The Effects of the Flipped Classroom Model on Academic Achievement, Academic Motivation, and Cognitive Absorption

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ABSTRACT

The purpose of this study is to investigate the effects of the flipped classroom model on academic achievement, academic motivation, and cognitive absorption. The study was conducted with a group of 68 freshman students studying at a vocational school's "Computer Programming" department in the 2019-2020 academic year. A quasi-experimental framework with pre-test/post-test was employed in the research, and the participants were randomly assigned to the experimental group and the control group. In the experimental group (n=38), the flipped classroom model was utilized, while in the control group (n=30), the traditional classroom model was employed. The experimental process of the study continued for 5 weeks: 4 weeks of training, and 1 week of orientation. Demographic Information Form, Academic Achievement Test, Academic Motivation Scale, and Cognitive Absorption Scale were used for data collection. To analyze the data, Independent Samples T-Test, Paired Sample T-Test, Wilcoxon Signed Ranks Test, Spearman Correlation, and Mann-Whitney U Tests were used. The findings showed that the experimental group had higher levels of academic achievement than the control group. Besides, it was found that there was no discrepancy between intragroup and intergroup academic motivation. Although the pre- and post-test results of the experimental group students who took the cognitive absorption scale did not show a statistically significant difference, the results indicate a modest level of connection between cognitive absorption and academic motivation.

INTRODUCTION

With the development of the Internet, digitalization has been initiated abruptly, and digital culture has been integrated into every area of society. The process of digitalization, which began with the expansion of information technologies and the Internet, has laid the foundation for a transformation process beyond change (Gürbüz, 2018). So much so that, today we can do many things faster and more easily over the Internet, from education to health, shopping to entertainment, banking transactions to travel plans. These assurances make it almost impossible to give up the opportunities the Internet offers (Haug et al., 2015).

To adapt to these developments in the field of science and technology, individuals in modern societies are expected to have 21st-century skills. These skills are defined by Eryılmaz and Uluyol (2015) as creativity and critical thinking, problem-solving, effective communication, collaboration, being both flexible and adaptable, being information and media literate, having autonomy and social skills, being productive, and having leadership qualities. Therefore, to be able to donate the individuals of this century with these skills, their learning environment must also be organized accordingly.

In this century, experts have been reevaluating educational systems with all their dimensions, emphasizing the need for transformation in education and developing and implementing new strategies to adapt to changing situations (Gürbüz, 2018). Education systems also go outside of the traditional understanding of education and require environments that actively involve the student in the learning process, are suitable for individual learning styles, and do not have restrictions on time and space. One of these education models is flipped classroom which aims to take advantage of two education models by combining the traditional face-to-face education model with online education. The major purpose of the flipped classroom is to make the most of the time spent in the classroom (Bergmann & Sams, 2012).

Flipped classroom is a technology-supported, student-centered learning model in which teachers prepare and share video content online with their students, students prepare for the face-to-face lessons before coming to class by watching these contents, and the face-to-face classes consist of discussion sessions and other in-class activities about the content of the videos watched before coming to class (Bergmann & Sams, 2012).

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Since the emergence of technology in educational environments, as in many areas, the interaction of individuals with technology has increased in education. Some researchers have developed theories to understand the experiences that resulted from this interaction (Koçak Usluel & Kurt Vural, 2009). One of these theories, which is named cognitive absorption theory, is defined as "the state of deep attachment that occurs as a result of individuals' experiences with software" by Agarwal and Karahanna (2000), and it is explained in five dimensions: *focused immersion, control, curiosity, temporal dissociation,* and *heightened enjoyment.*

Focused immersion: The user is fully focused when interacting with technology and ignores other things that they normally would pay attention to.

Control: The user thinks that they are fully in charge when they are interacting with technology.

Curiosity: The experiences of the user while interacting with technology stimulate their cognitive and sensual curiosity.

Temporal dissociation: The user spends more time interacting with technology than originally planned as they lose track of time.

Heightened enjoyment: The user simply enjoys interacting with technology.

