EFFECT OF THE WEB PROJECT-BASED PRESENTATION OF A MATHEMATICS UNIT ON STUDENT SUCCESS AND STUDENTS' OPINIONS ON THE PROJECT PROCESS

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ABSTRACT

This study was conducted to determine the effect of the web-based presentation of a mathematics unit appropriate for project-based teaching on student success and to reveal students' opinions on the project process. Qualitative and quantitative research methods were used together in this experimental study. Data were collected with group study and personal study assessment forms within the scope of qualitative research and with the pre-test and post-test containing 10 questions within the scope of quantitative research. The participants of the study consist of 81 students participating in the 11th-grade basic level mathematics curriculum in Yozgat province. Quantitative data were analyzed by the independent samples t-test, and qualitative data were analyzed by the content analysis. It was concluded that the web-based presentation of a mathematics unit appropriate for project-based teaching has a positive effect on student success, but students experience problems in reaching information sources in the process of project studies conducted in group, performing group studies, and in time management in the process of personal project studies.

Keywords: Project-based learning, web-based project application, web presentation of project-based mathematics teaching, problems encountered in project-based learning.

BİR MATEMATİK ÜNİTESİNİN WEB-PROJE TABANLI SUNUMUNUN ÖĞRENCİ BAŞARISINA ETKİSİ VE ÖĞRENCİLERİN PROJE SÜRECİNE YÖNELİK GÖRÜŞLERİ

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ÖZ

Bu araştırma proje tabanlı öğretime uygun olan bir matematik ünitesinin web tabanlı sunumunun öğrenci başarısına etkisinin belirlenmesi ve öğrencilerin proje sürecine yönelik görüşlerinin ortaya konması amacı ile yapılmıştır. Deneysel araştırma türündeki bu çalışmada nitel ve nicel araştırma yöntemleri birlikte kullanılmıştır. Veriler nitel araştırma kapsamında grup çalışması ve bireysel çalışma değerlendirme formları, nicel araştırma kapsamında ise 10'ar soruluk ön ve son testler ile toplanmıştır. Çalışmanın katılımcılarını Yozgat ilinde 11. sınıf temel düzey matematik dersi öğretim programına katılan 81 öğrenci oluşturmaktadır. Nicel veriler ilişkisiz örneklemler için t testi, nitel veriler ise içerik analizi ile çözümlenmiştir. Proje tabanlı öğretime uygun olan bir matematik ünitesinin web tabanlı sunumunun öğrenci başarısı üzerinde olumlu etkisi olduğu, öğrencilerin grupla yürüttükleri proje çalışmaları sürecinde bilgi kaynaklarına ulaşma, grup çalışması yapma; bireysel proje çalışmaları sürecinde ise zaman yönetimi konusunda sıkıntılar yaşadığı sonuçlarına ulaşılmıştır.

Anahtar Kelimeler: Proje tabanlı öğrenme, web tabanlı proje uygulaması, proje tabanlı matematik öğretiminin web sunumu, proje tabanlı öğrenmede karşılaşılan problemler.

INTRODUCTION

Project-based learning

Project-based learning, as it was indicated by Pecore (2015: 155), started to be implemented in educational institutions by asking daily life-based and practical questions to the students of architecture and engineering departments in final exams in Europe in the early 18th century. This application became widespread in elementary and secondary schools in the 19th century. The studies of Kilpatrick, who was influenced by John Dewey's opinions and philosophy about education, during the 1920s also ensured the spread of project-based learning (Krajcik and Blumenfeld, 2006).

Project-based learning is a teaching technique that explains the solutions of problems under conditions similar to daily life through individual or small groups (Bilen, 1996). Gözütok (2006: 160) defined project-based learning as solving problems by students based on the concepts and principles learned in different disciplines, designing individual or group research to produce a product, and doing studies using a scientific method. According to Kalaycı (2008: 87), project-based learning is a learning approach based on project development, imagination, planning and designing in terms of students, and is a method of teaching that is student-centered and enables students to establish interdisciplinary relationships while they are working within the frame of projects by taking real-life environments to the classroom in terms of teachers.

Kilpatrick (1918) grouped projects under four main headings. In the first type of projects, some ideas or plans are concretized. Putting a plan how to do of which has been previously described into practice or concretizing it, e.g. building a boat, writing a letter or playing a game, are included in this scope. In these projects, the steps of determining the objective, planning, implementing and evaluating the plan are performed respectively. The second type of projects consists of projects aiming at having an aesthetic perspective-experience. Interpreting a work of art, listening to a symphony or listening to a poem are included in this scope. In the third type of projects, it is aimed to resolve - analyze some situations, such as determining the influences of a war or revealing the results of an experiment. In such kind of projects, the steps of the scientific problem-solving process are expected to be applied. These steps are listed as identifying the problem, creating hypotheses for the solution of the problem, collecting and analyzing data to test the hypotheses, and interpreting analysis results and coming to a conclusion. The fourth type of projects is aimed at gaining specific knowledge or skill. In such kind of projects, the steps of determining the objective, planning, implementing the plan and evaluating are performed respectively, and the implementer or group is intended to gain knowledge or skill at the end of the project study (Pecore, 2015: 158).

