The Effect of Timely Online Feedback on Student Achievement
Zamanında Verilen Çevrimiçi Geri Bildirimin Öğrenci Başarısına Etkisi

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Abstract

Purpose: In this study, it was investigated whether timely online feedback in the Faculty of Education 2nd grade Scientific Research Methods course has an effect on students' academic achievement.

Design/Methodology/Approach: The study was designed as a quasi-experimental model with pretest-posttest control group by determining experimental and control groups. The sample consisted of 82 students with two groups of 41 students each at the same level. The lessons were taught by the researcher for nine weeks with the students in the experimental and control groups using the traditional method according to the learning objectives. In this study, a pre-test was administered to measure the levels of both groups before the experimental procedure and a post-test was administered after the experimental procedure. Independent samples t-test, dependent samples t-test, and effect size analysis were used to statistically evaluate the data.

Findings: According to the findings obtained in this study, according to the posttest mean scores of the experimental and control groups, a significant difference was found in favor of the experimental group with a medium effect size.

Highlights: As timely online feedback contributes to student success; similar research can be generalized by applying similar studies to student populations at different levels and to face-to-face and distance learning processes.

Keywords: Computer Education and Instructional Technology, Feedback Timing, Feedback, Online Feedback

Özet

Çalışmanın amacı: Bu araştırmada deneysel yöntemle Eğitim Fakültesi 2. sınıf Bilimsel Araştırma Yöntemleri dersinde zamanında verilen çevrimiçi geri bildirimlerin öğrencilerin akademik başarılarına etkisi olup olmadığı araştırılmıştır.

Materyal ve Yöntem: Araştırma deney ve kontrol grubu belirlenerek öntest sontest kontrol gruplu yarı deneysel model biçiminde desenlenmiştir. Örneklem, aynı seviyedeki 41'er kişilik iki grupla toplam 82 kişiden oluşmaktadır. Dersler dokuz hafta boyunca araştırmacı tarafından deney ve kontrol grubunda yer alan öğrencilerle geleneksel yöntemle, öğrenme hedeflerine uygun bir şekilde işlenmiştir. Bu çalışmada deneysel işlem öncesi her iki grubun seviyelerini ölçmek için ön test ile deneysel işlem sonrasında son test uygulanmıştır. Verilerin istatistiksel olarak

705

değerlendirilmesinde bağımsız örneklem t testi ve bağımlı örneklem t testi ile etki büyüklüğü analizleri yapılmıştır.

Bulgular: Bu araştırmada elde edilen bulgulara göre, deney ve kontrol gruplarının son test puan ortalamalarına göre deney grubu lehine orta etki büyüklüğünde anlamlı farklılık bulunmuştur. **Önemli Vurgular:** Zamanında çevrimiçi verilen geri bildirimlerin öğrenci başarısına katkı sağladığından benzer araştırmalar farklı seviyelerde öğrenci gruplarına, yüz yüze ve uzaktan eğitim süreçlerinde uygulanarak genelleştirme sağlanabilir.

Anahtar Kelimeler: Bilgisayar ve Öğretim Teknolojileri Eğitimi, Geri Bildirim Zamanlaması, Geri Bildirim, Çevrimiçi Geri Bildirim

INTRODUCTION

Online learning platforms are rapidly increasing and becoming widespread in the education and training process. Although technology is a tool for the acquisition of target behaviors in the learning and teaching process, more time and effort is required to prepare effective and efficient online learning environments. There is a need to implement new technology-supported strategies to provide flexible, personalized, high quality, effective and timely feedback, especially in the measurement and evaluation phase of the face-to-face and online course design process.

Feedback

Many of the objectives and behaviors that are set out when designing a course related to the instructional process emerge during the needs analysis phase. In the teaching process, many methods, techniques, strategies, tools, exercises, multimedia, online applications, etc. are included in the process to achieve these goals. In the teaching process, effective, timely, quality and clear feedback should be given in order to eliminate misconceptions and deficiencies and even to prevent learning losses that may occur during the process.

The use of feedback in learning processes is considered among the effective methods for improving learning and teaching activities in order to increase the quality and efficiency of education (Ezzat et al., 2017). Although there are some difficulties during the implementation, with a quality or effective feedback, students can correct the insufficient and missing gains of the students, thus providing the opportunity to improve the quality of the educational process.

