



Prospective middle school mathematics teachers' points of view on the flipped classroom: The case of Turkey

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Abstract

The purpose of this study was to investigate prospective middle school mathematics teachers' views on the flipped classroom. 41 third-year undergraduate students who were enrolled in the mathematics education department participated in this qualitative study. The study was conducted in the Statistics and Probability course and lasted for 11 weeks. Findings were organized under four themes as positive opinions, negative opinions, suggestions and the use of flipped classrooms in mathematics teaching. The findings showed that flipped classrooms had positive effects on prospective teachers' active participation in the lesson, self-regulation and teamwork skills. On the other hand, not making any revision of the subjects during the course and technical problems were found as the negative sides of the flipped classroom. The findings showed that it was important to establish a mechanism for arranging the self-regulation of students. In this context, Kahoot activities could be a useful way to make sure all students watch lecture videos before the class. It was also found that prospective teachers had different opinions on the use of flipped classrooms in mathematics teaching. Some prospective teachers would tend to use flipped learning when they start their careers for students to come prepared for the course and be responsible for their learning process. However, it was found that some prospective teachers would not implement flipped learning in their lessons since mathematics education should be only be carried out traditionally.

Keywords Flipped classroom · Mathematics teaching · Technology-based learning environments · Teacher education · Student perspectives

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1 Introduction

In recent years, many countries have included practices related to the development of students' conceptual learning, problem-solving and communication skills within the scope of reform studies in mathematics education (Simon 2008). In the case in Turkey, elementary education mathematics curriculum was arranged to develop in students such skills as producing knowledge and using it functionally, problem-solving, critical thinking and communication skills (Ministry of Education [MoNE], 2018). For this reason, mathematics teachers working in secondary education must have a high level of cognitive skills. However, the teachers working actively in educational institutions had education in the traditional educational approach and it is a barrier in front of making the required reforms (Simon 2008). In addition, traditional learning approaches do not adequately support students to gain higher-order thinking skills such as analysis, synthesis, and evaluation (Sams and Bergmann 2013). It is because teachers have little interaction with students in traditional classrooms (Hao and Lee 2016). The study results in Turkey indicate that prospective teachers adopt teaching methods based on traditional understanding in mathematics education (Kayan and Çakıroğlu 2008). Although the constructivist approach has been confirmed in learning environments, educational applications are still based on traditional learning (Altemueller and Lindquist 2017). National Council of Teachers of Mathematics [NCTM] (2014), state that all students should use the effective teaching methods in realizing mathematics learning. In this context, teacher education programs can be designed to enable students to gain those skills. Yough et al. (2017) claim that the teaching methods used in teacher education should be designed consistently with course content. They also suggest the flipped classroom to eliminate the limitations of traditional education and it contributes to learning outcomes and motivation levels of students. The flipped classroom could be an effective teaching method when used properly for all learning disciplines (Dill 2012). It is because active learning processes such as authentic, inquiry-based, and experimental could be carried out in the flipped classroom (Jacot et al. 2014).

The flipped classroom, presented as an alternative to the traditional learning approach, has become popular at the undergraduate level in recent years. The flipped classroom is generally defined as a teaching model in which instructional technologies and active learning strategies are used together (Brooks 2014). It is a student-centered method where teaching carried out through videos, outside classrooms (Chuang et al. 2018; Findlay-Thompson and Mombourquette 2014; Kong 2014). Students have the opportunity to learn at their speed by pausing, forwarding or rewinding the videos independently of time and space in flipped classrooms (Asef-Vaziri 2015; Moos and Bonde 2016; Sun et al. 2018). Students are expected to be responsible for their learning processes in flipped classrooms (Davies et al. 2013; Kong 2014). In this model, class time is used for problem-solving and discussion activities that reinforce the concepts students learn in videos (Asef-Vaziri 2015; Filiz and Kurt 2015; O'Flaherty and Phillips 2015; La-Marca and Longo 2017). In this way, the learning process is transformed from group learning to individual learning. This provides an opportunity to discover difficult concepts in the course (La-Marca and Longo 2017). In flipped classrooms, teachers can adopt more active learning strategies (Shih and Tsai 2017), and fulfill the individual needs of students (Blau and Shamir-Inbal 2017). However, there are some misunderstandings about the flipped classroom, such as reducing teachers' duties, the obligation

to prepare lesson videos, and reducing the interaction between teachers and students (Filiz and Kurt 2015).

