Online Flipped Learning for Engineering Students

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Abstract
The integration of digital tools into language teaching has increased with the COVID-19 pandemic. In parallel, online learning has become popular, resulting in a substantial amount of online courses. In addition, nowadays, it is preferred over traditional face-to-face learning in emergency situations. All of this has led educators and researchers to explore ways to improve online learning. Online flipped learning is one of the teaching strategies that can be used in online courses. However, there is not enough study to examine how successful online flipped learning is. Therefore, the aim of this study was to investigate the effect of online flipped learning on engineering students' foreign language learning in terms of self-efficacy and anxiety levels. For this purpose, a course was designed based on online flipped learning to measure the impact of the teaching method. The course "Technical Writing & Communication" was for third-year engineering students. The design was based on students' watching the asynchronous lesson recordings before online course sessions. During live online sessions, students were required to participate in the lesson activities which were based on the video recordings. One-group pretest-posttest design was used in the study. There were a total of 30 engineering students who completed both the pretest and posttest. The findings showed that online flipped learning had a positive impact on self-efficacy and the level of anxiety in foreign language learning. In conclusion, online flipped learning is an effective teaching method to teach a foreign language in an online setting.

Keywords: Online Flipped Learning, Higher Education, Self-Efficacy, Anxiety, Foreign Language Learning

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1. Introduction

The use of digital tools in teaching has been common recently. Especially in foreign language teaching, the digital tools have been integrated into the classroom practice so as to engage the students in the activities. One of the reasons why digital tools are commonly used in classrooms is that they draw the students' attention easily and they are practical to prepare and use for the teacher. Considering the students' use of computer and the internet as an important requirement of the 21st century, the teachers want to engage the students in the learning process in the most effective way (Gök et al., 2023).

Online learning has become an inevitable part of our lives with the outbreak of the pandemic COVID-19. It has started as the only means to carry on educational activities in pandemic lockdowns, so it was the solution in an emergency. However, the online applications and some activities have been a part of the teaching process to teach more effectively. After experiencing online teaching for a certain period of time, teachers have tried different ways to improve it. Online flipped learning is one of these various strategies to be used in language teaching.

According to The Flipped Learning Network (FLN) flipped learning is a model consisting "four pillars": "Flexible environment, Learning culture, Intentional content, Professional educator" (Arfstrom et al., 2013). Students are at the center of the flipped classroom. Before the lesson in the classroom, students are introduced to the lesson material. In this way, students are given some responsibility of their own learning process as well. The "flexibility" comes from the variety of the settings the teacher creates for the students. Students can work in the classroom on different task. Also, they start learning outside the classroom when they are preparing for the lesson. In addition, it is related to the "learning culture". Students are actively engaged in the learning process, which enables them to create a learning culture. Students are expected to be at the center of activities given by the teachers. However, teachers are not at the center of the activities. As for "intentional content", the teacher is considered to decide on which content is to be taught and to be actively learnt and used by the students. In this way, it can be said that teachers act as content creators for their students. The last pillar "professional educator" focuses on collaboration and cooperation among the teachers to improve their teaching.

As aforementioned, it is possible to have varieties of flipped learning. The integration of technology enables the students to be more actively engaged in the learning process as they have access to the videos, online activities shared before face-to-face lesson (Fulton, 2012). Another reason why online flipped learning is applied is that the use of technology based activities positively affect the students in terms of lower level of anxiety (Aydin, 2018). As for foreign language learning, especially in speaking skills, students have more anxiety. When online flipped learning is conducted, students will have a chance to be familiar with some of the contents before meeting in the classroom, which means they will be ready for the activities. Furthermore, they will participate in the activities with their classmates as a part of the learning process creatively. In addition, teachers will act as mentors and facilitators in the classroom rather than lecturer; therefore, students will be supported by their teachers, and they will feel less anxious. The less anxious they feel the more confident they are in the learning process, which means the level of self-efficacy gets higher. Online flipped learning depends on the students' having their own control on studying time and environment related to the materials shared online before the lesson in the classroom. This will improve learner autonomy at the same time. Self-efficacy is about a person's beliefs about the things they can

achieve. In online flipped learning, students are exposed to contents which they need to watch, analyze, think about, and evaluate. Therefore, they will be aware their own capacity to do all these (Bandura, 2006).

