

## The Effect of Blended Learning on the Persistence of Academic Performance for Computer Education

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### Abstract

Nowadays new learning processes are being designed where online education is reinforced and used along with face to face education. This co-use that was established to eliminate various limitations is called Blended Learning (BL). Blending could be considered as building a new process by combining the positive aspects of online and face to face processes levelly. In this study, we shared the research to determine the effect of the BL process on the persistence of the learners' academic performance. The research was conducted by the participation of 63 university students in Turkey to a 10-weeks implementation of a BL process designed by the researchers. The research showed that the effect of the BL process on the persistence of the academic performance is more pronounced than that of face to face learning process.

**Keywords:** Blended learning, academic performance, persistence in education

### Özet

Günümüzde yüzyüze eğitimi, çevrimiçi eğitim ile destekleyen yeni öğrenme yaklaşımları geliştirilmiştir. Çeşitli sınırlılıkları ortadan kaldırmak için kurulan bu ortak kullanım, Harmanlanmış Öğrenme (HÖ) olarak adlandırılır. Harmanlama çevrimiçi ve yüzyüze ortamların olumlu yönlerini birleştiren yeni bir yaklaşım olarak düşünülebilir. Bu çalışmada, Harmanlanmış Öğrenme yaklaşımının öğrencilerin akademik başarısındaki kalıcılığa etkisi incelenmiştir. Bu araştırma, 63 üniversite öğrencisinin katılımıyla, 10 haftalık bir sürede gerçekleştirilmiştir. Araştırma sonucunda Harmanlanmış Öğrenmenin akademik başarının kalıcılığı üzerine etkisinin yüzyüze öğrenmeden daha fazla olduğu belirlenmiştir.

**Anahtar Kelimeler:** Harmanlanmış öğrenme, akademik performans, kalıcılık

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## **1. Introduction**

The rapid changes in the Internet and the information technologies have directly affected the education as well as the production, service, and trade businesses and they changed the learning and management methods significantly. These technologies have supported the idea of using the online environments for educational purposes since they provide access to a huge amount of data, easy access to information and rich communication environments. The training environments have gained an enrichment and multidimensionality in terms of interactivity particularly through online technologies. The individuals at different locations were enabled to participate in the same educational process and also it was made possible to design the educational process in a substantially customized way by taking into account the individual differences such as the learning speed or style more thanks to the education provided independently from the physical environment. However, despite its lots of positive aspects, the significant limitations for performing some practice-intensive activities such as some laboratory and workshop activities (Rossett, 2002:60; Driscoll, 2002; Kaya, 2002:2; Usun, 2006:6-88; Gulbahar, 2009:2-202) started discussions about the limits of taking advantage of the mentioned technologies and established the basis for searching for new implementation models. At this juncture, it is possible to consider Blended Learning (BL), which is a model formed by combining the positive aspects of the online activities with that of the face to face environment of the courses, as an alternative approach (Horton, 2000; Young, 2002).

In BL, the objective is to form a whole and therefore a stronger learning environment (Bielawski and Matcalf, 2003), which involves using multiple learning approaches and technologies along with the face to face environments (Zenger and Uehlein, 2001; Bersin, 2004; Wilson and Smilanich, 2005), directing the students to the individual learning (Garnham and Kaleta, 2002; Valiathan, 2002) and blending the online and face to face learning activities synchronously or asynchronously (Singh and Reed, 2001; Osguthorpe and Graham, 2003: 230). Moreover, it is aimed to offer environments that are customized for the individual, economical, updateable and that provide social interaction by taking advantage of the advanced information and communication technologies (Enjoo, 2006 cited in Usta, 2007: 42; Graham and Dziuban, 2003: 270-271; Wilson and Smilanich, 2005: 90; Unsal, 2007: 59-64). To this end, efforts are made to combine the strong points of the online and face to face environments in a balanced manner (Horton, 2000: 62; Graham, 2006: 7) and to use the existing facilities and technologies together in order to achieve the educational objectives (Orey, 2002). In this way, it could be said that BL provides significant benefits for the students, teachers and institutions (Kerfeld, 2002; Esfandiari, 2005; Posner, 2005). However, at this juncture the necessity of establishing the strategies and activities in accordance with the objective and content analyses, evaluating the compliance of the related institution, preparing the technical and technological

infrastructure for the implementations and knowing the ethical aspects of the process becomes evident (Khan, 2005: 23-379). Therefore it is observed that the dependent or independent factors regarding BL are taken into account during the education design process and that the process is dealt with using a program development approach (Wilson and Smilanich, 2005: 17-18).

In this sense the studies performed for evaluating the effects are important. Hence it is necessary to evaluate the effects of all those efforts in different dimensions. This study focuses on determining the effect of a BL implementation, which was designed and executed in accordance with the literature, on the persistence of the learners' academic performance.