1.1 Literature review

There are some studies in which flipped classroom has been investigated in mathematics education are available in the relevant literature. These studies indicate that the flipped classroom provides students with some opportunities for evaluating and planning the study period properly (Lai and Hwang 2016), having positive relationships between peers and instructor (Smallhorn 2017), increasing self-efficacy (Lai and Hwang 2016; Tawfik and Lilly 2015) and academic performance (Adams and Dove 2018; Bhagat et al. 2016; Cronhjort et al. 2017; Lai and Hwang 2016; Mason et al. 2013; Overmyer 2014). Bhagat et al. (2016) state that the flipped classroom contributes to the development of the students' content knowledge who have low performance in the mathematics course. For example, the study results conducted by Kay and Kletschin (2012) showed that mathematics education implemented in flipped learning was adopted by undergraduate students and that there was a significant increase in students' math knowledge in this model. Wilson (2013) found that the flipped classroom affected the students' attitudes and learning performances positively in the statistics course. Love et al. (2014) concluded that flipped learning increased the academic performance of students in linear algebra lessons more than traditional learning. The researchers also found that the students had positive attitudes towards and perceptions of the flipped classroom. Cummins-Sebree and White (2014) found that flipped learning enabled students to prepare for the course and actively participated in the course. In another study, Ogden (2015) implemented the flipped classroom for three semesters in the algebra course. The study results showed the flipped classroom allowed students to ask more questions. Touchton (2015) investigated the effects of the flipped classroom on the problem-solving skills and satisfaction in the statistics course. The researcher concluded that the flipped classroom was more enjoyable than traditional learning and supported problem-solving skills. Tawfik and Lilly (2015) found that the flipped classroom supported problem-based learning experiences of the students in the psychological statistics. Zengin (2017) found that flipped classroom increased student success in the double integral subject and it made easier to understand integral and to visualize mathematical concepts. Lo and Hew (2017) stated that the flipped classroom was an effective method of increasing the mathematics success of students with low and high performance and their motivation for the course. On the contrary, Strayer (2012) compared traditional and flipped learning in the statistics course. It was concluded that although the students were not biased towards innovative and cooperative teaching methods, they were not glad about classroom activities conducted in the flipped classroom. Jaster (2013) stated that the students both had positive and negative ideas about watching videos and they preferred traditional learning in the algebra courses. Similarly, Talbert (2014) found that the students believed that teaching the lesson was the duty of the teacher; therefore, they were not satisfied with the flipped learning in the algebra course. Novak et al. (2017) investigated the students' views on the flipped classroom in an undergraduate mathematics

course to offer an active, interesting and effective learning experience. The researchers discovered that, although students perceived flipped learning as interesting, they were unable to decide whether learning was more useful in this approach.

Although many studies are investigating the flipped classroom approach in mathematics courses in the literature, there are a limited number of studies investigating the use of this learning approach in mathematics education programs. This study is significant since it presents the findings related to the views of prospective middle school mathematics teachers on the flipped classroom. It is believed that the perspectives of prospective teachers towards the flipped classroom approach and how they will use this approach in the future is very important. Following its purpose, the study aims to investigate prospective middle school mathematics teachers' views on the flipped classroom.

2 Method

The study aiming at identifying prospective middle school mathematics teachers' views on the flipped classroom was carried out with the basic qualitative research method. Basic qualitative research focuses on how individuals interpret their lives, how they structure their perceptions and make their experiences meaningful (Merriam and Tisdell 2015).

2.1 Participants

41 third-year undergraduate students who studied in the department of mathematics education participated in the study. The convenience sampling method was used in this study. The study was conducted in a medium-sized public university with low socio-economic status, in Turkey. The participants' ages range from 19 to 23 years ($Mean = 21.19$, $SD = 0.13$). The participants stated that they did not have any experience with a flipped classroom before the application process. Detailed information about the participants is presented in Table 1.

