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The effect of flipped classroom approach on learning achievement, online self-regulation and interaction in synchronous distance education

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Abstract

A quasi-experimental design was employed to examine the effects of flipped classroom approach on students' academic achievement, self-regulation skills, and interaction level in synchronous distance education. The participants consisted of 50 undergraduate students. In an online synchronous course, the Zoom application and its breakout rooms were used. For ten weeks, students were asked to attend the course two times each week. For data collection, learning achievement test, online self-regulation scale, and online course interaction level determination scale were administered. The results revealed that while flipped classroom approach in an online synchronous course positively influenced students' self-regulation skills and the interaction level, it did not affect students' learning achievement.

Research Article

1. Introduction

Technological innovations improve instructional technologies and integration processes, which, in turn, results in acceleration of digital transformation in the world (Chen et al., 2016). This improvement also affects the change in educational paradigms (Li et al., 2014). Specifically, due to the positive effects of student-centered approaches on learning performance (Agbatogün, 2014; Smit et al., 2014), researchers' interest in this field has increased. Many approaches such as research-based learning, problem-based learning, project-based learning, and constructivism have been included in the learning process by researchers, and their effect on various dependent variables was studied. In the flipped classroom approach (FCA), the activities that students traditionally carry out in the classroom and at home are swapped (Tsai et al., 2020). More specifically, since the activities that allow students to gain knowledge are conducted out of the classroom, more time is spent for students to synthesize, analyze, apply, and evaluate their knowledge in classroom activities (Maxwell & Wright, 2016).

It can be said that the FCA learning process consists of two parts, in-class and out-of-class. Group activities are prioritized in classroom activities, and computer-assisted activities are prioritized in out-of-class activities (Bishop & Verleger, 2013). Studies in the literature generally examined students' self-efficacy, motivation, learning autonomy, and learning performance based on these activities (Bhagat et al., 2016; Chuang et al., 2018; Smit et al., 2014; Hsieh et al., 2017; Thai et al., 2017). This study differs from the

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other studies in terms of conducting computer-assisted and online activities as both in- and out-of-classroom activities. In addition, in the FCA, students are required to have a certain level of self-regulation skills (SRS) and are expected to take their own learning responsibilities in order to carry out individual learning processes. However, studies revealed that one of the most important problems encountered in the FCA is that the students have low SRSs and do not take responsibility without appropriate guidance (McLaughlin et al., 2014; Sun et al., 2016). Hew et al. (2021) examined 19 meta-analysis studies covering more than 495 studies and pointed out the importance of students' SRSs in flipped classrooms. In their studies, Hew et al. (2021) proposed that pre-class activities are very important for the flipped classroom approach to be effective and SRS is accepted as an important skill in performing these activities efficiently. In addition, Lee et al. (2019) stated that students' SRSs should be supported for the effectiveness of online learning environments. Therefore, self-regulation was included as a variable in this study. Another variable examined in the study is interaction level among the participants since interaction is one of the important factors that directly affect the quality of online learning and students' satisfaction and success (Garner & Bol, 2011; Anderson, 2003; Cheng & Chau, 2016). Also, in the study conducted by Li and Yang (2021), it is proposed that in the flipped classroom approach, the interaction enables students to develop their SRS and a positive attitude towards the flipped learning approach. On the other hand, it is known that students' SRSs are important in order to reach the desired level of interaction in online learning (Garner & Bol, 2011). In this context, it is considered important to examine the interaction along with the online SRS in the current study. Considering studies using FCA, it is generally mathematics (Algarni, 2018; Lai & Hwang, 2016), chemistry (Gillette et al., 2018), biology (Gallo, 2014), engineering (Lo & Hew, 2019), and English as a foreign language (Hung, 2015). Also, Jong et al. (2019) reported that only a few studies employed the FCA in humanities and social studies education. In order to fill this gap in the literature, this study was conducted in a history class from the Department of Humanities and Social Studies.

Based on the literature mentioned above, this study aims to determine the effects of the FCA in synchronous distance education on students' learning success, online SRSs, and interaction levels.