We think that the results of this study presents significant results in terms of determining the short and medium term benefits of BL implementations on the individuals' academic development.

## **2. Method**

### **2.1. Aim of the Study**

The general aim of the study is to determine the effect of the Blended Learning process on the persistence of the learners' academic performance.

### **2.2. Research Model**

The study was designed in an experimental pattern. The pre-test, post-test and retest model with a control group was implemented for this. All tests the experimental and control groups were at the same time.

### **2.3. The Study Group and Procedure**

The study was conducted through the participation of 63 learners that were attending to the Computer Programming department at the Vocational School of Higher Education in a university in Turkey (Inonu University). 32 of the learners in the study group were put into the experimental group and 31 of them were put into the control group during the online and face to face learning process designed by the researchers and this distribution was performed by a selection taking into account the learners' possession of or easy access to a computer and Internet connection.

The online process in BL requires the learners to have basic computer operation skills regardless of the subject matter of course. Being inadequate with respect to this skill may affect the learners' academic performance.

Therefore the whole study group (both the experimental and control groups) were subjected to a preliminary test to examine their basic technology use information and skills.

**Table 1.** Levels of students' basic computer use

Basic computer usage levels	Frequency	Percent
Inadequate	5	7,9
Mediocre	26	41,3

Good	32	50,8
Total	63	100

The classification showed (Table 1) that 50.8 percent of the group was good, 41.3 percent was mediocre and 7.9 percent was inadequate.

**Table 2.** Using the experiences of students' computer and internet

Years of experience in computer and internet use	Frequency	Percent
Less than 1 year	4	6,3
1-2 years	8	12,7
3-4 years	9	14,3
More than 5 years	42	68,7
Total	63	100

As shown in the table above 68.70 percent of the study group's having computer and Internet usage experience for more than 5 years is considered to be a factor that contributed to this result. In this sense, it could be said that the students that participated in the study most probably learned the computer-aided tools designed for the implementation easily and they didn't have any difficulty in using these tools.

Along with this mentioned technical aspect, whether the learners had been in the environments that involved the use and design of technology for the educational purposes previously or not would also affect their point of view regarding this process. Therefore all students in the study group were also asked if they had participated in a computer-aided education implementation previously.

**Table 3.** Status of students' participated in a computer-aided education implementation previously

Participation status	Frequency	Percent
Yes	46	73
No	17	27
Total	63	100

It was determined that the majority (73 percent) of the study group had participated in a computer-aided education (CAE) process previously. It could be said that this high ratio is due to the fact that the majority (71.40 percent) of the students had graduated from the computer department of the vocational high schools and that they had computer-aided courses there. On the other hand, it was also determined that the students participated in a CAE implementation at the higher education level for the first time through this study.

However, it wasn't ruled out that their existing experiences could affect their expectations from the implementation in the study.

**Table 4.** Internet and Computer Use Per Day Times the Students

Usage of use	Internet		Computer	
	Frequency	Percent	Frequency	Percent
Less than 1 hour	13	20,6	6	9,5
1-2 hours	25	39,7	22	34,9
3-4 hours	11	17,5	14	22,2
More than 5 hours	14	22,2	21	33,4
Total	63	100	63	100

When the distribution of daily computer usage duration of the students in the study group was examined, it was seen that 44.4 percent of the group spent 0-2 hours, 22.20 percent spent 3-4 hours, and 33.40 percent spent more than 5 hours for it. It was determined that 20.60 percent spent less than 1 hour and 79.80 percent spent more than 1 hour when the distribution of daily Internet usage duration was examined.

Based on these statistics it was deduced that the study group wouldn't have a difficulty during the BL activities to be performed over the Web and that they would connect to the Web site daily to actively participate in the activities. However, knowing the primary purpose of the students for using the computer and the Internet is important in order to understand their attitude and behavior in this process better.

**Table 5.** Objectives of the students use the computer

The purpose of the computer use	Frequency	Percent
Game-entertainment	21	33,4
Social communication	25	39,7
Study-learning	12	19
Office and packaged programs	5	7,9
Total	63	100

When they were asked about their usage purposes, 33.40 percent of the students said game-entertainment, 39.70 percent of them said social communication, 19 percent said study-learning and 7.90 percent said using office and packaged programs. Taking this information about the students into account, the animations and synchronous communication objects were put emphasis on while designing the blended process online environment in order for them to keep participating in the learning activities provided over the Web without getting bored.