2.2 The application process

The eleven-week (2-course hours) application process was conducted in the Statistics and Probability course. The course videos were selected by the researchers from the platforms such as Khan Academy and YouTube. 3–6 videos were shared with the students each week. The shortest video lasted 3 min and the longest video lasted 20 min on average. The students were informed about the flipped classroom before the application process. The students were asked to register the Edmodo learning management system and watch the course videos before coming to the classroom. Also, they were asked to take notes about the videos. Kahoot activities were implemented at the beginnings of the course to make sure all students watch course videos. At the end of the Kahoot activities, the points in which the students did not know or were lacking were explained to them by evaluating true-false answers. Following that, the activity sheets in MS

Table 1 Demographic information of the participants

Gender	f	%
Female	36	87.8
Male	5	12.2
General academic mean		
1.50–2.00	3	7.3
2.50–3.00	9	22
3.00–3.50	21	51.2
3.50–4.00	8	19.5
Type of high school of graduation		
Regular high school	2	4.9
Anatolian high school	30	73.2
Science high school	2	4.9
Other	7	17
Videos watched		
Quarter	2	4.9
Half	3	7.3
More than half	11	26.8
All	25	61
Having a personal computer		
Yes	22	53.7
No	19	46.3
The devices on which videos are watched		
Computer	4	9.8
Mobile phone	37	90.2
Total	41	100

Word format prepared by the instructor were shared with the participants. The course activities were designed in the form of filling in the blanks, creating tables according to data, interpreting sample tables. Question/answer, problem-solving, discussion and teamwork activities were implemented in the class time. The students were asked to study in groups with two or three people when creating and interpreting tables. Detailed information about the course content is presented in Table 2. A scene from the application process can be seen in Figure 1.

2.3 Data collection tool

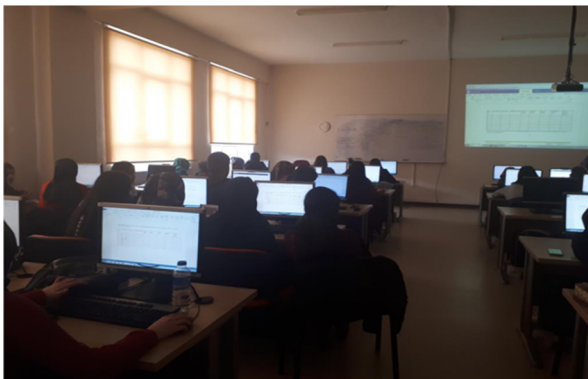
The focus group interview form developed by the researchers was used as the data collection tool in this study. The relevant literature was reviewed before developing the form. Two experts in Mathematics Education and Instructional Technologies were consulted for the expert opinion about the interview questions. In addition, a pilot study was conducted with five students. Questions difficult to understand or questions that were considered irrelevant were removed from the interview form or re-arranged according to feedback coming from the students and the experts; and thus, the interview

Table 2 Course content in the application process

Weeks	Subjects
1	Basic concepts I (Statistics concept, mod, arithmetical mean)
2	Basic concepts II (interquartile range, median, mode)
3	Histogram and frequency
4	Showing the categorical data by graphics I
5	Showing the categorical data by graphics II
6	The parametric and nonparametric measure of the central tendency I
7	The parametric and nonparametric measure of the central tendency II
8	Parametric and nonparametric distribution measurements and applications I
9	Parametric and nonparametric distribution measurements and applications II
10	Skewness and oblateness
11	Normal distribution concept

form was given its final shape. In the last two weeks of the application process, focus group interviews were held with 5-person groups in the researcher's office orally (only one group consisted of 6 people). Focus group interviews were recorded by taking the verbal consent of the participants. Each focus interview lasted approximately 15–20 min. The interview questions as in the following:

1. Before this course, have you had any experience of learning the contents out of the class and performing activities in the class?
2. What are your general opinions about the flipped classroom?
3. Did you have any challenges in the flipped classroom?
4. How did the flipped classroom model affect your classroom engagement?
5. Are there any learning skills that you have developed during this experience? If so, what are they?
6. What are your suggestions for the effective implementation of the flipped classroom?
7. How did flipped learning play a role in completing in-course activities?

