PRINT: ISSN 0972-0073 ONLINE: ISSN 2456-6802
Anthropologist, 20(1,2): 187-196 (2015)
DOI: 10.31901/24566802.2015/20.1-2.21

Online Collaboration Tools in Education: Google Docs Sample

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KEYWORDS Technology. Online Collaboration. Synchronous and Asynchronous Collaboration. Academic Performance

ABSTRACT The main purpose of this paper is to develop and integrate collaboration tools into an educational setting and examine the effect of online collaborative learning tools on students' academic performance. Synchronous and asynchronous techniques of online collaborative learning tools and different models are used for this paper. One technique focuses on creating work samples and sharing them with friends; the other focuses on correcting the samples that friends created. This research is quasi-experimental, and a final test-control group trial model was utilized. The working group for the research included one control and three experimental groups, all consisting of seventh-grade middle school students. The experiments were carried out by four collaborating student groups. One of the main findings of this paper is that the online collaborative tools can be an alternative to face-to-face collaboration. In addition, the paper demonstrates that the students who corrected the mistakes of others were more successful than the students that prepared samples; however, there is no statistical support for this outcome.

INTRODUCTION

With the development of technology and Web 2.0 applications, research interest in online collaboration tools has increased. Conversely, despite these developments, there is still a lack of knowledge about how to integrate these online collaborations into education. The existing literature provides different ideas about synchronous and asynchronous collaboration tools, butmost of these studies involved adults. Therefore, it is necessary to research the usage of these collaboration tools with children and determinewhich methods and tools are important for educators wishing to implement them. With the availability of new communicative environments through synchronous and asynchronous tools, online tools offer a new perspective for online collaborative learning. Online collaborative learning contributes to learning efficiency and outcomes, improves students' critical thinking, and builds communication skills (Brufee 1999; Johnson and Johnson 2000). Moreover, Wang et al. (2001) showed that online collaborative platforms improved students' connection and problem-solving abilities. Palloff and Pratt (2005) found that these platforms help students to create information and to think in imaginative ways (transmitted by Vallance et al. from Palloff and Pratt 2010).

The advantages of online synchronous platforms are cited in the literature (Duemer et al. 2002; Shotsberger 2000; Dickey 2003). Consequently, online synchronous interaction supplies feedback and responses as well as provides opportunities for collaborating as a group (Maushak and Ou 2007). Proponents, such as Walker and Pilkington (2000), assert that synchronous discussion environments are more advantageous than face-to-face collaboration in traditional classrooms. Similarly, Suthers et al. (2003) compared traditional face-to-face collaboration and online synchronous collaboration and determined that online synchronous collaboration platforms were more effective than traditional face-to-face collaboration in terms of presenting information. Wang and Woo (2007) offered a suggestion for comparing online synchronous and traditional face-to-face discussion platforms. Contrary to research that explains the advantages of synchronous platforms, there are studies that support the advantages of asynchronous platforms. Many researchers believe that online asynchronous interaction is more useful than online synchronous and traditional face-to-face interaction (Berge 1999; McDonald 2002; Koory

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2003; Morse 2003; Wang 2004; Johnson et al. 2005). According to the literature, online asynchronous discussion has a positive impact on learning in traditional classrooms (Andresen 2009). For example, Koory (2003) mentions that adult students who learn in online collaborative environments are more successful than adults who learn with face-to-face collaboration in a traditional classroom. Hence, it is useful to determine whether this status is acceptable for younger age groups such as children.

Researching the works will be more effective if used with online collaboration tools in an asynchronous way is also important. One alternative teaching method is to review peers' work by identifying correct and incorrect points, and modifying the incorrect solutions. Grobe and Renkl (2007) determined that if students have enough prior knowledge, they obtain better learning outcomes when given incorrect solutions inprogramming. The opposite of this result is to providestudents incorrect solutions that do not yield better learning outcomes in case where the students do not have sufficient prior knowledge. Additionally, VanLehn (1999) found that mistakes or incorrect solutions in programming can contribute to thinking in a creative way. Thus, it is necessary to research whether finding and correcting mistakes in documents contributes to academic success.