**Table 6.** Status of the students to have computer and internet connection

Ownership status	Computer	Internet connection
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	Frequency	Percent	Frequency	Percent
I have my own computer/internet connection	48	76,2	29	46
A computer/An internet connection does not belong to myself, but I have a computer I can use if necessary	8	12,7	23	36,5
I cannot use my own computer/internet connection and do not have a computer/an internet connection	7	11,1	11	17,5
Total	63	100	63	100

It has been determined that approximately 89 percent of the study group have use a computer, 83 percent have an Internet connection. These high ratios have streamlined the distribution for the experimental and control group. Furthermore, it could be said that this is significant since it shows that the learners have good opportunities regarding the computers and Internet technologies and therefore the online dimension of the BL activities could be carried out effectively.

The process was executed solely in the face to face environment for the control group, while it was executed 40 percent in the face to face laboratory environment and 60 percent in the online environment for the experimental group. The implementations lasted 10 weeks on “The Mainboards, Processors, Memory Units, Hardware Cards, Peripherals and Disk Drivers” chapters of the “Computer Hardware” course for both groups during the spring semester.

#### 2.4. Data Collection Tools and Data Analyze

A test that measures the academic performance of the learners' in the subjects taught during the process was used as the data collection tool. At first, a 75-question performance test was given to the student group that had taken this course before in order to improve the test. After the analyses of the results, 25 questions that had a discrimination power less than .25 were removed from the test in a way that wouldn't disturb the validity of the scope and 7 questions that had a discrimination power less than .30 were edited. After these arrangements the performance test took its final form that was composed of 50 questions. The difficulty of the test questions varied between .09 and .96. Accordingly, it could be said that there were very easy, easy, medium, hard and very hard questions in the test. The discrimination power of the questions varied between .31 and .46. The average difficulty level of the test was determined to be .51 and its reliability coefficient was determined to be .64. The mentioned test was given 3 times (before, at the end of and 5 weeks after the implementations). In addition, at the end of the implementation the students in the experimental group were asked about their opinions regarding the process they participated in. Their opinions related to the positive and negative aspects of the process, the appreciated

aspects and the problems experienced during the process were recorded through a semi-structured interview. The content analysis was performed through CAQDAS on the acquired qualitative data. The quantitative data was analyzed using frequency, percent, average, independent t test and covariance analyses.

### 3. Results and Discussion

In this section we shall share the results in parallel with the findings acquired from the study.

#### 3.1. The Gender Distribution of the Study Group

First of all some interesting points regarding the characteristics of the study group should be known and shared in order to be able to evaluate the findings of the study properly. To this end, a series of tests were performed on the study group before the implementation in the study.

**Table 7.** Gender distribution of students

Gender	Frequency	Percent
Male	38	60,3
Female	25	39,7
Total	63	100

About 60 percent of the study group was male and 40 percent was female students. This ratio is the same as the gender distribution of the educational institution that they were attending to.

#### 3.2. The Results for the Pre-Test Performance Points

An independent group's t test was performed for the preliminary test performance points in order to see the academic performance of the experimental and control groups in the study before the implementation and the results are shown in Table 8.

**Table 8.** The pre-test performance points

Group	N	$\bar{X}$	ss	sd	t	p
Experimental	32	38.37	12.32	61	.781	.438
Control	31	36.06	11.10			

As Table 8 shows, the preliminary test performance points average of the control group students is  $\bar{X} = 36.06$ , whereas the pre-test performance points average of the experimental group is  $\bar{X} = 38.37$ . After performing the independent group's t test, the difference between the preliminary test points of the experimental and control group students wasn't found to

be significant. According to this result, it could be said that there was no difference in terms of the academic readiness level of the control group and the experimental group.

**3.3. The Results for the Post-Test Performance Points**

An independent group’s t test was performed for the post-test performance points in order to see the academic performance of the experimental and control groups in the study after the implementation and the results are listed in Table 9.

**Table 9.** The post-test performance points

Group	N	$\bar{X}$	ss	sd	t	p
Experimental	32	53.80	11.90	61	-.989	.327
Control	31	50.25	16.76			

As Table 9 shows, the post-test performance points average of the control group students is  $\bar{X}$ =53.80, whereas the post-test performance points average of the experimental group is  $\bar{X}$  = 50.25. After performing the t test, the difference between the post-test points of the experimental and control group students wasn’t found to be significant. According to this result, there is no statistical difference between control group and experimental group. In other words, the groups have the similar academic performance levels at the end of the implementation.

**3.4. The Results of the Persistence Test Performance Points**

The standard deviation, arithmetic average and independent group’s t test results that were used to compare the persistence test performance points of the groups are shown in Table 10.

