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THE EFFECT OF FLIPPED LEARNING ON STUDENT ATTITUDES TOWARDS PHYSICS COURSE

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Abstract
The purpose of this research is to determine the attitudes of university students who took the Physics II course with flipped learning towards physics course. Participants of the study were 98 second grade university students in an education faculty of a state university in Turkey. An experimental design with pre-test and post-test was used in the study. As the data collection tool, attitude scale towards physics course was applied to students both before the application process and after the application process. Cronbach alpha values were calculated as .89 for pre-test and .91 for post-test. According to the findings, it was found that participants' mean scores of the attitude scale in both control and experimental group were close before the application process. As a result of the research, it was determined that the Physics Lesson Attitude Scale scores of the experimental group students were significantly higher than the control group students. This result shows that the flipped learning model enables students to develop a positive attitude towards physics lessons. As a conclusion, it was suggested the flipped learning activities should be used in different courses.
Keywords: Attitude towards physics, flipped learning, undergraduate students.

INTRODUCTION

The impact of information and communications technologies (ICT) undergoing rapid developments especially in recent years has been noteworthy in many fields of daily life. Therefore, it is virtually impossible to handle educational programs in isolation from ICT when training individuals who are compatible with the era of information (Hsin, Lin, & Tsai, 2014). ICT, which offers different learning environments, methods, and approaches to be exploited, makes favorable contributions to the learning (Yelland, 2011). Due to the opportunities that ICT provides and changing student profiles of today, the use of approaches involving ICT in lessons has become a common practice.

One of the approaches that involves information and communications technologies is blended learning which benefits from the advantages of multi-environment in online and face-to-face learning. Blended learning provides students with flexible opportunities to study in terms of time and place. In addition, Flipped Learning (FL) model has emerged as a tailored form the blended learning (Christensen, Horn, & Staker, 2013).

FL is an approach in which pre-lesson individual learning is supported through video lessons and online exams and students try to work out the problems they encountered in a collaborative classroom environment (Bishop & Vergeler, 2013). Its main distinction from traditional technology-oriented learning is that it has similarities with active learning (İyitoğlu, 2018). This approach aims at promoting students to study the lesson material prepared and shared by the teacher via a learning management system or an educational social network (Edmodo, etc.) before the class and to learn the topic through various activities in the guidance of the teacher during the lesson (Hung, 2015). In traditional learning, teachers merely transfer the information to students who attempt to comprehend the topic. Similarly, on the other hand, homework as out-of-classroom activity is a tool for ensuring practice in traditional learning. Contrary to traditional learning, FL rather involves a process during which students study the teacher-prepared content (video, other materials, etc.) related to the lesson as out-of-classroom activities, thus, grasping the subject matter beforehand, and perform activities supporting the subject guided by their teachers in the classroom (White, 2012).

The number of studies conducted on FL in Scopus database indicates a considerable increase in the last five years (Figure 1). In this sense, it can be stated that investigating the effectiveness of FL on teaching environments is quite significant. The most important reason for the frequent use of this model might be the widespread use of video sharing (Youtube, etc.) and e-learning (Moodle, Edmodo, etc.) environments. The literature includes studies indicating that FL has positive effects on achievement (Tune, Sturek & Basile, 2013) and attitudes towards lesson (Valenza, 2012).