Literature indicates that cognitive absorption affects cyberloafing (Sevinc & Dogusoy, 2022; Tanriverdi, 2017), the perceived benefit and perceived user-friendliness of Internet-based learning systems (Reychav & Wu, 2015; Saade & Bahli, 2005; Toraman, 2023), user participation (Reychav & Wu, 2015), and social network use (Dursun & Çuhadar, 2015; Cutuk, 2021; Barners et al., 2019). Yıldız and Yılmaz (2022) state that it is important to consider therapeutic coverage in educational evaluations outside the existing study process. In this study, the effects of the flipped classroom model and traditional method on pupils' academic achievements and motivations in "office software course" will be examined to find out whether there is a meaningful relationship between cognitive absorption and academic achievement and academic motivation. The research on the flipped classroom model shows varying findings, especially in the variables of academic achievement and academic motivation. Some of this research indicates positive outcomes in terms of academic achievement and academic motivation, whereas the others show no statistically significant effects of the flipped classroom model on academic achievement or academic motivation. Besides, when the literature on cognitive absorption was reviewed, it was noticed that there were not any studies that investigated the flipped classroom model and its effects on cognitive absorption. Therefore, this study aims to contribute to the literature by investigating the effects of the flipped classroom model on academic achievement and academic motivation, as well as on cognitive absorption. To reach this aim, the study seeks answers to the following research questions:

1. In the control group, where the traditional model was used,
   - Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic achievement?
   - Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic motivation?
2. In the experimental group, where the flipped classroom model was used,
   - Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic achievement?
   - Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic motivation?
   - Is there a statistically significant difference between students' pre-test and post-test scores in terms of cognitive absorption?
     - Is there a correlation between students' post-test scores of cognitive absorption and academic achievement?
     - Is there a correlation between students' post-test scores of cognitive absorption and academic motivation?
3. Between the experimental group, where the flipped classroom model was used, and the control group, where the traditional model was used,
     - Is there a statistically significant difference between the post-test scores of the experimental and control groups in terms of academic achievement?

● Is there a statistically significant difference between the post-test scores of the experimental and control groups in terms of academic motivation?

METHOD

A quasi-experimental research design with a pre-test/post-test control group was employed as a quantitative research method in this study, which investigated the effects of the flipped classroom model on cognitive absorption, academic achievement, and academic motivation.

The data collection processes carried out within the scope of this research were approved by the Sakarya University ethics committee, document dated 07.10.2020, and numbered 27.

RESEARCH DESIGN

The investigation was conducted with an experimental group in which the flipped classroom model was used and a control group in which the course was conducted with the traditional method. Table 1 below shows information about the research pattern used in this study.

Table 1. Research Pattern

Group	Pre-test	Experimental Process	Post-test
Control	Academic Achievement Test	Traditional Model	Academic Achievement Test
	Academic Motivation Scale		Academic Motivation Scale
Experimental	Academic Achievement Test	Flipped Classroom Model	Academic Achievement Test
	Academic Motivation Scale		Academic Motivation Scale
	Cognitive Absorption Scale		Cognitive Absorption Scale

PARTICIPANTS

The study was conducted with freshman students (n=68) studying at a vocational school's "Computer Programming" department in the 2019-2020 academic year. The students were randomly assigned to experimental (n=38) and control groups (n=30).) To specify whether experimental and control groups are similar with respect to their academic achievement and academic motivation, it was first determined whether the data was normally distributed. After it was established that the data of the experimental and control groups showed normal distribution, an independent samples t-test was conducted to examine the similarity between the groups. The findings are shown in Table 2 and Table 3 below.

Table 2. Independent Samples t-Test Findings of the Groups' Academic Achievement Pre-Test Scores

Group	N	$\overline{X}$	S	sd	T	p
Academic Achievement Pre-test (Experimental Group)	38	30,526	8.69			
				66	1.892	.063
Academic Achievement Pre-test (Control Group)	30	35.067	11.1012			

Table 3. Independent Samples T-Test Findings of the Groups' Academic Motivation Pre-Test Scores

Group	N	$\overline{X}$	S	Sd	T	p
Academic Motivation Pre-test (Experimental Group)	38	147.39	11.59			
Academic Motivation Pre-test (Control Group)	30	149	14.66	66	.504	.616

p <0.5

p <0.5

The findings of the independent samples t-test summarized in Table 2 above show no statistically significant difference (p=.063; p>.05) between the academic achievement pre-test scores of experimental and control groups.

The findings of the independent samples t-test summarized in Table 3 above show no statistically significant difference (p=.616; p>.05) between the academic motivation pre-test scores of experimental and control groups.