The best way of giving feedback is usually through talking, which can be explained as interaction and communication. However, time and place conditions may not be suitable for many issues in providing communication. In many cases, giving feedback by writing can be both easy and useful (Köğce & Baki, 2014). If the number of students is high and there are many missing acquisitions, misconceptions may occur in reaching the acquisitions while working on a group basis. In such cases, it may be preferable to give feedback to the group. The level of impact may decrease when the feedback preferred to be given individually is given in front of the whole group.

Feedback is seen as supportive for students. However, feedback needs to be consistent and useful. Although providing quality feedback is difficult and time-consuming for teachers, feedback is seen

706

as a need that supports the learning process. De Cecco (1968) stated that providing information in feedback affects learning and when it is reinforced with reinforcers, it contributes to the transformation of gains into behaviors.

Sadler (1989) sees feedback as the information given to students in order to close the gap between student performance and the target. Mory (1992), on the other hand, states that it is the performance information spent to achieve the learning process goals by providing behavioral development in the same process with cognitive development. Determining what has been learned in the learning process, what the deficiencies are, and what kind of corrections should be made at which stages of the learning process constitute the scope of feedback.

Feedback is a two-way communication process (Brinko, 1990). The indicators of this process are the information provided by teachers to students at every stage of education. Feedback is sharing with students the level they have reached in their performance during student evaluation processes (Brinko, 1990; Van de Ridder, 2008). Students' performances should be compared with predetermined standards and the results should be shared with students (De Cecco, 1968) and these shares should include results that explain the process (Hounsell, 1987).

Shute (2008) emphasized the gap between acquired performance and predetermined performance, and Hattie and Timperley (2007) stated that eliminating the gap between these performances is the main function of feedback. Feedback includes positive and negative evaluations made by the teacher to eliminate this gap (Voerman et al., 2012; Kluger & DeNisi, 1996).

Features of Feedback

It is stated that the feedback given by teachers to students can be explanatory, corrective, confirmatory, extensional or diagnostic. In confirmatory feedback, the student receives feedback about the "correct", "incorrect" or "incomplete" learning process. In corrective feedback, the incorrectness is tried to be corrected by showing the correct form. In the diagnostic feedback type, it is expressed what can be done to improve the learner's performance. In explanatory feedback, the reasons for the learning result being correct or incorrect are explained. Expanding feedback is about how to increase the existing gains (Schimmel, 1998). Studies show that feedback targeting skill gains is considered much more important and more valuable for learners (Dohrn & Bryan, 1994; Marsh, 1990). Teachers' feedback has a great impact on learners' learning processes, motivation and achievement. In terms of types of feedback, studies show that giving feedback often leads to increased achievement and motivation (Hattie & Timperley, 2007).

Timing of Feedback

Timing is among the factors that can make feedback effective. The temporal difference between the responses given by the learners and the feedback they receive is called the timing of the feedback. It is also stated as being given during or after the lesson (Scheeler et al., 2004). From this point of view, feedback timing is specified as immediate, slightly delayed and delayed (Brinko, 1990). Since learners can learn at different speeds, it may not be possible to give immediate feedback to every student (Wilbert, Grosche, & Gerdes, 2010).

In order for feedback to have a high impact, it should be given during the formation of behaviors or immediately afterwards. If feedback is given immediately, the learner will be able to understand the information to be developed or the information to be changed without miscoding. As the time difference between the behavior change process and feedback increases, the effect size may decrease.

The aim of immediate or slightly delayed feedback is to help the learner to use the feedback. The learner expects feedback as the learning and practice of the work continues. Feedback for completed work may not make sense (Brookhard, 2008). Feedback that can be evaluated instantly during learning processes can be given in written or electronic form, within a day or two, or immediately, as timely feedback.

Purpose of the Study

This research was conducted within the scope of the "Scientific Research Methods" course at the Faculty of Education of a foundation university in Istanbul. In the teaching process carried out for nine weeks, it was aimed to investigate the effect of online feedback given on time after the lectures every week on the academic achievement of the students with an experimental method. The following sub-objectives were sought for this purpose.

1. Is there a significant difference between the mean achievement post-test scores of the students in the experimental and control groups?
2. Is there a significant difference between the pre-test and post-test mean scores of the students in the experimental group?
3. Is there a significant difference between the pre-test and post-test mean scores of the students in the control group?

708

METHOD

In this section; the research model, design, study group, data collection tools, achievement test development processes, research execution and data analysis were discussed.