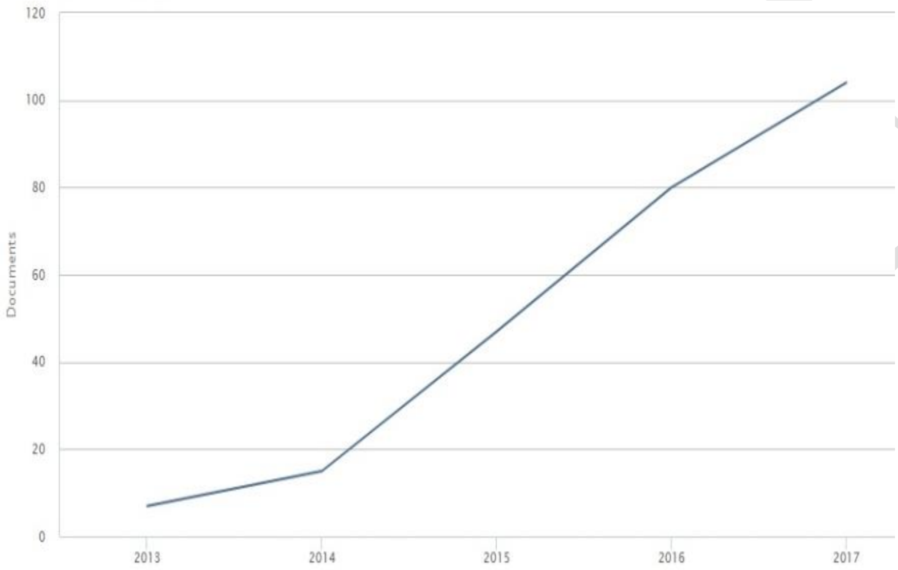

Figure 1. Distribution of studies regarding Flipped Learning in Scopus Database based on years

According to Thurstone, attitude is defined as the intensity of positive or negative feelings towards a psychological object (Gable, 1986 cited in Tekindal, 2009). In this view, attitude is regarded as one-dimensional and evaluated in perspectives such as positive-negative or preferable-unpreferable (Tekindal, 2009). It is acknowledged that from high school to university, students have negative attitudes towards physics lesson due to reasons such as physics lessons including a large number of subjects and difficulties in learning. Physics lessons serve as a foundation stone for university level students studying in different departments in a way that it enables them to develop fresh perspectives in applying their subject fields such as mathematics, computer and instructional technologies. Therefore, it is vital to change these negative attitudes towards physics since negative attitudes towards a lesson or a subject matter hardens the learning process, and both students and teachers dealing with reluctant students feel tormented by the situation. To prevent such scenario, lessons must be furnished with fun and attractive elements. Moreover, it is foreseeable that employing novel methods related to university students' subject fields may affect their attitudes towards the lesson in a positive way.

In the light of this anticipation, the research enquires the effect of Flipped Learning on students' attitudes in Computer and Instructional Technologies Department which is quite interbedded with technology. To test this circumstance, the effect of teaching during which FL was used on attitudes of students from Computer and Instructional Technologies department towards physics lesson was investigated. Below are the sub-problems of the research:

- Is there a significant difference between pre-test and post-test physics attitude scores of the experimental group in favor of post-test?

- Is there a significant difference between pre-test and post-test physics attitude scores of the control group in favor of post-test?
- Is there a significant difference between pre-test physics attitude scores of the experimental group and the control group?
- Is there a significant difference between post-test physics attitude scores of the experimental group and the control group?

METHODS

The extent of FL model's effect on the attitudes of Computer and Instructional Technologies department students towards physics lesson was investigated. Research design, participants and sampling methods were presented in the next sections.

Research Design

The research undertook a quasi-experimental research design with control group, pre-test, and post-test. As Karasar (2005) noted, the research designs with pre-test and post-test control groups are models which have experimental and control groups to be measured with regards to a dependent variable prior to and after the experimenting.

Sample and Sampling Method

The sample of the study involved 98 second grade students studying at the faculty of education of a state university in the 2017 academic year. The research made use of "convenient sampling" method that includes samples chosen from an environment enabling an easy implementation in terms of economy, finances, and time (Balcı, 2004). Furthermore, in designating experimental and control groups, students were divided into groups according to their student numbers being even and odd numbers. Following this, two groups were randomly assigned as control and experimental groups. However, some students who did not want to participate in FL were placed in the control groups in accordance with their requests.