2. Literature

2.1. Flipped classroom approach

Today, with the change in educational approaches, addressing and meeting learners' needs come to the fore and educational processes in which learners access educational content individually by their own pace gained importance (Bishop & Verleger, 2013). One of the models among these educational processes is flipped (or inverted) classroom model which is called the blended learning style due to its use of both online and face-to-face learning environments. The basis of this model depends on the shift in duties in the classroom and at home. In other words, learning in the classroom and solving problems and doing homework at home shift to solving problems in the classroom and learning at home (Morin et al., 2013; Maxwell & Wright, 2016). This shift enables students to gain basic knowledge at home and to conduct discussions and find solutions to problems through team work under the guidance of the teacher in the classroom (Bergmann & Sams, 2012; Lai & Hwang, 2016).

In terms of the Bloom's taxonomy, while the steps for low-order thinking skills are followed before the class, the steps for high-order thinking skills are applied in classroom (Talan & Gülseçen, 2018). Thus, learning through educational technologies enables learners not only to build their own knowledge but also to carry out problem solving, cooperation, and mastery learning processes (Aydın & Demirer, 2017). Missildine et al. (2013) stated that students' learning basic facts on their own before the class through a video or web-based tutorial provides teachers more discussion and practice opportunities in the classroom, so that deeper learning occurs. Based on the studies in the literature, this model increases student participation, improves learning experiences (Bossaer et al., 2016; Chiang, 2017; Connell et al., 2016),

enables students to control their cognitive learning and increases their motivation (Abeysekera & Dawson, 2015), performance and satisfaction (Betihavas et al., 2016; Peterson, 2016), student-teacher and student-student interactions, advances students' problem-solving skills (Davies et al., 2013; Della Ratta, 2015), reduces students' anxiety levels (Marlowe, 2012), and encourage students to learn on their own. Bishop and Verleger (2013) stated that this model consists of two parts including in-class activities with interactive groups and out-of-class activities which are computer-assisted individual learning activities. While out-of-class activities are teacher-centered and computer-based; in-class activities are carried out with student-centered and interactive classroom activities. Kim et al. (2014) presents the following design principles for the flipped classroom (Figure 1).

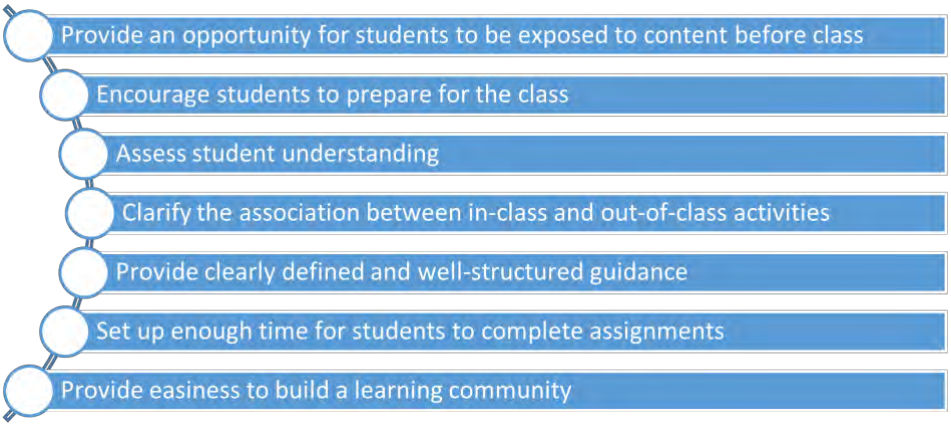

Figure 1. Design principles for the flipped classroom

The flipped classroom model, which has many differences compared to traditional approaches, has some disadvantages as well. Materials for in-class and out-of-class activities in the flipped classrooms should be high-quality, which may increase the cost (Cheng et al., 2019). For instance, designing a ten-minute video may take two or three hours for the instructor to create (Altaii et al., 2017). Also, the requirement for a well-equipped computer and strong internet connection, the difficulty in following up students to determine whether they watch the course videos, students' inability to ask questions while listening to the course content, inability to provide instant feedback for misconceptions, and the decrease in the importance of the school and classroom concepts are considered as disadvantages of the flipped classroom model (Sams & Bergmann, 2012; Fulton, 2012; Enfield, 2013; Herreid & Schiller, 2013). Indeed, O'Flaherty & Phillips (2015) stated that some educators are reluctant to adapt this model to their classroom due to similar disadvantages.