Larmer and Mergendoller (2015) listed the basic elements that should be included in project-based learning as follows:

1- The objectives of the project should be aimed at students and should be suitable for students.

2- These objectives, which are determined according to students, should be placed at the center of the project.
3- During the project studies, students' critical thinking, problem-solving, cooperation and presentation skills should be developed.
4- During the project studies, students should necessarily encounter a problematic situation or difficulty.
5- Students should be enabled to ask questions that will provide in-depth understandings instead of having superficial knowledge.
6- It is absolutely necessary to share the knowledge reached by students.
7- Students should be enabled to ask the question "What do we need to know?" during the project.
8- Students' studies should be original.
9- It is necessary to share what and how students have learned during the project study and what they have reached when the project is completed.

The most important feature of project-based learning is that it allows students to determine what they need to do while performing a project on their own. During the fulfillment of tasks within the scope of the project and the execution of operations, the student tries to understand the given situation, decides which knowledge he/she needs to reach, reaches this knowledge by doing research, and learns to organize and present the knowledge he/she has reached in a logical order. In this process, the student is involved in the environments created to solve various problems in a real situation. These real situations prepared for students consist of various problematic situations that they may encounter in their daily life. While students are looking for solutions to these problematic situations, they also have knowledge about different issues related to the problematic situation. In other words, project-based learning allows for interdisciplinary learning. This process is not completed in a short period of time, and students continue their project studies with works that last for weeks or months. The student unwittingly learns different knowledge related to the subject and the relevant issues while doing research. In other words, the student also learns other subjects related to an objective. As it was indicated by Blumenfeld et al. (1991: 372), students, who investigate questions in project-based learning, understand the basic principles and concepts of the subject better, establish links between the information learned in the classroom and real-life situations, and try to find solutions to the various problems they encounter from an interdisciplinary point of view. Holmes and Hwang (2016) have revealed that the academic success of students increases in project-based learning, their critical thinking skills develop, project-based learning supports peer education, and students are more active in using learning strategies. Thomas (2000) has revealed that project-based learning is effective in the academic success of students, in their problem-solving skills, understanding the subject, developing special skills and strategies related to the project, problem-solving as a group, and creating study habits. Saracaloğlu, Akamca and Yeşiltepe (2006) made a quotation from Dori and Tal and stated that students' high-level cognitive skills including data analysis, problem-solving and decision-making develop and that their sense of responsibility towards their physical and social environments increase via project-based learning. They also made a quotation from Zoller (1991) and stated that the active participation of students in the project process enables them to shape their own ideas and reveal their

perspectives. Solomon (2003) stated that students acquire the skills appropriate for real life with project-based learning and that they perform various applications suitable for individual differences including learning styles, types of intelligence, abilities and various obstacle situations.

Project-based learning also has some limitations as well as the advantages listed above. The fact that students are insufficient in planning the project on their own and need the guidance of a teacher in performing activities, the fact that students tend to choose projects far beyond what they can do by exaggerating the practical power, and consequently reliable data do not emerge, the fact that teachers do not trust and believe in students in some cases, and the fact that assessment in project-based learning is different from general assessment and evaluation standards, and therefore some wrong results can be reached at the end of the project are some of the limitations that can be listed (cited from Gull, 1936 and Knoll, 1997 by Demirhan, 2002).

Despite the limitations listed, when the national and international studies were examined, it was observed that project-based learning has been applied in many lessons. In national studies, the applications of project-based learning have been found in foreign language teaching, biology, geometry, life sciences, visual arts and mathematics lessons (Yaman, 2014; Cömert, 2014; Aydınyer, 2010; Gündüz, 2014; Sayın Yücel, 2012 and Tabuk, 2009). When international studies were examined, it was observed that project-based learning approach was used in the teaching of science and technology, foreign language, mathematics, science-technology-engineering-mathematics (Hun, Capraro, Capraro, 2016; Remijan, 2016; Gibbes, Carson, 2014). Furthermore, it was also observed that studies were carried out on the issues such as the evaluation of the effect of project-based learning in peer teaching, the determination of the effect of online presentation of project-based learning, and the analysis of the effect of project-based learning on asynchronous online discussions (Ching, Chang, 2013 and Koh, Herring, Hew, 2010). The studies evaluating the effect of the project-based learning process on student success have also been found (Ural, Morgil, 2016; Ayaz, Söylemez, 2015 and Bayram, Seloni, 2014). In these studies, it was observed that project-based learning had a positive effect on the academic success of students. The problems encountered in the project-based learning process were revealed in a study carried out by Harun (2012). Harun revealed the problems encountered by science and technology teachers in the project-based learning approach. Since this study was conducted to determine the problems encountered by students in the project-based learning process, it is thought to be original from this aspect.