Data Collection Tool

Physics Lesson Attitude Scale

The research was conducted with the help of a Physics Lesson Attitude Scale (PLAS) involving 24 items 12 of which are positive and vice versa. Using five-point Likert scale type, the scale was adapted by (Çirkinoğlu) Şekercioğlu (2011), and majority of its items were derived from the items of a physics attitude scale developed by Demirci (2004). In addition, Serin's (2002) "Science Attitude Scale" and Küçüker's (2004) "Electric Circuits Attitude Scale" contributed to the study. According to (Çirkinoğlu) Şekercioğlu (2011), the scale was examined by three scholars in the field in terms of content validity while one Turkish language expert evaluated spelling and intelligibility elements. To ensure the reliability of the collected data, Cronbach's Alpha (α) coefficient was calculated.

Table 1. Reliability coefficients of PLAS data

	Cronbach's Alpha	N
(Çirkinoğlu) Şekercioğlu (2011)	.90	157
Pre-test	.89	98
Post-test	.91	98

Table 1 presents the Cronbach's Alpha reliability coefficients related to PLAS data used in the research.

Table 2. Distribution of PLAS items according to factors

No	Items	Favor	Interest	Trust	Benefit
1	I like physics lesson.	**.775**	-.203	-.120	-.272
2	I'll feel happy if the number of physics lessons are reduced.	**.536**	.377	-.234	-.042
5	Physics is a charming and fun lesson.	**.701**	-.046	.038	-.166
7	I like physics lesson due to my teacher.	**.664**	.309	.051	-.180
8	If given authority, I'd remove physics lesson from school.	**.671**	.185	-.307	.198
9	I like studying for physics lesson.	**.763**	-.147	-.166	-.260
13	Physics lesson is among my top three lessons.	**.769**	-.102	-.032	-.069
16	I like to receive a book or a tool related to physics as a gift.	**.547**	-.239	.417	.133
17	I'd like to see more physics lessons in school.	**.710**	.059	.102	.024
20	I like talking about physics and its applications outside the classroom.	**.618**	-.160	.345	.251
21	I hate physics lesson.	**.692**	.106	.044	-.147
3	I enjoy doing physics experiments.	.353	**-.631**	-.114	-.014
6	I'm not interested in physics-related news on newspapers, magazines, and TV.	.446	**.522**	-.155	.235
11	I'd like to see more experiments in physics lesson.	.402	**-.542**	-.321	.042
12	If given authority, I'd reduce the number of physics subjects to minimum.	.490	**.509**	-.028	.358
14	I don't feel any desire to do something about physics in my leisure time.	.297	**.601**	.417	.120
15	I'm interested in everthing related to physics.	-.184	**.703**	.297	.168
23	I want to make discussions with my friends and teachers to improve my physics knowledge.	-.271	**.586**	.189	.281
4	I always feel nervous in physics lesson.	-.162	.353	**.464**	-.210
19	I'm afraid of physics lesson.	.035	.295	**.556**	-.461
24	I feel self-confident in problem-solving related to physics lesson.	.199	.003	**.719**	-.242
10	I don't think what I learn in physics lesson will be helpful in daily life.	.300	.201	-.378	**.542**
18	Text books are not helpful in learning physics whatsoever.	.019	.384	-.089	**.539**
22	Physics is not an important lesson to learn.	.090	.166	-.271	**.532**

Table 2 presents the load distribution of the scale comprising of favor, interest, trusts, and benefit in terms of factors.

Procedure

Prior to teaching, second grade students studying in Computer and Instructional Technologies were divided into two groups according to even and odd numbers in their student numbers to assign them to control and experimental groups. Following this, a PLAS pre-test was administered to both groups. As the next step, teaching process was initiated for the groups during the entire semester (12 weeks). Control group received traditional instruction such as lecture, question and answer while with the experimental group, FL method was implemented.

In the first week, students from the experimental group received an orientation; in that, they were informed about FL method. Each student was encouraged to sign into Edmodo which is an e-learning platform through httpss://www.edmodo.com. A module of physics lesson was created on Edmodo (Figure 2) to make students enroll in the online lesson. Downloading Edmodo application on their mobile phones, students used it throughout the entire semester. Each week, the lesson content (video, presentation, enactment, example problems, etc.) designed by the researcher was shared with students through Edmodo. In this phase, videos were exploited in particular because the literature indicated that learning experienced through videos proved interesting and permanent (Köse, 2013).

