom context about the video cases. This was to be ensure that the students learned to share ideas about how to use the content learned from the video cases when they became a teacher. The instructor then explained the topic in more detail and provided examples. In addition, the course videos supported students who missed a course once in a while (Basol, 2017).

The role of the instructor was a guide and facilitator. The instructor introduced the content; and related the content with previous topics learned in the course. She also implemented hands on activities related to topic. She also prepared checklists for the assignments to have students informed about what was expected of them with that assignment.

The other component of the BILM was assessment. The main features of the assessment of the model were being formative, self-regulated learning and e-quizzes with instant feedback. Self-regulation has three stages; forethought, self-reflection and performance (Zimmerman, 2005). In BILM includes, these all three phases. The online platform have many sources for students, they have a chance to choose and carry out the assignments based on their own pace and program. If they need a support to finish the assignments both instructor and their peer could

help them. According to this model the focus was not on the grade, instead the focus was on students' learning (Basol, 2017).

The last component of BILM was motivational beliefs. In this model it is aimed to have students developed a positive attitude towards the statistics by designing the course in an extraordinary way. Giving students private learning time via course videos, computer presentations and frequent online quizzes it is expected decreasing students' stress level, and increasing the motivation and self-efficacy skills (Basol, 2017).

The statistical course designed according to BILM in this study. The overall objective of the model is to enable students to better understand statistics by using educational technology to enable them to study in their spare time.

Research Problem

The purpose of the study was to explore student views on the effectiveness of flipped classroom in a statistics course at undergraduate level in Turkey. Our research problem was mainly to explore the student views on the flipped classroom activity that were used to aid students for their final project in a statistics course.

The sub-questions of the study were:

1. In general, what were the student views on the flipped classroom application that were used for the test project in five headings (positive and negative)?
2. How did students consider the videos (in terms of the quality, length and the depth of the in-formation and any other aspects that they brought it up)?
3. What were the negative aspects and problem areas of flipped classroom application in terms of use (due to the course portal and due to the resources)?
4. What did students expect from the course at the beginning and what were these in five headings (fulfilled and not)?
5. To what extend were the students satisfied with the flipped classroom application in statistics teaching?

The questions were intended to be supported with several verbatim quotes from the students. We predicted that flipped classroom application would be beneficial for students to complete their final project consisting of statistical data analysis since the project heavily includes visual aspects and demonstration of certain analyses (data processing, one sample t tests, independent samples t test, paired samples t test, ANOVA, and Regression) in SPSS.

Methods

It is a case study in the qualitative design. The aim of this study is applicable for implementing a case study since the nature of the subject required in depth explorations on the basis of Pre-service Teachers' (PST) views about flipped classroom experience on their learning practices. The data were gathered through purposeful sampling in a mid-size university in Turkey. Participants were 143 undergraduate sophomores, consisting of 96 female and 47 male, registered in a statistics course. The MOODLE was used as a teaching management system in the course, designed based on the blended learning. The data processing procedure and five main analyses (t tests, ANOVA, regression, Chi Square and factor analysis) were covered in the syllabus. Students were assigned to complete a final project from each of these topics. In this blended course, students were able to follow the course online and they also attended

weekly lectures in a regular classroom setting. There were computer presentations for each topic, sample data and detailed explanations on the course topics as well as sample analyses in the form of screenshots from SPSS. Additionally, there were seven videos (three videos for one sample t test, independent groups t test and dependent groups t test, one for data processing, one-way-ANOVA, and regression analysis) in the instructors' YouTube channel regarding this content (https://www.youtube.com/gulsahbasol). The final projects were on five main analyses and three of them (t tests, ANOVA, and regression) were covered in the videos; there were no videos for factor analysis and chi-square for control purposes. While the Computer presentation and handouts on each topic were available as the topic progressed, the videos were uploaded a month before the semester was over. In the last class session, students were requested to fill out an online questionnaire on their experiences on the flipped classroom use. The semi-structured interview items were on the overall views, the views on the videos, the cons of video use, to what extent the expectations from the course were fulfilled or not, and students' satisfaction levels.

Data Collection Process

A brief personal information form, student projects on five main topics, including five self-reported control lists, consisting of main characteristics of each project (one for each project), an eight-item semi-structured interview form were the data collection tools of the study. The content validity of the instrument was verified by two experts in information technologies field who are familiar with flipped classroom activities.