RESEARCH INSTRUMENTS AND PROCEDURES

In the study, the "Academic Achievement Test," "Academic Motivation Scale," and "Demographic Data Form" were utilized within both the experimental and control groups, while the "Cognitive Absorption Scale" was also utilized with the experimental group.

Academic Achievement Test

The Academic Achievement Test by Özdener and Saraç (2015) consists of 25 multiple-choice questions to measure students' knowledge about using MS Excel spreadsheets. The test is graded from "0" to "100." To measure its reliability, the test was piloted with 187 freshman university students. The results showed the reliability coefficient score of KR-20 as 0.77 and the content validity score as 0.82. In the current research, the academic achievement test was given to students in both the experimental (n=38) and the control groups (n=30) as a pre-test and a post-test. The Cornbach's Alpha reliability coefficient of the test was found to be 0.79, which indicates that the test has high reliability (Tavşancıl, 2006).

Academic Motivation Scale

To determine the academic motivation of students, the "Academic Motivation Scale" developed by Vallerand et al. (1992) and adapted to the Turkish context by Demir (2008) was used. Demir (2008) conducted the adapted scale with 350 vocational school students. The 7-point Likert scale, which allows measuring motivation according to the cognitive approach, consists of 28 items. It measures lack of motivation, intrinsic motivation (knowledge, achievement, stimulus), and extrinsic motivation. The Cronbach's Alpha reliability coefficient of the scale was discovered to be 0.85 by Demir (2008). In the current study, the academic motivation scale was given to students in both the experimental (n=38) and the control groups (n=30) as a pre-test and a post-test. The Cronbach's Alpha reliability coefficient of the pre-test was found to be 0.85 and that of the post-test was found to be 0.91, therefore it was concluded that the scale was quite reliable in the applied group (Tavşancıl, 2006).

Demographic Information Form

The form was used to obtain various demographic information about the participants. It included questions regarding students' years at university, their educational status, whether they are taking the course for the first time, whether they have taken any online courses before or not, how much time they spend online during the day, and how much of that online time they spend on studying or doing research.

Cognitive Absorption Scale

In the study, the "Cognitive Absorption" scale developed by Agarwal and Karahanna (2000) and adapted to Turkish by Koçak-Usluel and Vural (2009) was given to the students in the experimental group (n=38). The 10-point Likert scale consists of 17 items and 4 factors. The Cronbach's Alpha reliability coefficient of the scale was revealed to be 0.92 by Koçak-Usluel and Vural (2009). In this research, the Cronbach's Alpha reliability coefficient of the scale was found to be 0.89. These numbers indicate the test to be reliable (Tavşancıl, 2006).

DATA ANALYSIS

Table 4 below shows the normal distribution values of the academic achievement test, academic motivation, and cognitive absorption scales applied to the experimental group.

Table 4. Normal Distribution Data Obtained from the Scales Applied to the Experimental Group

Experimental Group		N	Min	Max	$\bar{X}$	Skewness	Kurtosis
Pre-test	Academic Achievement	38	16	52	30.526	.470	-.187
	Academic Motivation		124	175	147,395	-.106	-.119
	Cognitive Absorption		39	165	114.921	-.624	1.808
Post-test	Academic Achievement	38	20	88	68.526	-1.563	2.541
	Academic Motivation		104	195	146.789	.021	1,589
	Cognitive Absorption		52	164	113.158	-.415	.058

Whether the experimental group showed normal distribution was determined according to the skewness and kurtosis coefficients. If the coefficient of skewness and kurtosis is between +1.5 and -1.5, it is accepted that the group has a normal distribution (Tabachnick & Fidell, 2013). Therefore, the data indicates that while academic achievement and academic motivation pre-test and cognitive absorption post-test showed normal distribution, cognitive absorption pre-test and academic achievement and motivation post-tests did not show normal distribution.

Table 5 below shows the normal distribution values of the academic achievement test, academic motivation, and cognitive absorption scales applied to the control group.