Research Model

Experimental research is used to determine the cause and effect relationships between the dependent and independent variables of the research (Büyüköztürk 2002). In this study, quasi-experimental research method with pretest-posttest control group was used. The variable whose effects on the dependent variable are investigated is called the independent variable. In this study, the dependent variable was the academic achievement of the students after the lesson, while the independent variable was the online feedback given to the students on time. The experimental group received timely online feedback after the lessons. No action was taken for the control group after the lesson. The experimental design used in the study is given below. Table 1 shows the experimental design used in the study. While planning the research, ten learning outcomes were determined for the scientific research methods course and it was decided to conduct the study over eight learning outcomes for nine weeks.

Table 1. Experimental Design of the Study

Experiment	AT 1.1	X	AT 1.2
Control	AT 2.1	-	AT 2.2

X: Experimental group students were given timely online feedback via e-mail after the lesson.

AT 1.1: Achievement test pre-test

AT 1.2: Achievement test post-test

Control group (No intervention)

AT 2.1: Achievement test pre-test

AT 2.2: Achievement test post-test

Participants

This study was conducted on two separate sections of 41 students each who took a nine-week scientific research methods course in the second year of the faculty of education of a foundation university in Istanbul. The students consisted of 82 undergraduate students. The pre-service teachers consisted of students from two different sections taking the same course in the same year. The course was given by the researcher.

Data Collection Tools

The academic achievement test developed for the "Scientific Research Methods" course was designed according to the learning outcomes. It consists of questions to measure students' targeted learning outcomes and cognitive achievements. A specification table was created. According to this table, a pool of 34 multiple-choice questions was prepared. The suitability of the questions for content validity, spelling rules and students' levels were presented to four faculty members who teach the same course at the faculty and their opinions were taken. As a result of the expert opinions, 14 questions that were not found appropriate were removed from the pool. The 20-question achievement test was piloted on 80 students at the same grade level in the same faculty for item analysis. For item analysis, correct answers were coded 1 and 0 for incorrect or blank answers. The results of the item analysis based on the data obtained from the 20-item achievement test are presented in Table 2 below.

709

Table 2. Results of Item Analysis

Item No	Item Difficulty	Item Discrimination	Item No	Item Difficulty	Item Discrimination
1	0,27	0,41	11	0,92	0,53
3	0,76	0,54	13	0,67	0,38
4	0,92	0,40	15	0,81	0,43
5	0,88	0,53	16	0,85	0,66
6	0,96	0,38	18	0,87	0,65
8	0,57	0,46	19	0,72	0,43
9	0,87	0,59	20	0,91	0,42
10	0,78	0,53			

In achievement tests used to measure knowledge and skills, item difficulty (p) shows the proportion of correct answers given to the items of the test (Büyüköztürk et al., 2020). Item difficulty index is calculated between 0 and 1. It gets more difficult as it approaches zero. When it approaches 1, it becomes easier. For achievement tests, item difficulty is expected to be at a medium level, that is, around 0.50, but it is recommended to include easy and difficult items in the test (Büyüköztürk et al., 2020). In this study, achievement test item difficulties were calculated between 0.27 and 0.96.

The discrimination of items refers to the extent to which they distinguish individuals within the scope of the feature to be measured. It is the test's power to distinguish between individuals with high and low score levels who have the characteristic that the test aims to measure. Item discrimination of 0.40 and above is very good, 0.30-0.39 is quite good, 0.20-0.29 should be corrected and improved, and items smaller than 0.19 should be removed from the test if possible (Büyüköztürk et al., 2020). In this direction, the discrimination indices of the achievement test were calculated between 0.38 and 0.66 after the items numbered 2-7-12-14-17 were removed from the test due to their very low difficulty and discrimination values. It can be said that the prepared test can be used at the beginning and end of the research for diagnostic and level determination purposes.

Reliability Analysis

Kuder Richardson-20 is a measure of the internal consistency of a test (Baştürk, 2014). Since the structure of the achievement items was 1-0, the KR-20 formula was used to determine the reliability. When item analysis is performed for a test, the KR-20 coefficient is used to calculate item difficulty and item discrimination (Karasar, 2012). The achievement test was piloted on 80 students studying in the same faculty and class, and the item difficulty and item analysis were calculated. As shown in Table 3, the reliability coefficient of KR-20 is 0.762, the average difficulty is 0.7, and the average discrimination is 0.49. It can be said that the 15-item achievement test, whose validity and reliability are in the appropriate range, can be used in "Scientific Research Methods" courses.