The main purpose of this paper is to develop collaborative tools, implement them in an educational setting, and examine the tools' effect on students' academic success. Synchronized and asynchronized online collaborative learning tools and two different models (one of the models entails students creating work samples and sharing them with friends; the other one entails correcting the samples that friends created) are used in this paper. In this paper, the following hypotheses were researched:

1. When comparing the control group that studies with face-to-face collaborative techniques and the experimental group that studies by using collaborative tools with a synchronous technique, the experimental group will perform significantly better.
2. When the experimental groups, which use collaborative tools with synchronous and asynchronous techniques, are compared in terms of academic success, the experimental group using the asynchronous technique will perform significantly better.
3. When the control group studying using the face-to-face collaborative technique and the experimental group using collaborative tools with asynchronous technique are compared with regards to academic success, the experimental group performs better.
4. When the experimental group that creates samples and shares them with class peers is compared with the other group that corrects samples that friends created using collaboration tools with asynchronous techniques, the group completing the document performs better academically.

METHODOLOGY

Research Design

This research is quasi-experimental and benefitted from a control group trial model posttest. The dependent variable is students' academic success. The independent variables are summarized;

Teaching methods (face-to-face traditional collaboration and online collaboration) and Online collaboration tools (synchronous and asynchronous)

Different teaching patterns (creating the samples and sharing with friends; correcting samples that friends created by using online collaboration tools with asynchronous techniques).

Research sources and patterns were designed as shown in Figure 1. First, the pre-test about "basic information technology" was performed with all work groups. The four different groups, each with four students, were compiled by random selection. Over the course of two weeks, "basic html tags" were taught to students in all work groups during lectures. Collaborative learning was implemented in all groups. As seen in Table 1, in the control group collaborative applications were performed by traditional face-to-face contact in the classroom. Synchronous applications were carried outby using online collaboration tools in Experimental Group I. In Experimental Groups II and III asynchronous applications were conducted by using online collaboration tools. In Experimental Group II, students started creating a worksheet and shared it with their group friends in Experimental Group III. The students in Experimental Group III continued developing the worksheet that their