2.2. Online self-regulation

In recent studies, the importance of raising students who are able to question, think, make their own decisions, search, follow the developments in science and technology, and solve the problems they encounter is emphasized. Individuals with these qualities are only the students who are successful in organizing their own learning processes. These abilities are directly related to students' SRSs (Aydın & Atalay, 2015). Self-regulated learning can be defined as students' active participation in their own learning process by controlling their motivation, metacognition, and behaviors in order to achieve their learning goals (Boekaerts & Cascallar, 2006; Michalsky & Schechter, 2013; Zimmerman & Kitsantas, 2014).

Bandura (1991) defines self-regulation as an activity mechanism that plays a major role in the development of personal identity with the effect of motivation, emotions, thoughts, and behaviors. Specifically, the joint aspect of the definitions is that students take an active role in their learning processes in terms of behavioral, cognitive, and motivational aspects (Ainley & Patrick, 2006). In addition, those students develop strategies and use them to achieve their educational goals (Pintrich, 2004). Some studies also considered self-

regulation as a critical factor to improve students' motivation and academic success (Dignath et al., 2008; Zimmerman, 2001).

Students can gain problem solving and lifelong learning skills, which are considered as the most important skills for students, through self-regulation. The rationale of this is that students with SRSs are able to attempt to complete educational tasks by interpreting and analyzing them based on their knowledge and beliefs. In addition, these students insist on solving the problems they encounter while managing the learning process and spend more effort on challenging tasks (Dabbagh & Kitsantas, 2012). Those students are aware of their responsibilities in the learning process and focus on advancing their own learning rather than earning higher grades (Akdogan et al., 2016).

In the FCA, students' ability to conduct web-based activities that they are actively and independently exposed to at home and to increase their academic success depends on their SRSs (Wang et al., 2013). The reason is that, at home, they should have the ability to control, plan, and manage their work independently from the teacher. Studies on the FCA revealed that this approach positively influences students' SRSs (Ciftci & Ocak, 2016; Sletten, 2017; Talan & Gulsecen, 2018; Thai et al., 2017).

2.3. Interaction in distance education

As in face-to-face environments, interaction is also critical in technology-based learning environments in online learning environments (Simpson & Anderson, 2012; Moore & Kearsley, 2005) since interaction is an important element for creating an effective learning environment (Anderson 2003; Hiltz & Goldman, 2005; Lou et al., 2006). Students consider learning environments that allow high interaction more enjoyable (Holmes & Benders, 2012). Also, studies reported the positive association between students' interaction level and their satisfaction with the course (Bolliger & Martindale, 2004; Kuo et al., 2013). McIssac et al. (1999) consider interaction as the single and most important aspect of a well-designed distance education. Anderson and Hatakka (2010) define interaction as communication between people or between people and technical applications. Moore (1989) describes three types of interaction in online learning environments: learner-learner, teacher-learner and learner-content interactions. Later, Hillman et al. (1994) extended this framework by adding learner-interface interaction as the fourth type. Without these interaction types, it is very difficult to achieve success in the learning process (Bouhnik & Marcus, 2006). As a result of students' interaction in the online learning environments, changes occur in their understanding, cognitive structures, and thoughts. Thus, students create new meanings with these interactions by making associations with their pre-existing knowledge (Juwah, 2006).