Table 5. Normal Distribution Data Obtained from the Scales Applied to the Control Group

Control Group		N	Min	Max	$\bar{X}$	Skewness	Kurtosis
Pre-test	Academic Achievement	30	16	56	35.067	.394	-.700
	Academic Motivation	30	117	173	149	-.460	-.580
Post-test	Academic Achievement	30	28	92	59.867	-.089	-.990
	Academic Motivation	30	82	181	149	-1.714	5.010

The data of the control group indicates normal distribution except for the academic motivation post-test.

FINDINGS

Findings Regarding the Control Group

Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic achievement?

Table 6 below summarizes the results of the t-test comparing the academic achievements pre-test and post-test results in the control group.

Table 6. t-Test Results of the Control Group Academic Achievement Test Showing Pre-Test Post-Test Scores for Dependent Groups

Academic Achievement	N	$\bar{X}$	S	sd	T	p	
Pre-test	30	35.07	11.101				
Post-test	30	59.87	16.954	29	-7.806	.000	.67

The results show that there was a dramatic ascension in the academic achievement of the students after the treatment they received with the traditional method, t(29) = -7.806, p<.05. The students' mean academic achievement test score before the treatment was X = 35.067, and it increased to X = 59.867 after the treatment. In other words, there was a statistically significant difference in the academic achievement scores of the participants in the control group, $n^2 = 0.67$, which suggests that the traditional method significantly affected the academic achievement of the participants in the control group.

Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic motivation?

Table 7 below summarizes the results of the t-test comparing the academic motivation pre-test and post-test results in the control group.

Table 7. t-Test Results of the Control Group Academic Motivation Test Pre-Test Post-Test Scores for Dependent Groups

Academic Motivation	N	$\bar{X}$	S	sd	t	p
Pre-test	30	149	14.669			
Post-test	30	149.83	18.753	29	-.276	.785

* Based on negative ranks.

It was found that there was not a statistically significant difference between the control group's pre-test and post-test academic motivation scale scores, t(29) = -.276, p>.05.

Findings Regarding the Experimental Group

Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic achievement?

Table 8 below summarizes the Wilcoxon Signed-Rank Test results of academic achievement pre-test and post-test scores of the experimental group.

Academic Achievement Post-test-Pre-test	N	Mean Rank	Sum of Ranks	z	p	r
Negative Ranks	1	1.50	1.50			
Positive Ranks	36	19.49	778.50	5.28*	.000	0.85
Ties	1	-	-			

Table 8. Wilcoxon Signed-Rank Test Results of the Experimental Group Academic Achievement Test Pre-Test Post-Test Scores

* Based on negative ranks.

No statistically significant difference was observed between the experimental group's pre-test and post-test academic achievement scores, z=5.28, p<.05. When the mean rank and the total of dissimilar scores are considered, it can be observed that the difference is positive, that is, post-test scores seem to indicate positive outcomes. In other words, the flipped classroom model has a significant effect on academic success, r=0.85. Therefore, it can be inferred that the flipped classroom model increases academic achievement.

Is there a statistically significant difference between students' pre-test and post-test scores in terms of academic motivation?

Table 9 below summarizes the Wilcoxon Signed-Rank Test results of academic motivation pre-test and post-test scores of the experimental group.

Table 9. Wilcoxon Signed-Rank Test Results of the Experimental Group Academic Motivation Test Pre-Test Post-Test Scores

Academic Motivation Post-test-Pre-test	N	Mean Rank	Sum of Ranks	z	p
Negative Ranks	20	18.88	377.50		
Positive Ranks	17	19.15	325.50	.392*	.695
Ties	1	-	-		

* Based on positive ranks.

After the flipped classroom model had been utilized, no statistically significant difference was observed between the experimental group's pre-test and post-test academic motivation scale scores, z=.392, p>.05.

Is there a statistically significant difference between students' pre-test and post-test scores in terms of cognitive absorption?

Table 10 below summarizes the Wilcoxon Signed-Rank Test results of the experimental group's cognitive absorption pre- and post-test scores.

Table 10. Wilcoxon Signed-Ranks Test Results of the Experimental Group Cognitive Absorption Scale Pre-Test Post-Test Scores

Cognitive Absorption Post-test-Pre-test	N	Mean Rank	Sum of Ranks	z	p
Negative Ranks	22	18.50	407		
Positive Ranks	16	20.88	334	.529	.597
Ties	0	-	-		

There was no statistically significant difference in the experimental group's cognitive absorption pre-test and post-test scores: z=-.529, p>.05. Taking into account the mean rank and the total of the varied scores, it can be said that the obtained difference is in negative ranks, that is, in favor of the pre-test score. Taking into account these findings, it is clear that the flipped classroom model reduces cognitive absorption but does not make a significant difference.