In conclusion, online flipped learning enables the students to raise awareness about their own capabilities for language learning process. As they are the actors of their own learning journey actively, they will improve their problem-solving and communication skills in language learning. Therefore, the purpose of this study is to examine the effect of online flipped learning on engineering students' foreign language learning in terms of self-efficacy and anxiety levels.

2. Research Method

One-group pretest-posttest design (Campbell & Stanley, 1963) was used as a research method in this study. One group is more feasible when all students are to be taught with the same method. Pretest-posttest design enables it to be measured whether the applied method creates a change in students.

2.1 Research Questions

There are two main research questions in this study:

RQ1. Does online flipped learning play a significant role in the *anxiety* level of the students?
RQ2. Does online flipped learning have a significant effect on students' *self-efficacy* in higher education?

The first research question focuses on the anxiety level of the students and investigates whether online flipped learning is suitable for decreasing the students' foreign language anxiety. The second research question is constructed to determine whether an increase in students' self-efficacy toward English can be achieved with online flipped learning.

2.2 Participants

Participants are 3rd-grade engineering students taking Technical Writing and Communication course at a public university in Turkey. The course is given as compulsory for students studying Mechanical, Energy Systems, and Materials Science and Engineering. The course aims to develop basic skills that students may need in their courses and professional lives. The medium of instruction is English in the university, and therefore, students took their courses in English from the beginning. In other words, their English knowledge level is at a level to follow lessons. Moreover, convenience sampling (Johnson & Christensen, 2019) was the sampling strategy to determine the participants since the instructor had easier access to the students in the course she taught.

2.3 Instruments

Two validated and reliable scales were used to collect data from the participants: (1) Foreign Language Classroom Anxiety Scale, and (2) English Self-Efficacy Questionnaire. Foreign Language Classroom Anxiety Scale was developed by Horwitz et al. (1986) to measure the anxiety level of students toward a foreign language. It consists of 33 five-point Likert-type items, ranging from 1 (Strongly disagree) to 5 (Strongly agree). English Self-Efficacy

Questionnaire developed by Wang et al. (2014) aims to measure the beliefs of students on their capability related to English. It contains 32 seven-point Likert-type items, ranging from 1 (I cannot do it at all) to 7 (I can do it well). It also includes 4 factors, each related to the basic skills of English: Listening, Writing, Reading, and Speaking.

2.4 Procedure

At the beginning of the course, students took pretests about their anxiety and self-efficacy related to English as a foreign language. There were a total of 62 students who filled out the pretests. Then, they followed the Technical Writing and Communications course given by the online flipped learning method for one semester. In the applied online flipped learning, the same type of video lecture was shared with the students by the instructor two days before online lesson time each week. The video lectures were prepared by the course instructor, and they were recorded in a professional studio. Students watched the videos asynchronously until the synchronous lesson time. The course was conducted live for 3 hours a week via an online platform during the semester. In the live sessions, the students did exercises related to the topic in the video they had watched before. Thus, in line with the purpose of flipped learning, the theoretical part was presented with video lectures, and they had the opportunity to practice more with exercises. At the end of the semester, a total of 30 students completed the posttests.

3. Results

This section presents the findings for each research question. The paired sample t-test was used to compare the pretest and posttest results. Although more students completed the pretest, the results of 30 students who completed both tests were used in the analysis.

3.1. Results for Students' Anxiety

The effect of online flipped learning on students' anxiety was investigated by comparing the students' Foreign Language Classroom Anxiety Scale pretest and posttest scores.