Teacher-student interaction is a type of interaction that is seen as important by many educators and desired in educational environments, as reported by Battalio (2007). This type of interaction is stronger than the learner's interaction with the content. In distance education, insufficient interaction with the instructor results in disappointment in students (Xu & Jaggars, 2013). Learner-learner interaction occurs between students or within groups and is independent from the teacher. In the learning process, students should be able to communicate with each other, ask questions to each other, and exchange their thoughts. This interaction type was ignored in the first years of distance education; however, it gained importance to be included in applications with the spread of Web 2.0 technologies. According to Moore (1989), learner-content interaction determines the characteristics of learning. In some situations, students only interact with the content without interacting with the lecturer or other participants. Brady (2004) stated that the learner's interaction with the content positively affects learning outcomes and learning speed. The last interaction type, learner-interface interaction, is defined as the process of using educational tools by students in distance education (Hillman et al., 1994).

3. Research Questions

In this study, the research questions (RQs) were as follows:
RQ1. What is the effect of the FCA used in synchronous distance education on students' success?
RQ2. What is the effect of the FCA used in synchronous distance education on students' SRSs?
RQ3. What is the effect of the FCA used in synchronous distance education on students' interaction level?

4. Methodology

4.1. Participants

In this study, 50 students voluntarily took part in a university located in the east of Turkey.Students were in two different classrooms (nclass1=26 and nclass2=24) and they voluntarily participated to the study. Students study in two separate classes, one of which consists of 26 and the other 24. All participating students have the necessary technical infrastructure such as an internet connection, camera, and microphone. These classes were determined as one experimental group and one control group. Pre-tests were made to determine whether the groups had similar characteristics. In this context, an achievement test consisting of 30 questions developed by the researcher and an Online Self-regulation Questionnaire scale developed by Barnard, et al. (2008) and adapted into Turkish by Kilis and Yildirim (2018) were used. Before analyzing the pre-tests, it was examined whether the data showed normal distribution and as a result of the Shapiro-wilk test, the independent groups t-test was performed because the data showed normal distribution (p>.05). The results are provided in Table 1.

Table 1.
The t-test results for pre-test scores of the groups

Dependent Variable	Groups	N	$\bar{X}$	SS	sd	t	p
Learning Achievement	Experimental	26	38.92	13.77	48	.271	.787
	Control	24	37.75	16.74			
Online Self-regulation Questionnaire	Experimental	26	86.11	16.63	48	.266	.791
	Control	24	84.91	15.03			

When Table 1 is examined, it is seen that there is no significant difference between the groups in terms of the dependent variables examined. In other words, the control and experimental groups had similar characteristics.

4.2. Experimental Procedure

In this quasi-experimental study, both groups received instruction through the Zoom application for ten weeks. The steps of the research procedure are depicted in Figure 2.

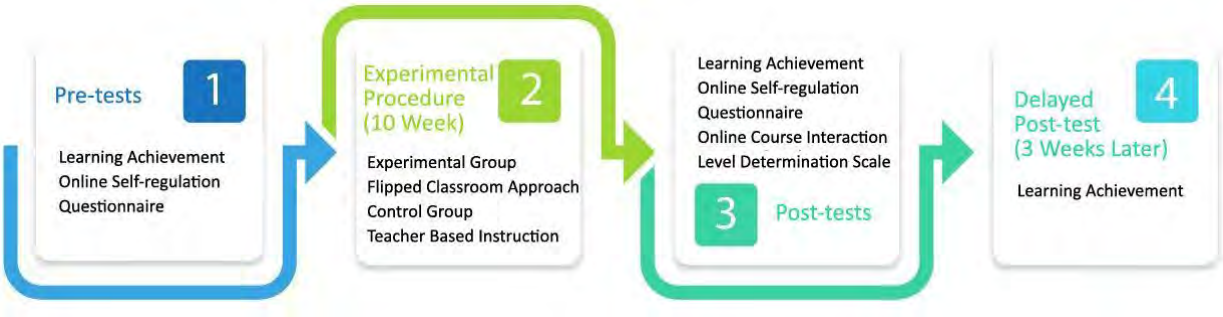

Figure 2. Experimental Procedure

In the first step of the study, the pre-tests were administered to examine whether the groups were similar. Then, each group attended the course twice a week for ten weeks. The same objectives for the History class were followed. The experimental procedures including teaching methods and techniques used in the experimental and control groups are summarized in Figure 3.