**Table 10.** The persistence test performance points

Group	N	$\bar{X}$	SS	Sd	t	p
Experimental	32	49.15	10.90	61	2.11	.038*
Control	31	46.90	14.90			

\* p < 0.05

As Table 10 shows, the persistence test performance points average of the control group students is  $\bar{X}$ =46.90, whereas the persistence test performance points average of the experimental group is  $\bar{X}$  = 49.15. After performing the t test, was determined significant difference on the persistence test points between the experimental and the control groups [t = 2.11; p < 0.05]. According to this result, it could be said that the learning achieved by the experimental group students is more persistent than the learning achieved by the control group students. The post-test performance points of the students in the class that were



taught in accordance with the BL were compared to that of the students in the class that were taught in accordance with the face to face education and the descriptive statistics for the persistence comparison of the learning are shown in Table 11.

**Table 11.** The descriptive statistics for the persistence total points of the experimental and control groups

Group	N	The Persistence Test Average	Corrected Average
Experimental	32	49.15	50.60
Control	31	46.90	45.30

As Table 11 shows, the corrected (according to the post-test) persistence test performance points average of the control group students is calculated to be  $\bar{X} = 45.30$ , and the corrected (according to the post-test) persistence test performance points average of the experimental group students is calculated to be  $\bar{X} = 50.60$ . The covariance analysis (ANCOVA) was performed in order to determine if these points differ between the groups and the analysis results are shown in Table 12.

**Table 12.** Covariance analysis (ANCOVA) results of the persistence total performance points of the experimental and control groups

Source of Variance	Sum of Squares	Sd	Mean Squares	F	Significance Level (p)
Post-test	9931.47	1	9931.47	1346	.003
Group	452.15	1	452.15	61.28	.005 *
Error	442.74	60	7.38		
Total	155796	63			

\*  $p < 0.05$

According to the ANCOVA results, there is a significant difference between the persistence test points of the experimental and control group students [ $F = 61.28, p < 0.05$ ]. A significant difference in favor of the experimental group is detected when these findings are evaluated. According to this finding, BL gives more positive results in terms of the persistence of information compared to the face to face learning. This difference shows that the control group students didn't perform as good as the experimental group students in terms of the persistence of information. Through BL, the students were made to show more interest in the course via the reinforcements of the online elements without leaving the facilities of the face to face learning completely. This ensured more active participation of the students in the course and created a positive effect in terms of the persistence of information.

### **3.5. The students' views on the BL in the context of the appreciated aspects and problems**

In order to get feedback from students about BL environment the semi-structured interviews were conducted. According to the students' views, there are four major positive aspect of the process of BL as making preparation for class (N=20), self-test or self-assessment (N=16), increase in interest towards the course (N=10) and reinforce lessons (N=6).

Most of the students (N=21) stated that they have not had a significant problem in the BL process. On the other hand, some students expressed some negative situations related the BL process. The most important of these problems were created by the internet connection interruptions. In this case, students' motivation decreases. Four of the students complained about this situation. In addition, some students (N=5) expressed that they are easily distracted while connected internet. Recently a problem has been reported on the application. According to students (N=11) statements some applications (such as test and implementation) in the process were evaluated as a problem due to the applications is mandatory.

## **4. Discussion**

It could be said that the academic readiness of the experimental and control group students regarding the topics in the scope of the study before starting the implementation were homogeneous and that they didn't have a statistically significant difference in terms of academic performance. A similar situation was also observed between their academic performance test points just after the implementation. Accordingly, it could be said that there wasn't a significant difference in terms of academic performance in the Computer Hardware course subjects between the face to face learning process and the learning process where the BL approach was implemented. In other words, the study shows that the learning acquired through the BL approach is as effective as the one acquired through the face to face learning approach. This also supports the study results of Delialioğlu (2004), Unsal (2007) and Esgi (2005). However, a significant difference in favor of the experimental group was detected in the performance test that was given 5 weeks after the end of the implementation to measure the persistence. According to this result, it could be said that the BL that the experimental group was subjected to give better results in terms of persistence compared to the face to face learning approach. In other words, it could be claimed that the cognitive behavior acquired through BL approach is more persistent. The studies carried out by Edwards and Fritz (1997) and Jones (1999) also gave a similar result.

On the other hand, it was found out during the student interviews, which were carried out in order to understand the causes of the difference in the persistence of academic performance better and to collect the opinions regarding the process, that more reviewing and practice opportunities thanks to the rich content provided by the BL activities and the high quality interaction with the peers and the instructor of the course when needed was highly effective. This result shows that the negative criticism in the past about the enriched

communication process through online environments should be reviewed for the current implementations. As a matter of fact, the studies carried out by Rasmussen (2003), Robinson (2004) and Usta (2007) also gave similar results and it was shown that the interaction in the BL environment has a positive effect on the class environment in terms of quality and that it has less limitations.

In conclusion, the study shows that the BL process has a positive effect on the persistence of the academic performance compared to the face to face learning process. On the other hand, it is recommended to carry out new studies that examine the factors that affect the learner's motivation, which is one of the significant elements that affects the learners' academic success, within the BL process.

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