Table 3. Reliability Analysis

Cronbach's Alpha	Number of Items (N)
,762	15

SPSS 20 program was used for data analysis. A significance level of 0.05 was used to interpret the results of the statistical analysis. In order to test the effect of independent variables on each dependent variable, eta squared (η^2) = 0.01, which indicates the effect size, was analyzed as a small level, 0.06 as a medium level and 0.14 as a large level effect (Büyüköztürk, 2002).

Experimental Procedure

The experimental and control groups were taught with the same method. By structuring the teaching process with figures, pictures, photographs, animation, the stages of lecture, demonstration technique and scientific research methods, which are defined as traditional teaching, clues about the learning outcomes of the course were given, examples were given, examples were given, emphasis was placed on the learning objectives to concretize and facilitate understanding, and the topics were explained by giving examples from life. It was implemented by the researcher

during the nine-week teaching process with activities such as question-answer-discussion to ensure student participation.

During the teaching process, the answers to the questions of both groups and the feedback in the course process were at the same level, and only the online feedback was given to the experimental group after the class via e-mail through the university e-mail server on time (within one or two days) after the class for nine weeks.

During the research period, the same method was used for nine weeks. At the end of the weekly program, students were given performance tasks for the following week. At the end of the study, an achievement test (post-test) was administered to measure the students' level of academic achievement in the subjects studied.

Data Analysis

The number and information on the students included in the research group is presented in Table 4. During the development of the achievement test, test and item analyses were conducted. In the test and item analyses, the item difficulty and item discrimination indices of each item were examined. In determining the reliability of the academic achievement test, the KR-20 internal consistency reliability coefficient was calculated. Pretest and posttest scores were obtained. Parametric tests can be used when the sample size is 30 or more (Büyüköztürk, 2002). The research sample consisted of 41 students in each group. In order to determine the difference between the pre-test and post-test scores of the students, the independent samples t-test, which is a parametric test, was conducted for the experimental and control groups. The results of the study are presented in tables under the title Results and Comments.

711

For the normality test of the data, it was examined whether the results obtained from the achievement test were normally distributed before statistical analysis. The skewness value of the experimental group data was found to be -1.201 and the kurtosis value = .988, while the skewness value of the control group data was found to be -0.777 and the kurtosis value = -0.384.

Since the skewness and kurtosis values are in the range of -1.5, +1.5 for both groups, it can be said that the data are normally distributed (Tabachnick & Fidel, 2013). In data analysis, $\alpha=0.05$ significance level was considered. If the data are normally distributed, parametric tests are used (Büyüköztürk et al., 2011).

According to the results of the t-test, the calculation of the effect sizes was done with the following formula: $\eta^2= 0.01$ indicates a small level effect, 0.06 indicates a medium level effect, and 0.14 indicates a large level effect (Büyüköztürk, 2002):

For the t test $\eta^2= \dfrac{t^2}{t^2 +(n1+n2-2)}$

FINDINGS

This section presents the results of the research. Table 4 shows the distribution of groups and students who participated in the study.

Table 4. Groups participating in the study and student distribution

Groups	Female(n)	Male(n)	Total
Experimental Group	20	21	41
Control Group	23	18	41
Total	43	39	82

Table 4 shows the number and gender of students in the experimental and control groups. There are 41 students each in the experimental and control groups. The total number of students in both groups is 82. These students consisted of 43 female students and 39 male students.

The students in the experimental and control groups who participated in the application were given a pre-test before the study and a post-test at the end of the study. In addition to the results of the independent samples t-test analysis of the pre-test and post-test means, the data obtained by calculating the eta squared ($\eta2$) values, which indicate the effect sizes (ES), are shown in Table 5.

Whether the pre-test scores of the experimental and control groups were homogeneously distributed or not is included in the t-test results, and accordingly, the result of Levene's test was found to be 0.097 (p>0.05), which is not significant. According to the result of Levene's test, it can be said that the data are homogeneous.

Table 5. Independent samples t-test analysis and effect size values of pre-test and post-test mean achievement scores of pre-service teachers

Tests	Experimental Group			Control Group			t	p	ES (η^2)
	N	$\bar{x}$	sd	N	$\bar{x}$	sd			
Pre-test	41	75,12	18,06	41	75,45	12,69	0,09	0,92	0,0001
Post-test	41	91,21	9,11	41	85,69	9,60	2,67	,009	0,081

When the p and eta-squared ($\eta2$) values showing the effect size (ES) of the data in Table 5 are examined according to the 0.05 significance level, it can be seen that there is no statistically significant difference between the experimental and control groups in terms of pre-test (p>.05; ES=0.0001). According to these data, it can be said that students in both experimental and control groups had the same level of knowledge about "Scientific Research Methods" course before the research.