Data Analysis

In order to analysis and interpretation of the qualitative data, inductive process of open coding was conducted in the present study. According to Marshall and Rossman, (1999), the analytic procedure follow the sequence of organizing the data, generating categories, themes and patterns, coding the data, testing the emergent understandings, searching for alternative explanations and writing report. Moreover, lived experiences of individuals were discovered through extracting specific themes and patterns from the data, categorizing them and finding explanation (Creswell, 2008). Data analysis of the documents was conducted through open coding by the researchers separately, at first. Then, they gathered together to explore the emerging codes. After this open coding and agreement stage, the researchers determined and code the rest of the transcriptions and decided on main categories. The result of the document analysis was compared to the results obtained from the observation notes in order to find consistencies and inconsistencies between the PSTs' views, experiences about flipped classroom and their practices in online course environment. Than results of the data analysis was tabulated. Moreover, in order to emphasize the importance of PSTs' ideas, besides reporting the themes and codes, clarifying quotes was directly taken and incorporated into the results in order to enrich the description of the themes (Creswell, 2008).

The Role of the Researcher

The first author of the study was the instructor of the flipped classroom course. For that reason, the researcher might have some bias about the flipped classroom. That is, the researcher might believe that flipped classroom has positive effect on students' learning. Therefore, the researcher may expect to see the positive results about this issue. Against this bias, the content validity of the study was verified by two experts in information technologies field who are

familiar with flipped classroom activities. In these procedures, interpreting the different source of data by different researchers provided valid results for the study.

Internal Validity Threats

Possible threats to the internal validity of this study were subject characteristics, location, instrumentation and instrument decay. Subject's characteristic was a problem in the main study because PSTs who are not interested in technology might not be able to use online course portal, or who do not prefer using it may affect the results. This threat controlled by studying with volunteer PSTs.

Another threat to internal validity that was in our consideration was location. It might be argued that location effect on the data PSTs provide, since the PSTs involved the course portal at their own will it was not available for the researcher to control this variable. We were aware that the PSTs used course portal out of class hours. Some of them did not have internet connection at their home and this made it hard for them to use course portal. This situation might affect their thoughts about flipped classroom.

Limitations

The generalizability of the results might be considered limited since case studies involve a certain group which may not be representative of the general group or population. This study was implemented with 2nd grade PSTs who had flipped classroom experience in their course. It was difficult to generalize findings to population; therefore, study cannot be generalized for students who did not have any flipped classroom experience in their programs. However, in similar case groups or settings can consider the results of the present study while conducting flipped classroom in their program. In addition, the main object of the flipped classroom was course videos. First author recorded all videos with a great attention to quality, video speed and narrator sound. She had 18-year teaching experience; however, videos might still be improved with time since she is new in flipped teaching material development.

Findings

In this study, PSTs views about their flipped classroom experience were analyzed. The main data source of the study was PSTs written answers to semi-structured interview forms. The researchers investigated each answers of the questions.

The findings for each question were as follow:

1. In general, which activity, supplied in the course supported students learning in statistics the most?

Table 1.The student views on the activities that were supplied in the course

Activities	Frequency
Videos	40
Computer Presentations	33
E-quizzes	22

Lab Applications	10
Feedback	8

According to Table 1, students favored the flipped classroom activities the most. Computer presentations in each topic followed the videos. E-quizzes were also highly regarded compared to lab applications and feedback. Students expressed that they had less problems in the projects, (t-tests, ANOVA and regression), covered in the videos in comparison to factor analysis and Chi square projects. Additionally, students initiated flipped classroom activities as highly regarded. They said, "I wish there were videos on factor analysis and Chi square, too", and "Thanks to the videos, I had less problems doing t-tests, ANOVA and regression analyses".

2. How did students consider the videos?

Table 2.Students considerations of the videos.

Considerations	Frequency
1. Being able to stop and replay the lesson	44
2. Long term effect of visual learning on memory	23
3. Its positive effect on SPSS applications	20
4. Good substitute for missed classes	13
5. Good for doing the analysis in the projects	6

According to Table 2, students favored the videos mostly because of its replay function. Unlike to a traditional classroom lecture, it was possible to stop and rewind a video. Visual support provided through the videos was another highly regarded aspect of flipped classroom activity. It was more flexible than a computer presentation or graphic demonstration which able the instructor to capture the screen shoots. Explaining statistical analysis through demonstration in a video was the best way to teach how to use a certain program. Flipped classroom activity was also favored for its use for the students who missed a certain class. If the lesson was covered in the flipped class videos, students were more likely to quickly complete the project on that topic. As the last forth coming consideration, the videos were preferred for their use in doing statistical analysis. Additionally, students' statements on the present status of the videos made us reconsider about the technology used to create the videos. Next time we will give great attention to video quality and the length/depth of the information, covered in the videos. They said, "I wish the videos were better in visual quality", "I want the videos to last longer and include more explanation", and "It was nice to be able to stop and rewind the videos doing the projects that helped me a lot".