Table 1. Pretest-posttest results for students' anxiety

Variable	Test	n	Mean	SD	df	t	p
Anxiety	Pretest	30	2.76	0.73	29	2.374	0.024
	Posttest	30	2.51	0.62			

Table 1 shows the comparison of the pretest-posttest results for students' anxiety. The results show that online flipped learning significantly decreased students' anxiety ($M_{posttest}$=2.51 < $M_{pretest}$=2.76) towards foreign language ($t(29) = 2.374, p < .05$).

3.2. Results for Students' Self-efficacy

Students' self-efficacy was examined with the comparison of English Self-Efficacy Questionnaire pretest-posttest scores. Table 2 shows the comparison of the pretest-posttest results for students' self-efficacy. The results show that online flipped learning significantly increased students' self-efficacy ($M_{posttest}$=5.81 > $M_{pretest}$=5.37) about foreign language ($t(29) = -4.812, p < .05$).

Table 2. Pretest-posttest results for students' self-efficacy

Variable	Test	n	Mean	SD	df	t	p
Self-Efficacy	Pretest	30	5.37	0.81	29	-4.812	0.000
	Posttest	30	5.81	0.78			

As mentioned in section 2.3, it is possible to calculate the self-efficacy of students for each basic skill (Listening, Writing, Reading, and Speaking) separately. Therefore, separate self-efficacy scores for listening, writing, reading, and speaking were also determined in addition to the general self-efficacy score. These scores were also compared to see how much improvement has been obtained in self-efficacy for each skill. Table 3 shows the self-efficacy results for each basic skill of English:

Table 3. Pretest-posttest results for students' self-efficacy in terms of each basic skill

Self-Efficacy	Test	n	Mean	SD	df	t	p
Listening	Pretest	30	5.44	0.90	29	-2.695	0.012
	Posttest	30	5.71	0.97			
Speaking	Pretest	30	5.38	1.00	29	-4.203	0.000
	Posttest	30	5.90	0.81			
Reading	Pretest	30	5.46	0.79	29	-4.078	0.000
	Posttest	30	5.85	0.80			
Writing	Pretest	30	5.21	0.83	29	-5.528	0.000
	Posttest	30	5.76	0.79			

The separate self-efficacy results show that online flipped learning significantly increased students' self-efficacy about foreign language in terms of all basic skills. In other words, the proposed method has a positive effect on students' self-efficacy in terms of listening ($M_{posttest}$=5.71 > $M_{pretest}$=5.44), speaking ($M_{posttest}$=5.90 > $M_{pretest}$=5.38), reading ($M_{posttest}$=5.85 > $M_{pretest}$=5.46), and writing ($M_{posttest}$=5.76 > $M_{pretest}$=5.21).

4. Discussion and Conclusion

The results of the study showed that the online flipped learning has a positive impact of the students' self-efficacy while it decreases their anxiety level in language learning process. At the end of the term, a focus group including five students were interviewed about the online flipped learning conducted in the lesson. The students were asked questions about how useful they found the course choosing a number between 1-5 (1 is the minimum, 5 is the maximum level of satisfaction). They chose five for this question. Also, they were asked if they felt that their English skills improved, they said that speaking and writing skills improved most. In addition, they suggested more speaking activities in the following years for the course. In the light of the answers they gave, it was also understood that they found the asynchronous videos before the lesson beneficial. Although more detailed analyses of the interviews are planned in the future, it is clear from the comparison of the pretest and posttest results that online flipped learning can be utilized to increase the impact of online courses.

5. Limitations

This study has also some limitations. The first one is about sample size. Even if much more students completed the pretest, almost half of them completed the posttest. This can be expected since the course was mainly taught online. It is more challenging to involve all students in online education than in face-to-face education. Nevertheless, we could be able to reach enough number of participants at the end of the study. The other limitation of the study is that although the course started completely online as a result of a devastating earthquake in Turkey, all courses, including Technical Writing and Communications, were later switched from online to hybrid education upon the request of authorities. Even so, a few students followed the course face-to-face, and the data of the students who followed the course completely online were used in this study.

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