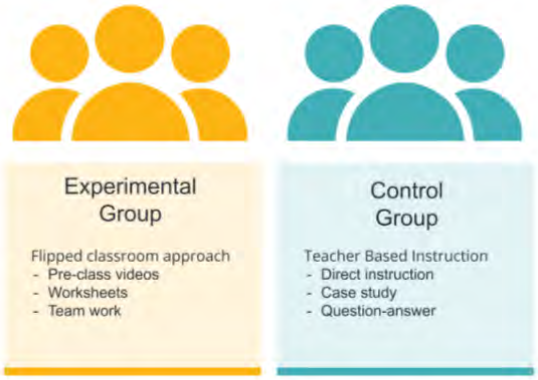

Figure 3. Experimental-Control Group

The Research Procedure for the Experimental Group

Before the implementation, a meeting was organized with the participants to discuss the objectives of the course, instruction style, and before-class and in-class activities. In addition, they were informed about how they seek help if needed during the semester. During the lessons, the design principles stated by Kim et al. (2014) for the FCA were followed. In this context, a total of ten videos and worksheets, one for each objective, were created by field experts. Each video was about seven to eleven minutes. Through these videos and worksheets, students had the opportunity to get familiar with the topic of the week before the lesson. The students were encouraged to come to the lesson prepared by establishing a connection between out-of-class and in-class activities. The videos and worksheets were shared with the students at least five days before each lesson through a learning management system they were familiar with. Also, students received instant answers/feedback to their questions or suggestions. The lessons were handled through the Zoom application. During these sessions, a collaborative learning approach was employed. Before each in-class activity, the students were introduced about the activity by the field expert. All students were given directions about the activities to be done in that lesson before the students in the experimental group were divided into small groups. The expectation from them in the activities and the product they need to put out as a group was clearly expressed and the questions of the students, if any, were answered. Then, the students were divided into groups of five to six people and assigned to the breakout rooms of the Zoom application. While each team was completing the tasks, the field expert visited each room and directed the discussions

and provided the necessary guidance. Afterwards, the activities were discussed with the whole class and feedback was provided. This process was repeated in each lesson for ten weeks.

The Research Procedure for the Control Group

In the control group, the same objectives were covered by the same field expert through the Zoom application. The methods and techniques used by the field expert were not interfered with. The field expert used direct instruction, case study, and question answer methods in the control group. Also, instant answers/feedback was provided to students when needed.

4.3. Measuring Tools

4.3.1. Learning achievement test

The learning achievement test was developed within the scope of the study by the researchers and used as pre-, post-, and persistence test. There were a total of ten objectives for the course. First, five questions for each objective were developed, which resulted in a question pool of 50 items. The items were reviewed by two experts. After the revisions, a pilot study was conducted with 260 students. Then, the item difficulty index (pj) and item discrimination index (rj) were calculated, and the rj value of 0.30 was subtracted from 13 items in the test. In addition, 5 items without rj value were also excluded from the test. Finally, 2 more items were removed from the test with close expert opinion. The final version of the test consisted of three questions for each objective. Table 2 shows the objectives and related test items.

Table 2.
The distribution of test items according to course objectives.

Objectives	Item No
1. Understanding the reforms made in the political field	1, 15, 16
2. Understanding the reforms made in the field of law	7, 8, 12
3. Understanding the innovations in the field of education and culture	4, 9, 10
4. Understanding the reforms made in the social field	2, 11, 13
5. Understanding the reforms made in economics	5, 6, 22
6. Understanding the meaning and importance of Atatürk's principles and revolutions	3, 27, 28
7. Understanding the Turkish foreign policy in the Atatürk period	17, 23, 14
8. Understanding Turkish foreign policy after the National Struggle	20, 24, 25
9. Understanding the causes of World War II	26, 29, 30
10. Understanding the fronts and results of World War II and Turkey's attitude	18, 19, 21

The average item discrimination index of the learning achievement test was 0.58, the item difficulty index was 0.66, and the internal consistency coefficient (KR-20) was 0.92. An example item from the learning achievement test is given in Figure 4.