There was a statistically significant difference between the groups in terms of post-test mean scores (p<.05; ES=0.081). When the post-test mean scores of both groups were analyzed, it was found that the academic achievement of the experimental group was higher than that of the control group (experimental group=91.21; control group=85.69). Since the effect size was found to be 0.081, it has a moderate effect (p<.05).

As a result of the research, in order to determine which group's academic achievement increased more as a result of the nine-week training, the results of the dependent group t-test analysis of the pre-test and post-test means of both groups as well as the eta-squared ($\eta2$) values showing the effect size (ES) were calculated and the data obtained are presented in Table 6.

Table 6. Paired group t-test analysis of pre-test and post-test mean achievement scores of pre-service teachers and effect size values

	Pre-Test			Post-Test					
Groups	N	x̄	sd	N	x̄	sd	t	p	ES (η²)
Experimental group	41	75,12	18,06	41	91,21	9,11	6,88	,001	0,37
Control group	41	75,45	12,69	41	85,69	9,60	5,40	,001	0,26

When examining the data in Table 6, according to the results of the paired group t-test of the experimental group, it was determined that the timely online feedback created a significant difference in the academic achievement of the students in terms of pre-test and post-test mean scores for the experimental group (p<.05; ES=0.37). Again, according to the paired group t-test results of the control group, it was determined that the teaching methods applied created a significant difference in terms of pre-test and post-test mean scores of students' academic achievement (p<.05; ES=0.26). According to the eta squared (η2) values in Table 3, it can be seen that the effect size [η2(experimental group) =0.37; η2(control group)=0.26] of the teaching method applied to both the experimental and control groups on the students' academic achievement is high.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This section discusses and interprets the results of the study. In addition, suggestions are made to guide future studies of the timely online feedback used in the research.

713

Examining the results of the achievement pretest on the experimental and control groups, it was found that the achievement level of both groups was above 75% and there was no significant difference between their academic achievement (Table 5). The fact that there was no significant difference between the two groups in terms of academic achievement shows that the experimental and control groups were at the same level at the beginning. This may be due to the fact that they had similar educational program experiences in the past. The fact that the pre-test results are as high as 75% indicates that the learning objectives can be easily achieved in the teaching process. In similar studies, the pretest scores of students who received the same educational program were found to be close to each other (Aksoy & Doymuş, 2011; Turgut & Gürbüz, 2010).

As a result of the analysis of the post-tests of the students involved in the research process, there was a significant difference in favor of the experimental group in terms of academic achievement (Table 5.). Eta square (η²)=0,081 (p<.05). The effect size obtained here is moderate, and the reason why the experimental group was more successful may be the effect of the timely online individual feedback given in the electronic environment. However, when Table 6 is examined, it can be seen that there is an increase in academic achievement in both the experimental and control groups. The reason for this can be said that the researcher gave feedback to both groups in the same way during class, organized the environment, provided guidance, and directed them to scientific research. In line with the above explanation, the research has a high level effect on both groups in achieving the learning goals [η2(experimental group) =0.37; η2(control group) =0.26]. When this effect size is evaluated, it is seen that it has a greater effect on the experimental group that received timely

online feedback (η2=0.37). The reason for this can be said that timely and effective feedback facilitates the understanding of the subjects, and individualized feedback improves the students' performance (Table 5).

In a study conducted by Öztürk (2006), the type and timing of feedback was investigated in terms of students' academic achievement and retention level. He conducted an experimental research with 218 students by giving corrective feedback as feedback type and explanatory feedback immediately, one hour delayed and one week delayed. As a result of his research, he stated that immediate, one hour delayed and one week delayed feedback did not affect students' achievement and each of them had the same effect. In contrast, Butler et al. (2007) argue that delayed feedback is more useful than immediate feedback for student learning and retention of knowledge and skills.

As a result of the findings, suggestions are provided below for researchers planning to conduct a study on the timely online feedback application used in the study. Similar studies can be generalized by applying similar studies to student groups at different levels, face-to-face and distance learning processes. Since the research was applied in formal education and not in the monitored teaching process, preparations can be made in the planning of the research on how to use the tools that allow students to receive e-mail messages. If necessary, trainings and meetings can be organized on this subject and students can be informed about the application process. This study is limited to a total of 82 students with whom the researcher both planned the lessons and conducted the implementation, and larger groups of participants can be included in future studies. Especially in the distance learning process, the effect of timely online feedback can be investigated.

714

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Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported by the only author in full.

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715

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716