**Fig. 1** A scene from the application process

8. What kind of changes occurred in the problem-solving process with the flipped classroom?
9. What kind of a role did flipped classroom play in your study method?
10. What kind of effect did flipped classroom have on the retention of the knowledge you have learned?
11. How did the flipped classroom affect the time you spent on this course?
12. Do you think of using the flipped classroom in mathematics lessons when you become a teacher?
13. Can you give information about the positive aspects of the flipped classroom?

2.4 Data analysis

The qualitative data were analyzed with content analysis. Firstly, the interviews recorded as audio files were transcribed as written texts. The names of the students were kept confidential and the students were given codes as S1....S5. Then, the copies of the written texts were read three times, and then the researchers moved on to the stage of coding. Coding was conducted in Nvivo 9. Codes and categories which had been established by two different researchers were compared in the analysis process and the codes were included in relevant categories. This process continued until the inter-reliability point was 100%.

3 Findings

The findings were presented as four themes after analyzing the qualitative data. These themes are positive opinions about the flipped classroom, negative opinions about the flipped classroom, suggestions about the flipped classroom, and the use of the flipped classroom in mathematics education. In Fig. 2, there is a categorized form of themes and sub-themes.



Fig. 2 Themes and categories emerged from the qualitative data

3.1 Positive opinions about the flipped classroom

It was found in this study that the flipped classroom had positive contributions to classroom participation, active learning process, teamwork skills, and self-regulation skills.

52% of the participants said that flipped learning changed their study habits. They stated that they used to study only for exams or just before exams, but in this method, they had to study regularly every week for active participation. They also stated that they did not have to study much for exams since they studied regularly. Two participants expressed their ideas on this *“This was the course which I studied most regularly.”* Another participant stated his idea *“We had to study much more. We took notes and learned again. We also studied for the exam.”* The participants stated that the time they studied for this course was too much.

40% of the participants pointed out that they came to the lesson with this method in preparation. They stated that this preparation allowed them to reinforce the course content and revise the knowledge they learned. One participant mentioned his opinion on this issue *“We used to be unprepared for classes before. This time we watched the videos and came to the class prepared.* Some participants said that if the lesson was taught traditionally, they would only come to the lesson with their notebooks.

38% of the participants stated that the flipped classroom enabled them to be responsible for their learning. These participants expressed that when they came to the lessons without any preparation they were aware of being unsuccessful and this model led them to be planned and disciplined. The participants stated their ideas about coming to the classroom without watching the videos as *“I watched 75% of the videos. But there were some points I missed. Then I could not answer the questions in Kahoot correctly. But when I came to the classroom by watching the videos, I noticed that I would be more successful. When I did not watch some of them, I understood that I could not do anything.”*, *“There is a positive side to watching the videos. But when you come without watching them, you cannot understand anything. ...You cannot learn from the activities unless you watch the videos”*. One participant stated that she had a lack of responsibility as *“I had to take notes while watching the videos. I watched them by lying down, only not to say that I did not watch.”* Another participant stated this sense of responsibility in the statement *“When you first share these videos, I continuously think of watching the videos and doing homework. But when I come here and have the feeling of knowing something...I have the feeling of answering the questions in Kahoot correctly, a sense of achievement”*. One participant stated *“I learned the subject which I did not understand or the important ones. I watched the videos related to the activities and the details”*. Another participant stated the sense of responsibility created on him as *“Once, I went on a trip with my friend and missed the lesson that week. So, I felt isolated from the classroom. My classmates did something, but we were left out of the classroom.”*

26% of participants claimed that learning through flipped classroom was more permanent. They stated that the model offered students opportunities such as learning on their own, reinforcing the information they learn with activities in the classroom, and exchanging ideas with their friends. One of the participants stated that videos appealed to both visual and auditory senses, therefore, they played an important role in keeping information permanent. He stated his opinion *“Videos affected permanence. I*

remembered what was explained in the videos, as the videos appealed to both visual and auditory senses.” Three participants stated that they came to the classroom without any preparation in traditional classes, they only focused on taking notes, as a result, they could not learn efficiently. These participants stated their opinions *“If the teacher taught the course, we would be unprepared for the lesson. However, we took notes in this method. We repeated the lessons. This increased permanence. We learned the parts we did not understand with the activities.”* Other participants stated their opinions on the issue *“The teacher explains the topic on the board in the traditional method, and you take notes. Your mind is not just there at that moment if you do not listen to the teacher. You do not think anything. You have to sit and study again. But in this method, you learn by yourself. You come to the classroom and reinforce your knowledge. Learning becomes permanent”.*

26% of the participants stated that they developed their research skills through the flipped classroom. 13% of them said that they watched different videos on YouTube about the subjects they did not understand. One of the participants said that he watched similar videos; another participant said that he obtained different types of knowledge while researching.