Figure 4. An example item from the learning achievement test

4.3.2. Online self-regulation scale

In order to measure participants' online SRSs, the online self-regulation scale was used. The scale was originally developed by Lan et al. (2004). Although the scale consists of 86 items in its original format, Barnard et al. (2008) revised it. The revised version included 24 items. The 5-point Likert-type scale consists of six factors. The Cronbach's alpha value of the scale was found to be 0.95 (Kilis & Yildirim, 2018).

4.3.3. Online course interaction level determination scale

The scale developed by Karaman (2015) was used to measure the interaction in the study. The scale is 5-point Likert type and consists of 25 items. The Cronbach alpha reliability coefficient of the scale, which has a total of four factors, was found to be 0.89 (Karaman, 2015).

4.4. Data Analysis

For data analysis, descriptive and inferential statistical methods were performed. The data was examined through the Shapiro-Wilk test to determine whether the data was normally distributed. The result revealed normal distribution; therefore, an independent samples t-test, covariance analysis (ANCOVA), and variance analysis (ANOVA) were used in the analysis process to address the research questions.

5. Results

5.1. RQ1: What is the effect of the FCA used in synchronous distance education on students' success?

In order to answer the first research question of the study, the post-test achievement scores of the groups were compared and it was examined whether there was a difference between the post-test scores of the groups using covariance analysis. First of all, the assumptions necessary for the analysis of covariance were examined. In this context, there was no significant difference between the pre-test achievement scores of the groups, and the regression tendencies were equal [$F(1\text{-}50)=0.66$, $p>0.05$; 95% CI.] and homogeneity of variance [$F(1.48)=3.260$, $p>0.05$; 95% CI.] was determined. It has been shown that the assumptions needed for the covariance analysis of the obtained data are provided. The post-test average scores corrected according to the pre-test scores of the experimental and control groups are given in Table 3.

Table 3.
Adjusted post-test mean scores of the groups

Group	M	SD	Adj. M	SE
Experimental Group	53.88	15.33	53.91	3.26
Control Group	56.87	25.36	56.85	3.40

After examining the adjusted post-test scores of the groups, covariance analysis was performed and the results are given in Table 4.

Table 4.
Covariance analysis results

Source	Sum of squares	Df	Mean square	F	p	eta-square (η2)
Corrected Model	7758.59	2	3879.29	13.98	.00	.37
Intercept	3711.64	1	3711.64	13.39	.00	.22
Pretest	7646.99	1	7646.99	27.57	.00	.37
Group	195.39	1	195.39	.70	.40	.00
Error	13034.28	47	277.32			
Total	20792.880	49				

Looking at Table 4, it is seen that there is a significant difference between the pre-test and post-test scores of the students participating in the study ($F(1, 47) = 27.57$, $p<0.05$, $r=.37$). On the other hand, no significant difference was found between the post-test achievement scores corrected according to the pre-test achievement scores of the students ($F(1, 47) = .70$, $p >0.05$). The changes in students' pre-test, post-test and delayed post-test success scores were examined using two-factor analysis of variance. Before performing the two-way analysis of variance, the Mauchly sphericity test was performed and it was determined that the assumption was met ($W_{(2)}=.88$, $p>.05$). Another checked assumption is the equality of the variances of the scores obtained at the same time by the groups. The Levene test performed to examine the homogeneity of variances was confirmed that the homogeneity was satisfied for the pre-test ($F=2.01$, $p>.05$), for the post-test ($F=2.16$, $p>.05$), and for the persistence-test ($F=1.38$, $p>.05$). Also, according to the results of the Box's M test used to examine the equality of the covariance matrices for the dependent variable, the multiple normality assumption was met for the learning achievement test (Box's $M=11.104$, $p>.05$). The results of the variance analysis are given in Table 5.