3. What were the negative aspects and problem areas of flipped classroom application in terms of use?

Table 3. Negative Aspects and Problem Areas of Statistics Learning.

Negative Aspects	Frequency
Difficult lesson (abstract subject area, mathematics based, etc.)	50

Problems in focusing and participation	25
Technical problems (computer and software problems)	21
Problems in lab applications	15
Too many projects	15

Table 3 summarizes the negative aspects/problem areas of statistics learning in a course, covering flipped classroom activities. The main negative aspect was the difficulty of the lessons. Considering statistics as an abstract, mathematical area highly counted for this matter. Hence, problems in focusing and participation were regarded as another negative aspect of the statistics learning. Students also mentioned technical and software problems as another barrier to their understanding of statistics. Problems they encountered in the lab applications were also stated by a number of students. The number of projects (five in total) was given as another negative aspect discouraging them from learning. Students' statements can give an idea on their negative views toward the class. They said, "I wish we didn't have this much work", "I have difficulty in using SPSS", "If I was able to install SPSS in my computer, things would be different." and " I thought it was over with mathematics when I graduated from high school".

4. What were the students' expectations from the course, from the beginning to the end?

Table 4. Students expectations from the beginning to the end.

Expectations	Frequency
I realized that I can do it at the end.	47
I had thought it was more of a theoretical class, then I found out it was practical.	31
I thought I would be less involved unlike the reality.	26
I expected less work on students' part.	21
It was a resourceful course with many reinforcement unlike my expectation.	14

According to Table 4, students' expectations evolved greatly from the beginning to the end. First we found out that students mainly considered themselves bad in statistics and get confident by the end of semester. They regarded statistics as more of a theoretical class and realized that its application and practical aspects throughout the semester. They thought that it would be not as difficult as it was if there were less topics covered in the course. Finally, they regarded the course as resourceful with much reinforcement, unlike their expectations. They said, "I didn't expect it to be this hard but I managed with the help of materials in the course portal", "This class is more practical unlike my expectations", and "The class forced me to learn even if I didn't want to".

5. To what extend were students satisfied with the flipped classroom application in statistics teaching?

Table 5. Students Satisfactions with the Flipped Classroom Application.

Satisfaction	Frequency
I reached the course attainments (hand calculations, entering data, analyzing, interpreting the results)	50
I can construct a survey, collect data, analyze in SPSS	34
Now I realized that statistics is very important for a counselor.	20
I was forced to learn through the applications, now I feel confident.	13
I did not only learn the theory part, but also get better in practice.	
	3

Table 5 summarizes student views on their satisfaction with the flipped classroom application. According to our findings, majority of the students thought that they reached the course attainments. They considered themselves good at calculations, interpreting the results, entering and analyzing the data in SPSS. We found out from their statements that students came to realize the importance of statistics in their area. As future psychological counselors, they feel capable of constructing a survey, collecting data, and analyzing in SPSS. Here are a few examples from their statements: "I am capable of using SPSS for the main analyses", "I have pretty good comprehension of SPSS", "I got a hold of main concepts of statistics", "I feel confident in applying statistics to real life problems".

Discussion and Suggestions

In the present study, student views on the effectiveness of flipped classroom in statistics teaching were sought through a case study. Through a MOODLE based blended course design, it was aimed at improving statistics learning. It was possible to use several resources such as e-quizzes, computer presentations, and flipped classroom activities. Findings indicated that students enjoyed and preferred the flipped classroom activities among number of opportunities offered in the current study. We found that our students did better on the projects that were covered in the videos, which were t-tests, ANOVA and regression. Intentionally, there were no flipped classroom activities for factor analysis and Chi square analysis that students reportedly had more problems with it, confirmed also by the control lists for these projects. When studies on the effectiveness of flipped learning were examined, Ventry and Kilmer's (2012) one group pretest-posttest design study drew our attention. In this study, the scores obtained from a traditionally taught math class were compared to the scores of the same class taught through flipped classroom activities a year later. According to results, while the percentage of participants in the traditional teaching group was 35%, it reached 55% after applying the flipped classroom approach (Ventry and Kilmer, 2013). Likewise, in a research conducted by Roshan and Roshan (2012), 58% of participants in mathematics class reached fourth and fifth grades after they attempted to learn, and this ratio increased to 78% with no students scored below three. An experimental study on the effectiveness of the flipped learning approach over traditional learning approach was implemented at the University of North Carolina in 2011. Students from two major pharmacy classes in the Department of Pharmaceuticals; one class taught by the traditional approach and the other flipped learning