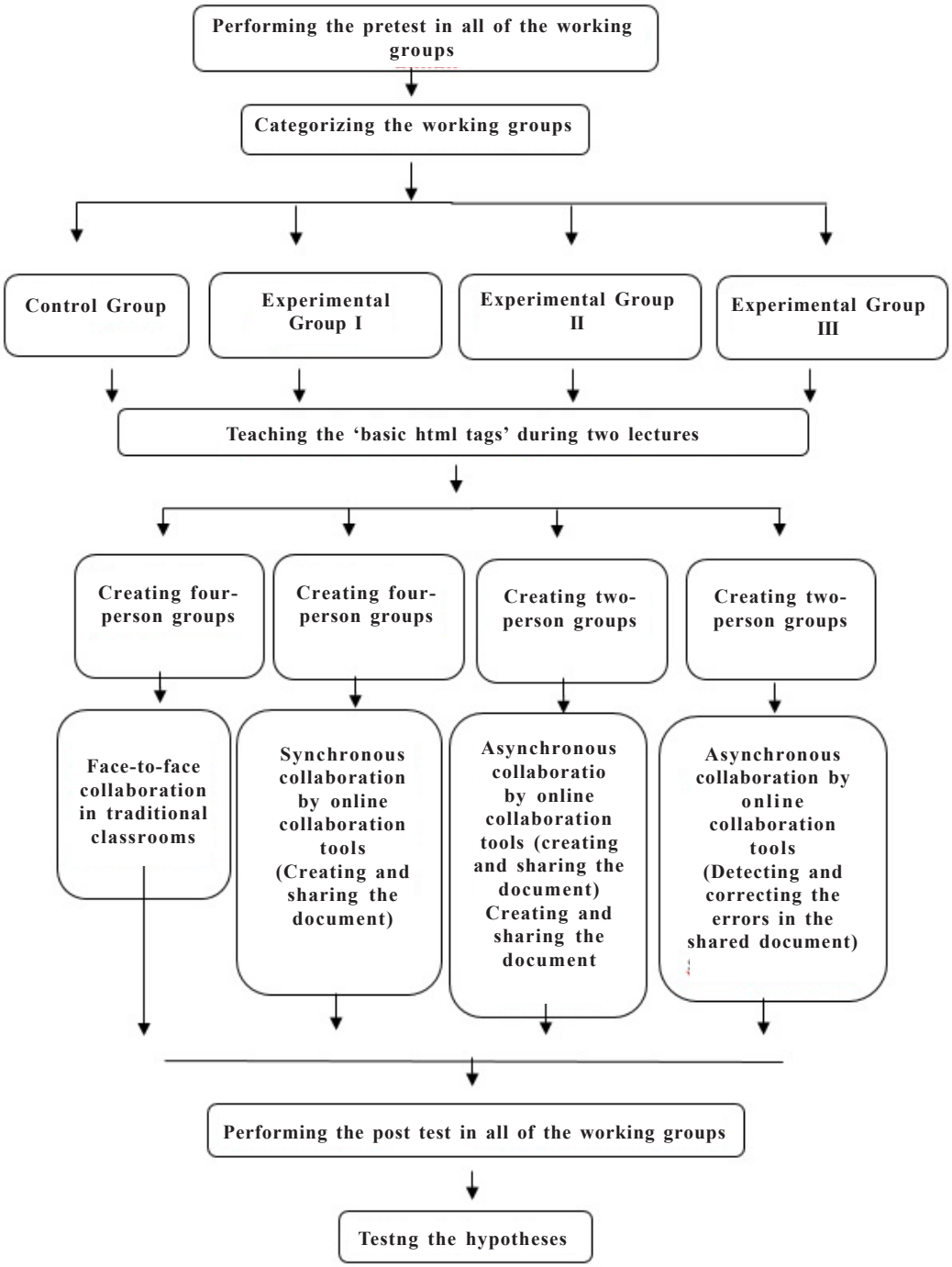

Fig. 1. Research design

friends shared with them in Experimental Group II. After the practice, the post-test was performed. In this research, "synchronous connection" means online synchronous collaboration performed with online collaboration tools.

Study Sample

The working group consisted of middle school students in seventh grade. In the working group, there were 115 students from four different classes. While choosing sampling, the appropriate sampling technique was used because of it was impossible to change the students' classes. The four working groups were determined randomly through a draw. Table 1 shows the working groups of this research.

Data Collection Tools

Pre-Knowledge Test

Before the experiments, a "basic information about technology" test was administered to test students' knowledge. This test contained 40 multiple-choice items. The pre-test was assessed by a maximum of 100 points. The internal consistency coefficient (Cronbach's alfa) of the pretest was determined to be 0.78. This data determined that the pre-test was reliable. To determine content validity of the pre-test, a matter of indicator table was prepared by categorizing target behaviors and five information technologies teachers were asked to evaluate if the current questions evaluated the target behaviors. Based on the teachers' answers, 82 percent of the current questions evaluate the target behaviors.

Final Test

To determine students' knowledge after the lectures, a final test was administered, which included 30 questions. This test was previously given to 60 students who had joined the HTML-lectures before; the test's Cronbach's alpha was calculated as 0.64. Five questions that were determined to reduce the test's Cronbach's alpha were excluded. At the last stage, the reliability coefficient was determined as 0.75. In the control and experimental groups, the test was administered ina 25-question version. In the final test, questions included HTML tags and the test used a 100-point scale.

To determine content validity of the post-test, a matter-of-indicator table was prepared by categorizing target behaviors. Four information technology teachers were then asked to evaluate whether the questions assessed the target behaviors. According to the teachers' answers, 85 percent of the questions evaluated the target behaviors.