Table 5.
The results of the variance analysis

Source	Sum of squares	Df	Mean square	F	p	eta-square (η2)
Between Subjects	26055.39	49				
Groups	15.28	1	15.28	.028	.867	.00
Error	26040.11	48	542.50			
Within Subjects	23562.61	100				
Time	8043.99	2	4021.99	25.06	.000	.34
Group*Time	113.61	2	56.80	.354	.703	.00
Error (Time)	15405.01	96	160.47			
Total	49618.00	149				

According to the results, the group effect ($F_{(1-49)}$=.028; p>.05) and the joint effect ($F_{(2-96)}$ =.354; p>.05) were not significant. On the other hand, the difference between the mean scores of the students' learning achievement in pre-, post- and persistence-tests, regardless of the groups, was significant ($F_{(2-96)}$=25.06; p<.05).

5.2. RQ2: What is the effect of the FCA used in synchronous distance education on students' SRSs?

In order to answer the second research question of the study, the posttest online self-regulation scores of the groups were compared and it was examined whether there was a difference between the posttest scores of the groups using covariance analysis. First of all, the assumptions necessary for the analysis of covariance were examined. In this context, there was no significant difference between the pre-test achievement scores of the groups, and the regression tendencies were equal [F(1-50)=0.06, p >0.05; 95% CI.] and homogeneity of variance [F(1.48)=3.860, p >0.05; 95% CI.] was determined. It has been shown that the assumptions needed for the covariance analysis of the obtained data are provided. The adjusted post-test scores of the groups and the results of covariance analysis are provided in Table 6 and Table 7.

Table 6.
The adjusted post-test scores of the groups

Group	N	M	SD	Adj. M	SE
Experimental Grup	26	96.03	15.68	95.65	2.77
Control Group	24	78.75	19.53	79.17	2.89

Table 7.
The results of the covariance analysis

Source	Sum of squares	df	Mean square	F	p	eta-square (η2)
Corrected Model	9234.18	2	4617.09	23.04	.00	.49
Intercept	1422.06	1	1422.06	7.09	.01	.13
Pretest	5504.02	1	5504.02	27.46	.00	.36
Group	3384.74	1	3384.74	16.88	.00	.26
Error	9419.43	47	200.41			
Total	18653.62	49				

A significant difference was observed between participants' pre- and post-test scores (F (1, 47) = 27.46, p<0.05, r=.36) and between the groups' adjusted post-test scores (F (1, 47) = 16.88, p<0.05).

5.3. RQ3: What is the effect of the FCA used in synchronous distance education on students' interaction level?

The third research question was about the effect of the FCA used in synchronous distance education on students' interaction level. As a result of the Shapiro-Wilk test, normal distribution of the data was ensured. The results of an independent samples t-test are provided in Table 8.

Table 8.
The results of an independent samples t-test on groups' interaction level post-test scores

Group	N	$\bar{X}$	SS	sd	t	p
Experimental Group	26	63.34	7.55	48	2.795	.007
Control Group	24	55.25	10.28			

According to the results, a significant difference was observed between the experimental and control groups' interaction level post-test scores (t(48)=2.795; p<.05).

6. Discussion and Conclusions

The aim of this study was to examine the effect of FCA on students' academic success, online SRSs, and interaction levels. While evaluating the results of this quasi-experimental study, its limitations should be taken into account. While the participants were limited to only 50 undergraduate students, the FCA was adopted to only History class. Also, the results were retrieved from the data that were collected through three different data collection tools.

This study first examined the effect of the FCA on students' academic success. The results revealed an insignificant difference between the experimental and control groups' academic success. On the contrary, the other studies in the literature reported that the FCA was effective in increasing students' academic performance compared to traditional approaches (Chiang, 2017; Connell et al., 2016; Gonzalez-Gomez et