17% of the participants stated that the flipped classroom increased their participation in lessons. In addition, 17% of the participants noted that activity-based lessons made them more active during lessons. Two participants stated their opinions on the issue *“We participated in lessons actively. We continuously made activities since the learning environment required that. We had to be active even we did not know anything. The teacher asked us to make more effort.*

13% of participants stated that the flipped classroom helped them to learn the course content in a short time. They also stated that practices and games added at the end of the videos were effective in making learning easier. 4% of them stated that the flipped classroom was effective in gaining teamwork skills. They also expressed that being in cooperation with their classmates during the activities contributed in positive ways to their social skills.

Some participants mentioned the advantages which the model offered in time management. 4% of the participants stated that the flipped classroom saved time in the learning process. They said that watching the videos regularly every week and taking notes provided them with advantages during exam weeks. The participants stated that they only studied their notes before the exams. 4% of them stated that they planned their time better with the help of this method. One participant said, *“We planned our study time better.”*

3.2 Negative opinions about the flipped classroom

The analyses showed that not teaching the subjects in the lesson and technical problems were the negative aspects of the flipped classroom.

58% of the participants stated that the lessons should not be taught only with activities and the subjects should be explained by the teacher before the activities. The participants stated that the students coming to the classroom without watching the videos could have some problems. Two participants stated that they would have understood the course content if the teacher had explained it instead of watching the videos.

31% of the participants stated their opinion as “*mathematics courses should be taught with traditional methods*”. These participants claimed that the courses should not be carried out with activities only, and students should also take notes while the teacher was teaching the lesson. Five participants stated that as they have experienced traditional methods for years in their education life, they thought in this way. Some participants stated their opinions on the issue “*We are accustomed to the traditional method for years. Our teacher has always been at the center. We watch lecture videos but there is always a gap in our minds.*” / “*I think that as there is not an explanation of the course content in the lesson, this model does not have any contributions to us.*”

Some participants stated that they had some technical problems in the flipped classroom. 7% of the participants expressed that the videos available in Khan Academy were of better quality than the videos on YouTube. 7% of the prospective teachers stated that sound quality, length, and content of the videos should be selected more carefully. 24% of the participants stated that lecture videos should be selected in accordance with the course content. 2% of them said that they could not determine any associations between the videos and the activities. Besides, 13% of the participants noted that some videos were very long, some were very short. One participant commented “*The videos could have been shorter or videos could be divided according to the different subjects.*” 13% of the participants stated that they had technical problems with the Internet connection. Most of the participants stated that they used Internet connection in their dormitories. They expressed that they had to watch videos earlier or later during the day because of the intensity of Internet usage. One participant stated that he had to watch the course videos on his mobile phone, but messages sent from the WhatsApp application distracted his attention. He said “*While watching the videos on the phone, a call or a message could distract our attention. A message sent from WhatsApp distracted my attention.*”

3.3 Suggestions about the flipped classroom

The suggestions made by the participants about the flipped classroom were divided into two categories as lecture videos and types of activities.

33% of the participants commented that there should be control about whether or not the videos watched in the flipped classroom. In this context, they stated that Kahoot activities would be an important factor in watching the videos. The participants defined the Kahoot application as entertaining, competitive, and motivating. One participant said that students watching the videos regularly could answer the Kahoot questions easily. Four participants said that if Kahoot activities were not be implemented, they could not come to the course in preparation. On the other hand, one participant held the view that quizzes should be applied instead of Kahoot activities once a week to check whether the videos were watched or not. Two participants mentioned the stress which the written exams caused them by saying, “*If you quiz, we will be stressed about whether we can do it or not, also it will be boring. The Kahoot eliminated the boring situation. Also, it increased learning.*” / “*When we take an official document in our hand, we become stressed. So, Kahoot is more enjoyable.*” 11% of the participants stated that the time when the videos were shared with the students was very important. One participant stated that the next course videos should be shared after the current lesson immediately. Another participant stated that teachers should prepare the videos

“Teacher can make lecture videos and upload them on the system. So, we will not watch videos made by other people”.