Is there a correlation between students' post-test scores of cognitive absorption and academic achievement?

Table 11. Spearman Correlation Analysis Results of the Relationship Between Cognitive Absorption and Academic Achievement Post-test Scores of the Experimental Group

	N	R	p
Cognitive Absorption Academic Achievement	38	.289	.078

The results showed no statistically significant correlation between cognitive absorption and academic achievement scores of the experimental group (p>.05).

Is there a correlation between students' post-test scores of cognitive absorption and academic motivation?

Table 12. Spearman Correlation Analysis Result of the Relationship Between Cognitive Absorption and Academic Motivation Post-test Scores of the Experimental Group

	N	R	p
Cognitive Absorption Academic Motivation	38	.382*	.018

* The correlation is significant at .05

A moderate, positive, and statistically significant correlation between the experimental group's cognitive absorption and academic motivation post-test scores was observed (p<.05).

Table 13. The Relationship Between the Factors of Cognitive Absorption and Academic Motivation

	Time	Curiosity	Focused attention	Enjoyment
Academic Motivation	.086	.410*	.391*	.470**

* The correlation is considerable at .05

** The correlation is considerable at .01

When Table 13 is viewed, it can be said that academic motivation and cognitive absorption show a moderately positive and significant correlation among the factors of curiosity, focus of attention, and enjoyment.

Findings Comparing the Experimental Group and the Control Group

Is there a statistically significant difference between the post-test scores of the experimental and control groups in terms of academic achievement?

Table 14 below shows the Mann-Whitney U test analysis of the post-test academic achievement test scores of the experimental and control groups.

Table 14. U-Test Results of the Academic Achievement Test Scores of the Control and Experimental Groups

Group	N	Mean Rank	Sum of Ranks	U	p	r
Experimental	38	39.14	1487.50	393.5	.029	0.26
Control	30	28.62	858.50			

The academic achievement scores differed between the groups. Accordingly, the control group's academic achievement scores (so = 28.62) were lower than those of the experimental group (so = 39.14). In addition, based on the calculated effect size, it can be said that the flipped classroom model had a low effect on the difference between the academic achievement scores of the groups, r = 0.26.

Is there a statistically significant difference between the post-test scores of the experimental and control groups in terms of academic motivation?

Table 15. U-Test Result of the Academic Motivation Scores of the Control and Experimental Groups

Group	N	Mean Rank	Sum of Ranks	U	p
Experimental	38	31,68	1204	463	.186
Control	30	38,07	1142		

The academic motivation of the students participating in the study did not differ based on the treatment they were given. It was observed that the academic motivation (s = 31.68) of the experimental group was lower than that (s = 38.07) of the control group, but it was not found to be a statistically significant difference. These findings indicate that the flipped classroom model does not lead to a statistically significant difference in the academic motivation of students in the experimental group when compared with the control group.

RESULTS, DISCUSSION, AND SUGGESTIONS

This study has investigated the effects of the flipped classroom model on academic achievement, academic motivation, and cognitive absorption. Pre-test academic achievement scores of both the experimental and control groups before the treatment were observed to be similar. However, the post-test scores after the treatment were observed to have increased significantly within the groups. Although different models were applied to the groups, it is not surprising that the academic achievement of the participants increased at the end of the 5-week treatment for both groups. Analysis of the two groups' post-test results showed that the participants in the experimental group achieved higher than the ones in the control group. This finding is in line with the findings of the research conducted by Aydın (2016), Balıkçı (2015), Çakır and Yaman (2018), Göğebakan et al. (2016), Karaca and Ocak (2017), Salimi and Yousefzadeh (2015), Mason et al. (2013), Sohrabi and Iraj (2016), Thai et al. (2017), Tune et al. (2013), Turan (2015), Webb and Doman (2016), Polat and Karabatak (2021), Tutal and Yazar (2021), Debbag and Yildiz (2021), and Karaca et al. (2023). In some studies that compared the flipped classroom model with the traditional method, it was found that the flipped classroom model had no significant impact on learning (Eryılmaz & Çiğdemoglu, 2019; Howell, 2013; Sharpe, 2016; Tse et al., 2019; Yavuz, 2016).