al., 2016; Heybourne & Perett, 2016; Lai & Hwang, 2016; Moravec, Williams et al., 2010; Peterson, 2016). This opposite result may be due to the certain aspects required for successful implementation of the FCA and the contextual differences of this study from the other studies. One of the prerequisites needed for the FCA is that students need to be aware of their own learning and to take responsibility (Hew et al., 2021), which encourages students to complete pre-class activities. However, some studies reported that about 70% of students did not complete those activities (Diwanji et al., 2018; Palmer, 2015). This may be considered as a reason for the insignificant effect of the FCA on students' academic success. In addition, the students in this particular study were not familiar with the FCA that adopts different in-class and out-of-class activities, which may cause students not to take their own learning responsibilities. Moreover, although many studies in the literature adopted the FCA in face-to-face education, this study was conducted in an online learning environment. These may be considered as the reason for the insignificant effect of the FCA on students' academic success. This study also differs from the other studies in terms of context. Lawter and Garnjost (2021) conducted their study with German and US students and concluded that cultural differences affect learning outcomes in flipped classrooms. Thus, cultural factors may influence students' learning success in the online flipped classroom. In short, considering the various results in the literature, more experimental studies are needed in this area. Each element that may affect students learning in the flipped classrooms need to be tested by going through the experimental processes. Specifically, cross-cultural studies may provide evidence to improve the effectiveness of the FCA. The educators, who want to use FCA in their lessons, should encourage students to come to class with preparation and keep students' motivation high throughout the learning process. In this context, different strategies such as gamification can be used to keep students' interest levels high.

This study also examined the effect of the FCA used in synchronous distance education on students' online SRSs. In the FCA, students' ability to conduct out-of-class activities actively and independently depends on their SRSs (Dabbagh & Kitsantas, 2004; Wang et al., 2013). The reason is that students should be able to control, plan, and manage their out-of-class activities without their teachers. The studies with the focus on the FCA in face-to-face environments reported an increase in students' SRSs (Sletten, 2017; Thai et al., 2017; van Alten et al., 2020; Weinstein et al., 2011). This particular study also found that the online SRSs of the experimental group students increased significantly compared to the control group students. In this approach, appropriate guidance is critical for students to increase their SRSs and successfully take their own learning responsibilities (Sun et al., 2016). Students may not always use effective learning strategies while working independently (Dirkx et al., 2019). Thus, teachers should provide appropriate and effective guidance and provide quick feedback when needed in the FCA. Also, at the beginning of the learning process, students' responsibilities in the learning process can be clearly revealed by informing them in detail about FCA. In classroom activities, the role of the teacher in conducting the discussions effectively is in cooperative learning or small group discussions. The influence and misleading of the dominant students in the group should be prevented by the guidance of the teacher. Efforts should be made to ensure that students are active in the process by allowing each student to express their opinion freely. Today, SRS is one of the important skills that students are expected to acquire. Future studies must focus on implementing the FCA to different courses in various grade levels and in different cultures. In addition, the effects of SRSs on different factors such as students' attitudes towards the course, self-confidence, and study habits may be examined in the future. On the other hand, it is very important for educators, who want to use FCA in their classes, to measure the SRSs of the student group before starting the learning design. In line with the results obtained, measures can be taken to support student SRSs during the learning process or a different approach may be considered by deciding that the student group is not suitable to use the FCA.

The last research question of the current study deals with the effect of the FCA implemented in synchronous distance education on interaction. Lundin et al. (2018) stated that the FCA in face-to-face education positively influences classroom, teacher-student, and student-student interaction. This study found a similar result, which is critical since the approach was implemented in an online synchronous distance education

environment. Interaction is an important aspect in all educational processes, regardless of whether technology is involved (Moore & Kearsley, 2005). More specifically, interaction is an indispensable element in a well-designed distance education (McIssac et al., 1999). Despite this, interaction is an unsolved issue in all synchronous or asynchronous online learning environments (McIssac et al., 1999). In addition, many studies revealed that the communication among students during a lesson is effective in developing a positive attitude towards the lesson and that students are happier in environments with high interaction (Ali & Ahmad, 2011; Bray et al., 2008; Bolliger & Martindale, 2004; Holmes & Benders, 2012; Kuo et al., 2013). Since interaction, which is a critical aspect of the FCA, influences many factors in the learning process, future studies may focus on the effect of the FCA on interaction in terms of different variables. In this context, interaction and its indirect effects in synchronous distance education may be examined experimentally in different contexts by integrating many tools, especially Web 2.0 tools, into learning processes.

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