Procedure

To perform the activities that were planned, four-person groups were formed. The worksheets that the students created were recorded as texts (in the online collaboration environment) on the computers' hard disks in the control group. The web pages' print screens, which the students were to create each week, were uploaded to students' computers, and they were told to "create a web page like that shown in the print screen." In addition, manual worksheets were distributed to the students, and they were given some instructions. In the control group, students worked in four-person groups. As seen in Figure 2, four students used two computers side by side in a laboratory, worked collaboratively, and saved the HTML tags as a Word document to be prepared according to the worksheet.

Table 1: Working groups

Groups	*N*	*Method and techniques*	*Number of members in groups*
Control Group	30	Face to face traditional collaborative works	4
Experimental Group I	28	Synchronous collaborative works by online collaboration tools	4
Experimental Group II	28	Asynchronous collaborative works by online collaboration tools (Creating and sharing the document)	2
Experimental Group III	29	Asynchronous collaborative works by online collaboration tools (Detecting and correcting the errors in the shared document)	2

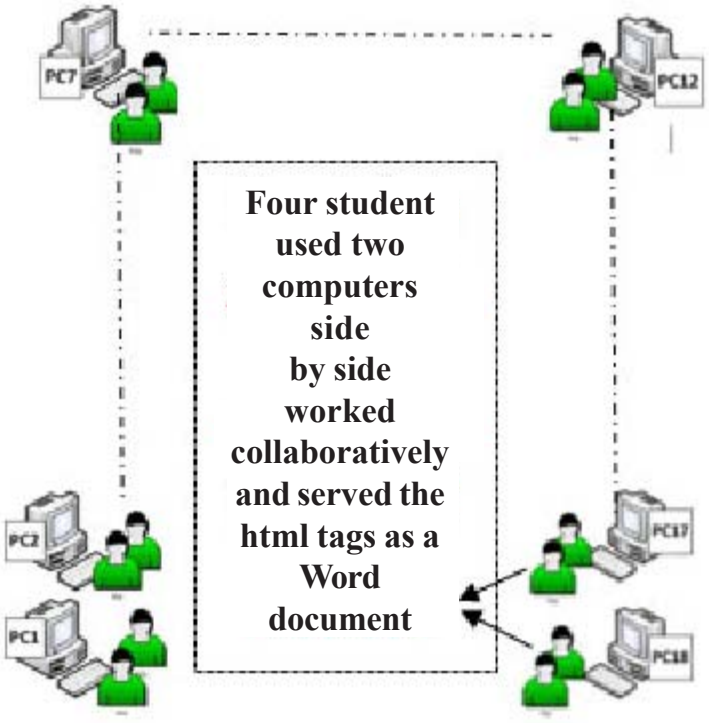

Fig. 2. Setup of students working collaboratively at two computers side by side

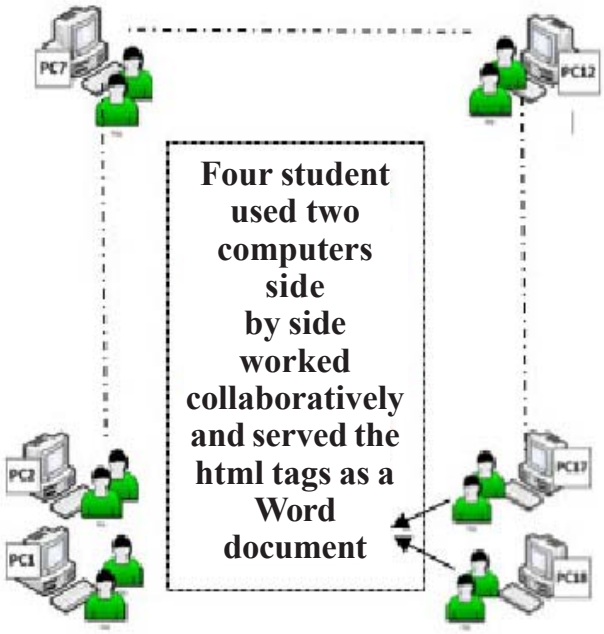

Fig. 3. The students who worked collaboratively by the synchronous technique on Google Documents by using two computers far from each other in Experimental Group I