approach. The results showed that the average final score increased from 160.06 to 165.48 and supported the flipped learning approach (McLaughlin et al., 2014).On the contrary, an action study conducted by Clark (2013) compared the performance scores of middle school students in traditional and flipped learning classes. However, although students expressed more positive views for the flipped learning approach, there was no significant difference in scores between the two groups.

In the current study, the students highly regarded the videos mostly because it was possible to stop and rewind. Visual support through the videos also favored as a positive feature of flipped classroom activity. It offers more than capturing a few screen shoots as in computer presentation. As easily can be confirmed, there are millions of videos on YouTube covering statistical analysis in software programs. Students who missed classes can catch up the course through their instructors YouTube channel (https://www.youtube.com/gulsahbasol) and would be encouraged to do their homework. Students in regular classroom sessions are likely to complete the project compared to the ones who took the course in the flipped design. They also indicated the importance of having videos in high visual quality, a bit longer than what we had and more in the quantity for an improved quality of flipped classroom activities. They think that learning statistics is difficult and flipped classroom supports their learning. In addition, students complained from technical and software problems in flipped classroom environment while learning statistics. Especially during the lab applications, technical problems could have distorted their learning. Completing analysis on five data sets was regarded as another negative aspect of flipped classroom activity by the students in the current study.

The findings indicated that the flipped classroom activity had a great positive impact on students' expectations of the course, even in a course, highly regarded as difficult by the majority of the students. Similarly, in a study conducted by Butt (2014) stated that the flipped classroom activities were beneficial to students' learning experience compared to a face-to-face courses. In this study participants expressed that due to its combination of activity and demonstration they had a chance to engaged in different learning opportunities of a flipped classroom approach. In a similar vein, in another study conducted by Tomas, Evans, Doyle & Skamp (2019) revealed that as much as students appeared reluctant to engage independently with the planned activities and a high level of engagement with the videos provided that have students involved more challenging science concepts. Additionally, students believed that flipped classroom supported their learning. In conclusion, the number of studies related to flipped classroom teaching can offer several advantages for both teachers and students of this kind of teaching activities. Using active learning strategies in the classroom allows teachers to better understand students' styles and challenges of their learning. It gives a chance to use class time more effectively and creatively. Moreover, it makes available for teachers to plan personalizing the curriculum and offering personalized teacher-student counseling and peer-to-peer collaboration (Fulton, 2012; Tomas et al., 2019). In the study conducted by Cheung Kong (2014) aimed to support students to develop information literacy competency and critical thinking skills through domain knowledge learning in digital classrooms also argued that by means of flipped classroom strategy students and teachers positively perceived the effectiveness of the pedagogical designs of the digital classrooms and students had a statistically significant growth in information literacy competency and critical thinking skills

Most of the studies claimed that flipped classroom activities support students' knowledge about the course context (Chiang, 2017; Hsieh, Wu & Marek, 2017) in present study, our focus was not on students' competences and critical thinking skills. Our focus was especially on students' views about the flipped classroom implementations used during the course period. In present study, student statements implied that as the flipped classroom activities in center, the class strengthens their self-confidence. In a course, they feared at the beginning; they turned into the ones able to apply statistical analysis with ease through the use of computer software. From the students' point of view, flipped learning was beneficial and general students preferred it. They can stop the videos at any time and review the material as they like while moving on their homework. It was great for issues related to sequential instructions. Flipped classroom practice was found to be a useful strategy for performance assignments in statistics. Its positive impact was not only limited to this, more importantly, their perceptions of the statistics have changed in a great deal; they were eager to apply statistics to real life problems as future psychological counselors. Finally, students were highly satisfied with their learning through the use of several new approaches, applied in the current study. Based on these findings, we propose a flipped learning continuum that fosters different kind of student-centered learning compatible with students' learning needs and their readiness for the course outcomes. With this in mind, it is inevitable that online supplements will be disseminated in near future and formal education should be supported by educational technology in a flipped classroom environment.

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