The advantages of the flipped classroom method include the following;
- Students can continue learning at their own pace and style outside the classroom (Bishop & Verleger, 2013; Fulton, 2012),
- They can come to the lessons pre-prepared via content shared online by the instructor (Halili & Zainuddin, 2015; McLaughlin et al., 2013; Zappe et al., 2009),
- They can be active participants in the learning process, which leads to more permanent learning (Millard, 2012),
- They interact more with their peers and instructors as a large portion of in-class time is allocated for active learning (Bergmann & Sams, 2012; Halili & Zainuddin, 2015).

It is assumed that these advantages enabled the experimental group which was treated with the flipped classroom model to be more successful than the group in which the traditional method was used.

Another variable examined in the scope of this research was academic motivation. Before the experimental treatment, both groups' academic motivation scores were similar. After the experimental process, post-test academic motivation scores did not change between the groups. There was no statistically significant difference between the two groups in terms of their academic motivation post-test scores, either.

When the literature is reviewed, it can be seen there is a large number of studies (Awidi & Paynter, 2019; Aydın, 2016; Bhagat et al., 2016; Bolatlı, 2018; Chao et al., 2015; Çibik, 2017; Çukurbaşı & Kıyıcı, 2017; Lai et al., 2020; Nouri, 2016; Yavuz, 2016; Ukzuzoglu, 2023) reporting that the flipped classroom model has a positive influence on motivation. However, the findings of the current study did not support the previous findings as it was found that the flipped classroom model did not have a significant effect on the participants' academic motivation. This outcome is similar to Duman's (2019) academic study. Duman (2019) concluded that this may be because students are given more work to do in the flipped classroom model than in the traditional method. Another study conducted by Gökdaş and Gürsoy (2018) showed no statistically significant difference in students' mathematics motivation scores within and among the control group, which was taught with the traditional method, and the experimental group which was taught with the flipped classroom model. Gökdaş and Gürsoy (2018) stated that this may be due to the design of the learning materials and the fact that the participants in the experimental group did not have the technology required to access the contents. In another study, it was concluded that students were not enthusiastic about watching videos in the flipped classroom model, and it was pointed out that there was a need for certain methods to increase student motivation and enthusiasm toward watching the videos (Larsen, 2013). On the other hand, Turan and Göktaş (2015) reported the disadvantages of the flipped classroom model as students not

watching the videos before the face-to-face lessons and the activities they need to do before and after the lessons taking a long time. In this study, the fact that students perceived the activities they needed to do before class as homework and that they had to do more work than in the traditional method is thought to be the reason why the flipped classroom model did not prove to be successful with the experimental group.

Cognitive absorption is another variable investigated in this study. When the literature is examined, it can be seen that no study examines cognitive absorption and the flipped classroom model together. However, there are several studies examining cognitive absorption with a focus on Internet-based learning systems (Saade & Bahli, 2005), online learning environments (Leong, 2011), and evaluation of web technologies (Ünsal & Ekşioğlu, 2019). In these studies, researchers made suggestions for further research to examine the relationship between cognitive absorption and concepts such as academic success and motivation (Ünsal & Ekşioğlu, 2019), its impact on a web-based educational environment (Kurt-Vural,2007), and in environments such as Edpuzzle where educational activities are done (Dursun & Çuhadar, 2015). Taking these suggestions into consideration, the effects of the flipped classroom model on cognitive absorption were examined within the scope of this study. The findings showed that there was not any statistically significant difference between the cognitive absorption scores of the students before and after the treatment in the experimental group. In another study, it was found that the increase in the frequency of being online of students who do research and study while they are online does not have a significant effect on cognitive absorption (Koç, 2019). In this study, it was found that all of the participants in the experimental group did research while they were online, and 78.94% of them studied while they were online. Therefore, the fact that all the students in the experimental group do research online and the majority of the student's study online may be the reason why the flipped classroom model did not have an impact on the cognitive absorption of the students within this group.