In Experimental Group I, students worked in four-person groups. In this work group, the applications were performed in an online, synchronous collaboration environment. As seen in Figure 3, two students used a computer together, so four students worked on only one document. Each student pair using a computer together obtained a Gmail account and created a document; they then shared this document with the other two students by using Google Documents. Over four weeks, students saved their work in the same document.

In Experimental Groups II and III, students worked in two-person work groups. In these working groups, the experiments were conducted in an online collaboration environment asynchronously. As seen in Figure 4, two students used a computer together in Experimental Group II, and two students used a computer together in Experimental Group III; they collaborated by using online tools in an asynchronous way.

Two students using a computer together in Experimental Group II created the worksheet in the Google Documents environment. In Experimental Group III, two students using a computer together examined and corrected the errors in the documents that the other two students had created and uploaded. Hence, two students in Experimental Group II and the two students in Experimental Group III worked collaboratively on Google Documents. In these working groups, the students saved the document in Google Documents.

FINDINGS

Findings Before Practices

First, the Shapiro-Wilks test was used and determined that the groups were normally distributed ($p > .05$). In terms of basic informational technologies, to determine whether the working groups were peers, a one-way ANOVA was used, as seen in Table 2.

The results in Table 3 show that there was no significant difference between the groups accord-

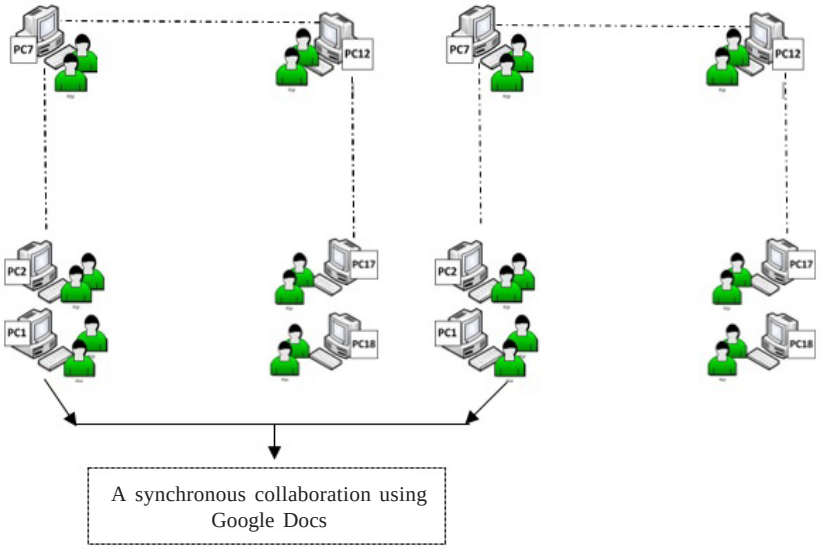

Fig. 4. A synchronous collaboration using Google Docs

Table 2: One-Way ANOVA results of pre-knowledge of test and control groups

Source of variance	*SS*	*df*	*MS*	*F*	*P*
Between groups	1054.07	3	351.35	2.23	.08
Inside group	17490.82	111	157.57		
Total	18544.89	114			

ing to their pre-knowledge, F (3,111) = 2.23; p > .01. The working groups are pre-groups according to their pre-knowledge. The work groups' academic averages and standard deviations on the final test are presented in Table 3.

Table 3: Academic averages and standard deviations of the students according to their pre knowledge

The working groups	*n*	*x*	*ss*
Control group	30	60.70	13.61
Experimental group I	28	65.71	10.36
Experimental group III	28	68.57	14.72
Experimental group III	29	63.18	10.95

Findings After Practices

To determine whether the control and experimental groups are normally distributed, a Shapiro-Wilks test was used after the final test. Itdetermined that the groups were normally distributed (p> .05). To examine whether the groups werepeer groups according to academic success, a one-way ANOVA for independent samples was employed, as seen in Table 4.