13% of the participants made some suggestions about the type of activities. For example, they said that activities such as filling in the blanks should not be used. On the other hand, one participant stated that learning environments should be designed in accordance with teamwork.

3.4 Using flipped classroom in mathematics education

Analyses showed that the participants had mixed opinions on the use of the flipped classroom in mathematics education. While some participants stated that this model could be used in mathematics education, others stated that the model was not proper for the mathematics course. Some participants stated that they were indecisive about the issue.

13% of the participants stated that flipped classrooms could be used in only some subjects in the mathematics course. They stated that the flipped classroom was more proper for verbal courses but that it was not proper for the courses requiring calculation. They, therefore, stated that they would decide to use it or not to use it according to the course content in the institutions they teach. One participant stated *“Teaching verbal courses through this method is more convenient... You could not understand the subjects by watching the videos on difficult courses such as Algebra.”*

31% of the participants claimed that the flipped classroom could be used in mathematics lessons. They stated that the flipped classroom was a different teaching model, and therefore, they could use the method when they become teachers. Besides, they stated that this model had advantages such as increasing the motivation of students, coming to the course with preparation, taking on responsibility for learning, realizing that they could access information, supporting students with different open learning sources and materials and saving time in the lessons.

One participant stated *“I think this model can be used in the mathematics course. Students can be responsible for their learning more.”* Another participant mentioned the advantages of this model as *“Drawing graphics can take too much time. But if students come to the course by watching videos, it can be easier for me. I can save class time.”*

38% of the participants claimed that the flipped classroom was not proper for the mathematics course. They said that the mathematics course should be taught in a traditional method, in other words, blackboard and pencil should be used while teaching the subjects. On the other hand, four participants stated that students would question the role of the teacher in this method. These participants stated their ideas on this issue *“This method can create a feeling of what the teacher contributes to the student.” / “Another perception can be created. I can learn from the video. So, why will I go to school? Students should first learn the subjects from me in order not to make a mistake.” / “I can feel invaluable. I could probably tell if I learn from the videos then what is the teacher doing?”* Three participants stated that it might be more appropriate to use this model only for repeating the course. Two participants said that students at small ages would possibly come to the course without watching the videos, so, the model was not suitable for secondary schools. In the context of Turkey, there are no Internet connections and computers in every home. Therefore, this model cannot be used effectively.

4 Discussion and conclusion

This study investigated prospective middle school mathematics teachers' points of view on the use of the flipped classroom in mathematics education.

Concerning the positive opinions on flipped learning, the results showed that flipped classrooms had many contributions to the prospective teachers' learning process. The most important advantages of this model, when compared to the traditional model, were found in this study as coming to the course with preparation, increasing the time spent for the course and planning the study process. These findings were similar to the previous research results (Cummins-Sebree and White 2014; Lo and Hew 2017; Mayer 2009; Mason et al. 2013). In a similar study conducted in Turkey by Göğebakan-Yıldız et al. (2016) found that the flipped classroom allowed instructors to implement active learning strategies and teamwork activities in learning environments. Adnan (2017) also found that flipped learning enhanced Turkish prospective teachers' self-regulated skills. On the other hand, this study showed that flipped learning made students study the course content all through the semester, not only in mid-terms or final periods. In this context, it could be said that flipped learning might decrease the exam anxiety of the prospective teachers. The prospective teachers noticed that they felt that they could not be active in the class when they did not watch the videos. For this reason, they were more responsible for their learning process. Also, learning becomes more permanent and easier since lecture videos appealed to both visual and auditory channels of the prospective teachers. In this study, it was found that flipped learning supported teamwork skills of the prospective teachers. Similarly, Strayer (2012) and Adnan (2017) emphasized that flipped classrooms supported collaborative learning skills. Another result of the study is that the flipped classroom increased the students' participation in the course. The prospective teachers attributed it to the fact that activity-based courses increased their interest in the course and made them more active in the lessons in this study. Previous studies (Adnan 2017; Altemueller and Lindquist 2017; Danker 2015; Elmaadaway 2018; Jamaludin and Osman 2014; Novak et al. 2017; Yang 2017) also stated that flipped learning was effective in increasing student participation in learning environments.