In the experimental group, the relationship between students' cognitive absorption, academic achievement, and academic motivation was also examined. The findings have revealed that there was no correlation between the academic achievement of the students and their cognitive absorption, but there was a correlation between their academic motivation and cognitive absorption. A moderate and positive correlation was found between curiosity, focus of attention, and pleasure factors, which are the sub-factors of cognitive absorption, and academic motivation. The sub-factors of cognitive absorption, curiosity, focus of attention, and pleasure are also expressed in studies as the intrinsic sources of motivation. While intrinsic motivation is defined by Deci and Ryan (1985) as an individual's drive to participate in and continue doing an activity because they enjoy it, it is defined by Vallerand and Blssonnette (1992) and Woolfolk (1998) as the state of acting with internal motivational sources, such as personal characteristics, interests and needs, and sense of curiosity. In this case, it is not surprising that there is a correlation between the cognitive absorption of the participants in the experimental group and their academic motivation.

Suggestions
Recommendations Based on Research Results

In this study, the experimental group was found to have higher academic achievement scores than the control group. When the literature is analyzed, it can be seen that studies have reported the flipped classroom model to be more academically effective than the traditional method or that there is no significant difference between them. The factors that lead to these varying results can be examined in further research.

It was also revealed that there was not a statistically significant difference between the intragroup academic motivation scores of the experimental and control groups before and after treatment. To better understand the reasons behind this situation, it is suggested to use qualitative research methods, as well as quantitative research methods, in further studies investigating this topic.

It was found that the cognitive absorption scores of the participants in the experimental group after 5 weeks of treatment were lower than before the treatment, but this difference was not significant. This may be due to the treatment period being limited to 5 weeks. Therefore, studies that include longer treatment periods may yield different findings.

In the experimental group, the first 10 minutes of each lesson were allocated to student questions. However, this period should not be exceeded, and nor should this time be spared for detailed revision of the video content. In that case, students may think that the topics in the video are revised at the beginning of the lesson, and they may feel that they do not need to watch the videos.

There were 38 participants in the experimental group in this study. It is thought that working with smaller groups in studies where the flipped classroom model is applied might facilitate a more practical and feasible application of the model.

In this study, it was determined whether the experimental and control groups had similarities before the treatment by analyzing their academic achievement and academic motivation pre-test scores. In future studies, students' school entrance scores can also be compared to increase reliability.

Suggestions for Future Research

This study was conducted with the students studying Computer Programming at a vocational school. In future research, analyzing the effects of the flipped classroom model in different departments may provide a further generalization of the findings obtained in this study.

In the research, the effects of the flipped classroom model were investigated in an "Office Software" course, where the practical content is more than the theoretical content. In future studies, the effects of the flipped classroom model in courses where the theoretical content is more than the application can be examined.

In the current study, content sharing with the experimental group was done over the Edpuzzle platform. In future studies, the effects of different platforms and the opportunities they provide for student participation can be examined.

This research was conducted for 5 weeks. Future studies may look into the effects of the flipped classroom model on the variables examined over a longer time.

In the experimental group where the flipped classroom model was used, the researchers could not make sure whether the students watched the videos. Although student activity can be tracked on Edpuzzle, students may have just opened the video but not have watched it all. In this case, some difficulties may be encountered in the implementation of the model. In future studies, the difficulties encountered during the implementation of the model and possible solutions to this problem can be investigated.

In addition to the flipped classroom model, an experimental group studying in an online learning environment can be added to the research design in future studies, and possible changes in cognitive absorption within and between groups can be examined.

Future studies can also delve into the effects of the flipped classroom model on the variables examined within the scope of this study, as well as its effects on the permanence of learning.

Declarations

Conflict of Interest

No potential conflicts of interest were disclosed by the author(s) with respect to the research, authorship, or publication of this article.

Ethics Approval

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Research and Publication Ethics Statement

Hereby, we, as the authors, consciously assure that for the manuscript "The Effects of Flipped Classroom Model on Academic Achievement, Academic Motivation, and Cognitive Absorption" the following is fulfilled:

- This material is the authors' own original work, which has not been previously published elsewhere.
- The paper reflects the authors' own research and analysis in a truthful and complete manner.
- The results are appropriately placed in the context of prior and existing research.
- All sources used are properly disclosed.

Contribution Rates of Authors to the Article

This study was produced from Esra Alkaya Karagöl's master's thesis. The author Özlem Canan Güngören is a supervisor of the author Esra Alkaya Karagöl.

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