As indicated in Table 5, the results show that there is a significant difference between the working groups in terms of academic success, F(3,111) = 19.92; p< .01.To determine in which groups significant difference were present, a Scheffe test was utilized, as seen in Table 5.

As revealed in Table 5, the Scheffe test results show that: there is a significant difference between the control group and Experimental Group I in favor of Experimental Group I; there is a significant difference between Experimental Groups I and II in favor of Experimental Group II; there is a significant difference between the control group and Experimental Group II in favor of Experimental Group II; and there is no significant difference between Experimental Group II and Experimental Group III.

Table 5: Results of Scheffe Test with regards to comparing control and experimental groups according to academic success

Groups (i)	*Groups (j)*	$\bar{X}^{i-j}$	*p*
Control Group	Experimental group I	-17.57*	.01
	Experimental group II	-30.14*	.00
	Experimental group III	-25.51*	.00
Experimental Group I	Control group	17.57*	.01
	Experimental group II	-12.57*	.04
	Experimental group Iii	-7.94	.33
Experimental Group II	Control group	30.14*	.00
	Experimental group I	12.57*	.04
	Experimental group III	4.62	.75
Experimental Group III	Control group	25.51*	.00
	Experimental group I	7.94	.33
	Experimental group II	-4.62	.75

The students' success and the standard deviation in the working groups are condensed in Table 6.There were significant differences between Experimental Group II, which used the online collaborative tools with synchronous techniques, and the control group, which engaged in face-to-face collaboration in a traditional class (p< .05). By Table 6, we can say that the students' academic performance in Experimental Group II (X=73.57; S=20.08) was better than students' academic performance in the control group (X=56.00; S=19.81). There were significant differences between the two experimental groups

Table 6: Students' success and standard deviation

Groups	*n*	*x*	*ss*
Control group	30	56.00	19.81
Experimental group I	28	73.57	20.08
Experimental group II	28	81.51	10.74
Experimental group III	29	86.14	10.97

Table 4: Results of One-Way ANOVA of comparing control and experimental groups according to academic success.

Group	*Sum of squares*	*Sd*	*Mean square*	*F*	*P*
Intergroup	15492.16	3	5164.05	19.92	.00
Within groups	28775.52	111	259.23		
Total	44267.68	114			

that used online collaborative tools with synchronous and synchronous techniques ($p < .05$). By Table 6, we can say that the students' academic success in Experimental Group II (X=81.51; S=10.74) was better than students' academic success in Experimental Group I (X=73.57; S=20.08). There was a significant difference between the control group, which worked with face-to-face classroom collaboration, and the Experimental Group II, which used online collaborative tools with asynchronous techniques ($p< .05$). By Table 6, we can say that the students' academic performance in Experimental Group II (X=81.51; S=10.74) was better than students' academic performance in Experimental Group I (X=56.00; S=19.81). There was no significant difference between Experimental Group II, which created theworksheet, and Experimental Group III, which continued work on that worksheet ($p > .05$). In brief, by Table 6, we can say that students' academic performance in Experimental Group III (X=86.14; S=10.97) was better than students' academic performance in Experimental Group II (X=81.51; S=10.74).

DISCUSSION

Based on the results, we can say the lectures using Google Documents with synchronous and synchronous techniques were more effective than face-to-face lectures. In line with this result, Walker and Pilkington (2000) mentioned that online synchronous learning environments encourage students that are reluctant to join discussions in class. Moreover, Chou (2001) highlighted that online collaboration tools are more suitable for collaborative activities. Similarly, Suthers et al. (2003) compared face-to-face traditional collaboration and online synchronous collaboration and determined that the effects of presented information are more effective in online collaborative environments than in face-to-face collaboration.