Students were asked to study the shared content and prepare before the lesson. To support individual learning, research problems related to the subject were presented. In the meantime, students were asked to discuss these problems on Edmodo environment to promote collaborative learning among them. Following this, classroom activities regarding the subjects and opportunities of face-to-face discussion were provided under the moderation/guidance of the teacher to offer students an environment for critical thinking. After the implementation, both groups were administered PLAS as post-test to compare attitude scores.

Figure 2. Edmodo group in physics lesson

Data Analysis

In the analysis of the data gathered from the research, SPSS software was used. Following the calculation of reliability coefficient obtained from PLAS data, it was detected that the scale data were in a reliable range. To ensure the normal distribution of the research data, the ratio of Skewness-Kurtosis values with standard error. For the data of a sample to be distributed normally, coefficients of Skewness and Kurtosis divided by their standard errors must provide a value between -1.96 and +1.96 (Can, 2014).

Table 3. Skewness-Kurtosis values of PLAS data

		Pre Test		Post Test	
		Statistic	**Std.Error**	**Statistic**	**Std.Error**
Experimental N:48	Mean	60.65	1.3798	67.07	1.6979
	Median	61.20	-	67.50	-
	Std.Dev.	9.5597	-	11.7638	-
	Skewness	.190	.343	.060	.343
	Kurtosis	.191	.674	.375	.674
Control N:50	Mean	58.30	1.4853	62.08	1.5145
	Median	57.20	-	61.67	-
	Std.Dev	10.5027	-	10.7093	-
	Skewness	.657	.337	.601	.337
	Kurtosis	.009	.662	.177	.662

Upon the decision that the data were distributed normally, parametric tests were designed to be used. Therefore, SPSS 23 software was used to run a Paired Samples t-test and an Independent Samples t-test.

RESULTS

Findings and interpretations of the research were examined in the order of sub problems.

Findings and Interpretations Regarding the First Sub-Problem

A paired samples t-test was run for PLAS pre-test and post-test scores gathered from the experimental group to detect the significance between their attitudes towards physics prior to and after the implementation.

Table 4. Paired samples t-test statistics of physics attitude pre-test and post-test of the experimental group

	N	Mean (%)	Std.Dev.	sd	t	p
Pre Test	48	60.65	9.5597	47	-14.122	.000*
Post Test	48	67.07	11.7637			

*p<.05

According to paired samples t-test findings, it was revealed that there was a statistically significant difference between pre-test and post-test scores of the experimental group regarding their physics attitudes [$t_{(47)}$=-14.122, p<.05].While their attitudes towards the physics were 60.65% prior to lessons, their scores were calculated as 67.07% after the process.

Findings and Interpretations Regarding the Second Sub-Problem

Similar to the first procedure, a paired samples t-test was run for PLAS pre-test and post-test scores gathered from the control group students to reveal if there is a statistical significance between attitudes towards physics prior to and after the implementation.

Table 5. Paired samples t-test statistics of physics attitude pre-test and post-test of the control group

	N	Mean (%)	Std.Dev.	sd	t	p
Pre Test	50	58.30	10.5027	49	-32.678	.000*
Post Test	50	62.08	10.7093			

*p<.05

Considering the paired samples t-test findings, it was indicated that there was a statistically significant difference between pre-test and post-test scores of the control group students considering their physics attitudes in the favor of post-test [$t_{(49)}$=-32.678, p<.05]. Control group students' attitude scores were calculated as 62.08% after the process whereas their attitude scores were 58.30% before the teaching commenced. Although the control group indicated an increase in score, it was lower than the increase rate of the experimental group.

Findings and Interpretations Regarding the Third Sub-Problem

With regards to the third sub-problem, the difference between the pre-test scores of both groups in terms of statistical significance was examined. To serve this purpose, an independent samples t-test was run to compare two groups' pre-test scores in the sense of physics attitudes.