Concerning the negative opinions on flipped learning, not explaining the subjects in the lesson and only having lessons with activities were found as the disadvantages of the flipped classroom. Similarly, Talbert (2014) claimed that if course activities had not been satisfactory, students could not perceive flipped learning positively. It was found that some prospective teachers could not adopt the flipped classroom in the current study. These prospective teachers explained the reason for it as being educated with the mentality of traditional learning. Other reasons for these prospective teachers' failure to watch videos could be deficiencies in metacognitive and self-regulated skills. Previous studies (Sun et al. 2017; Wanner and Palmer 2015) showed that the students' expectation of studying less and not being responsible for their learning processes (self-regulation skills) were the difficulties of the flipped classroom. Therefore, to increase the efficiency of the model, it is important to provide a mechanism for arranging the self-regulation of students (Lai and Hwang 2016). On the other hand, as some prospective teachers did not take notes while watching the videos and as they did not attach enough importance to the videos, they had problems while getting prepared for exams. Technical problems were found another disadvantage of this model in this

current study. The biggest problem which the prospective teachers faced was the deficiency in Internet connection. It was also found watching videos on the mobile phone could be a problem since receiving text could distract their attention. Previous studies (Karabulut-Ilgu et al. 2018; Zengin 2017) found that technical situations could pose a problem in flipped learning.

The results of this study showed that prospective teachers offered some suggestions for the effective implementation of flipped learning. Firstly, Kahoot activities could be used for determining students who watched videos or who did not watch. For this aim, if students' scores in Kahoot activities were used for evaluating student' achievement, there could be an increase in the number of students watching the videos. On the other hand, traditional exams could cause anxiety on students, therefore, using Kahoot in the flipped classroom could be more useful. Similarly, Galway et al. (2014) claimed that student-response systems motivated students to perform their tasks. Secondly, it is important to share the next lesson's lecture videos with the students immediately. Also, the length of videos, video content, and resolution/audio quality are the most important factors affecting student motivation in flipped learning (Fang 2017). Therefore, selecting lecture videos from professional open learning sources such as Khan Academy instead of YouTube might be more effective. Videos should not be too long because they can distract the students' attention and videos should be selected in accordance with the course content. Activities such as discussion, and problem-solving should be used instead of filling in the blanks (Al-Zahrani 2015) while implementing flipped classrooms, especially in mathematics education. Consequently, instructors who tend to implement this model in learning environments should carefully plan the activities, and select lecture videos (Karabulut-Ilgu et al. 2018; Zengin 2017). On the other hand, as mathematics require more higher-order cognitive skills, teachers could give a summary of the content at the beginning of the lesson in flipped learning. Teachers should play the role of a facilitator rather than transferring the content to the students; and help students to associate the new knowledge with the previous knowledge (Altemueller and Lindquist 2017). In this study, it was found that some prospective teachers were not open to new learning approaches and that they could not go beyond traditional methods. Thus, it is important to explain the aims of this model before the application process as the students could hesitate to accept such changes (Adnan 2017; Al-Zahrani 2015). Also, faculty members should include these types of new learning approaches in the learning environments for prospective teachers to embrace the knowledge of and skills in different learning methods and techniques.

Another finding of this study was that prospective teachers had different opinions on the use of the flipped classroom in mathematics education. According to some prospective teachers, mathematics courses should be taught in the traditional method and that it would be better to use this model in verbal courses. On the other hand, the teacher's role could be questioned by students in the flipped classroom, it would also be right to transfer the knowledge to students by the teacher directly. The study found that some prospective teachers would not use the flipped classroom in the learning environment. Their reason for why they thought so was that younger students did not have self-regulatory skills and that Internet access was not available for every student in Turkey. The prospective teachers who thought of using flipped classrooms in their

career life stated that they could use the model to increase the motivation of students, make sure they watch videos, have a responsibility for their learning, support students with different materials, and save class time.

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