This study found that Experimental Group II, which employed online collaboration tools with asynchronous techniques, achieved greater academic success than Experimental Group I, which made use of online collaboration tools with synchronous techniques. Similarly, Berge (1999) and McDonald (2002) support the opinion that online synchronous discussion is less effective than online asynchronous discussion. In contrast to the results of this research, academic success in our study was equal in both synchronous and asynchronous online platforms. The difference between the results of this research and Johnson's research may stem from the teaching designs and lecture plans. According to this current research, the experimental groups' academic success via online collaboration tools using synchronous techniques was better than the control group's face-to-face collaboration. This result supports Koory's research result, which concluded that students who attend online asynchronous lectures have more motivation and academic success than students who attend face-to-face lectures. While Koory (2003) underscores that online text-based communication strengthens students' skills, this paper's results also show that online text-based communication positively affects students' academic success. Similarly, Johnson et al. (2005) determined that students who belonged to an online synchronous discussion group were more successful than students in traditional discussion groups.

This research found no significant differences between the students' academic performance in the two experimental groups. The achievements of the students who created the worksheet were better than those of the students whose task was to continue working on that worksheet. Similar to this result, Grobe and Renkl (2007) mentioned that if the students have enough preknowledge, giving them incorrect programming language solutions encourages better learning results. Furthermore, VanLehn (1999) asserted that incorrect samples encourage students' thinking skills. Blau and Caspi (2009) found that the quality of the worksheet corrected by thestudent group was superior to that of work produced by student groups using different learning methods.

These research results generally show that teaching designs incorporating online collaboration tools can be an alternative to traditional, face-to-face learning. The results of this research contribute to teacher education on alternative teaching methods in terms of collaborative activities. Similarly, the results offer alternatives to students who do not have enough time to actualize collaborative activities. Therefore, the results of this work may solve problems with regards to actualizing collaborative activities in classrooms.

CONCLUSION

In this research, the purpose was to determine the effects of online collaboration tools on students' academic success. It was determined that the academic success of students who used the online collaborative tools with synchronous techniques in Experimental Group II is better than students who collaborated face-to-face in the control group in a traditional class (Experimental Group II =73.57; control group=56.00). On the basis of this result, we can say the lectures using Google Documents with synchronous and synchronous techniques is more effective than face-to-face lectures.

The other topic in this research was to examine the students' academic success in two groups that use online collaboration tools with synchronous and asynchronous techniques. It was found that Experimental Group II, which employed online collaboration tools with asynchronous techniques, achieved greater academic success, , than Experimental Group I, which made use of online collaboration tools with synchronous techniques (Experimental Group I=73.57; Experimental Group II= X=81.51). The other finding is that the experimental groups' academic success via online collaboration tools by synchronous techniques was better than the control group's face-to-face collaboration (experimental groups' academic mean using online collaboration tools via synchronous techniques =81.51; control group's academic mean using face-to-face collaboration=56.00).

In this research, two different experimental groups that used online collaboration tools with asynchronous techniques (the experimental group that created the worksheet/the experimental group that continued working on that worksheet) were compared in terms of academic success. Although there is no significant difference between the students' academic success in the two experimental groups, the performance of the students that created the worksheet was higher than that ofthe students whose task was to continue working on that worksheet (The experimental group that created the worksheet=81.51; the experimental group continuing to work on that worksheet=86.14).

RECOMMENDATIONS

In this research, Google Documents was used as an online collaboration tool. Future studies on this subject should examine the effect of other tools for online collaboration in terms of academic success. Studies should also investigate which methods were more effective for academic success while using online collaboration tools.

In this research, different teaching patterns (creating and sharing the document; detecting and correcting errors in the shared document) were used, while using online collaboration tools. In the future, the researchers should design different teaching patterns involving online collaboration and examine the results. This research involved primary school students as participants. Future research could focus on secondary school, high school or college students to examine the effect of applying different techniques while using online collaboration tools.

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