Table 6. Independent samples t-test findings of experimental-control group physics attitude pre-tests

	N	Mean(%)	Std.Dev.	t	sd	p
Experimental	48	60.65	9.5597			
Control	50	58.30	10.5027	-1.155	96	.251
Total	98	59.45	10.0694			

p>.05

Table 6 presents the descriptive statistics of pre-test physics attitude scores of control and experimental groups and independent samples t-test findings. The results revealed no statistically significant difference between pre-test scores of the groups [$t_{(96)}$=-1.155, p>.05].

Findings and Interpretations Regarding the Fourth Sub-Problem

Regarding the fourth sub-problem, a statistically significant difference between the post-test scores of experimental and control groups was sought. Thus, an independent samples t-test was run to compare two groups in terms of their physics attitude post-test scores.

Table 7 provides insight into the descriptive statistics of post-test percentage scores and findings regarding the independent samples t-test.

Based on Table 7, it was revealed that post-test scores of both groups showed a statistically significant difference in favor of the experimental group [$t_{(96)}$=-2.194, p<.05].

Table 7. Independent samples t-test findings of experimental-control group physics attitude post-tests

	N	Mean (%)	Std.Dev.	t	sd	p
Experimental	48	67.07	11.7637			
Control	50	62.08	10.7093	-2.194	96	**.031***
Total	98	64.52	11.4568			

*p<.05

In a general sense, even though there was no statistically significant difference between physics attitude pre-test scores of control and experimental groups, it was reported that the difference between two groups were statistically significant after the teaching process. Additionally, it was shown that FL-based physics lessons that lasted one semester elevated students' attitudes towards physics lesson. However, in spite of the increase in their attitude percentages, students' 67% attitude scores could still be considered to be on a moderate level.

DISCUSSION and CONCLUSIONS

This study in which how FL model would affect students' attitudes towards physics lesson in technology-rich Computer and Instructional Technologies department was investigated, a comparison was made by administering PLAS both prior to and after the teaching process. Based on the results of the research, considering the pre-test, both control and experimental group students had proximal attitudes towards physics lesson; and their attitude levels were accumulated around the moderate level of 58-60%. It is speculated that the reason for this is that students regard physics subjects as hard to learn since physics lesson is not offered as a part of the field lessons of Computer and Instructional Technologies department. This result coincides with the findings of some studies in the literature. For instance, Baran and Akpınar (2011) asked Computer and Instructional Technologies students their opinions of the necessity of the lessons in their departmental program in their stakeholder analysis report, which revealed that 50.6% of the students responded that physics is the most unnecessary lesson in the second grade.

In the research, physics attitudes of the experimental group students were 60.65% prior to FL-based physics lessons while it was revealed as 67.07% based on the post-test findings. At the same time, attitude levels of the control group were elevated to the level of 62%. This result indicates that students' physics attitude levels increased more in FL-based physics lessons and was significantly higher than the traditional lessons in which techniques such as lecturing were included. According to this, it was deduced that even if the lesson is physics, Computer and Instructional Technologies students showed a more positive attitude towards the lesson when it involved activities with similar nature to their departmental operations such as computer, technology, etc. Regarding the literature on FL-related studies, there are no studies focusing on the effect on FL on Computer and Instructional Technology students' attitudes towards physics. However, certain studies about attitudes towards FL, student achievement, motivation, FL's positive impact on class attendance are quite noteworthy. These studies suggest that teaching based on FL has become more widespread owing to certain variables (attitudes towards FL, lesson achievement, motivation, etc.) (Sakar & Sağır, 2007; Wilson, 2013; Boyraz, 2014; Göğebakan Yıldız et al., 2016).

Considering these outputs, the cruciality of designing modern and technology-rich teaching activities like FL in lessons is underlined since young people show great interest to electronic environments as a result of the era of technology. Therefore, such lessons including methods like FL should be disseminated for the reason that these types of lessons make positive contributions to increasing students' attitudes towards lessons. Moreover, educators ranging from primary level to universities must be provided with in-service trainings and seminars about FL or similar modern teaching methods. Furthermore, in the light of all the studies focusing on this model, necessary actions must be taken to raise awareness about the matter.

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