Project-based learning and web-based applications

In project-based learning, students are required to reach various knowledge by doing research and to organize and present this knowledge in a logical order. This requirement is facilitated by the use of technological tools in education. The use of search engines and databases on the internet while doing research enables students to reach knowledge wherever they want, and whenever they want. Moreover, the organization and storage of knowledge and the reuse of knowledge when the need arises can be performed more quickly and easily with technological tools, especially with computers. Technological tools make it easier for students to establish and

maintain the communication wherever and whenever they want. Sending and receiving e-mails through web-based applications, participating in discussion platforms in forums, reaching various information shared on social networks, and the use of software that allows simultaneous work on the contents make it easier for students to share knowledge. Solomon (2003) states that technological tools support project-based learning, students can communicate with the world outside the classroom via the internet and web tools, they can access physically distant places such as museums or libraries, they can create new contents in art, music and electronics by performing group studies, they can publish their studies on the web, and teachers will also have facilities in the evaluation of teaching with technological tools. Moursund (1999) indicates that students will be able to have high-level thinking skills in a project study supported by information technologies, it will be easier for them to cooperate in project studies conducted with group studies, and they can perform self-assessment and peer assessment.

Krajcik and Blumenfeld (2006) stated that students used the sensors installed in hand-held computers to collect various data in finding the pH value of the running water of the river and determining temperature and turbidity in the "Water Quality" project, the data collected via sensors could be viewed graphically on a computer, and it was easy to bring these graphics into the classroom and share them with other children in the classroom.

In a study conducted by ChanLin (2008), the use of technology in project-based learning activities performed by 10-11-year-old students within the scope of the science lesson was examined. During the project-based learning process, students used computers and the relevant technologies as a tool to collect information, organize information, and present it to their peers. Students used technological tools in the studies of organizing and planning the study, having interviews with their teachers and other relevant references, presenting and sharing what they learned at the end of the project via web. At the end of the study, it was observed that all students participating in the study achieved the aims of the study, acquired the skills related to the selection and synthesis of knowledge, gained the relevant skills, and benefited from web technologies in all these processes. In another study conducted by Morgil, Seyhan, Alsan, Temel (2008), the combined use and the effects of project-based learning and web-based applications were revealed. In that study, the effects of web-based project applications on the attitudes of students towards the chemistry course were determined. In the study conducted with 42 students who participated in the study from Hacettepe University, Faculty of Education, Department of Chemistry Education, students developed 11 web-based projects. When the developed projects were completed, presentations were made using the PowerPoint program, and the presentations were watched and evaluated in the classroom. In this process, it was observed that there was a positive relationship between the attitudes of students participating in the study towards the chemistry course and their performances. Gomez-Pablos, del Pozo ve Munoz Repiso (2017) brought 310 teachers working in different schools in Spain together in the projects carried out through digital technologies and asked teachers to participate in these projects with their students. 95% of the teachers stated that their students were actively involved in projects, 96% of them stated that their students were eager to learn, and 90% of them stated that

project-based learning supported by digital technologies was effective in the acquisitions of various skills related to the program of their students. However, teachers also stated that they encountered some problems in practice. 33% of the teachers stated that they did not receive adequate support from the school management and 34% of them stated that they did not have adequate technological tools to carry out the project.

Studies carried out have revealed that the use of project-based applications and web tools together has positive effects on students.

Project-based web-based mathematics teaching

Mathematics success that our students display in exams carried out nationally in addition to the results of the exams, such as TIMMS and PISA, in which our country participates internationally, indicates that the effect of the models and approaches we use in the teaching of this lesson, strategies and methods we employ is limited. The mathematics lesson is a tool used in solving the problems in our daily lives, a system that improves reasoning and an auxiliary discipline to understand the world and improve the environment (Baykul, 2003: 19). Because of this importance, some new and different applications should be tried in the teaching of mathematics, and their effects should be assessed. Holmes and Hwang (2016) investigated the effects of project-based teaching in the mathematics lesson at the secondary education level on the development of learning strategies and increasing academic achievement, and they achieved positive results. It was observed that mathematics teaching given in accordance with project-based learning had effects on the development of learning strategies and increasing academic achievement in students. Barrus (2013) created an instructional design for the acquisition of self-regulation skills, selected Algebra 1 lesson to evaluate the effectiveness of the design and conducted an experimental study. In that study, Barrus (2013) investigated whether the content prepared was effective on students' self-control, mathematics success, and motivation by an experimental study. The students were divided into three groups; the first group was given information by the conventional method in the classroom, the second group was allowed to learn by self-regulated and personalized web-based intelligent trainer, and the third group was provided with access to information through a web-based, self-regulated e-learning module. Positive changes were observed in the mathematics success, motivation and self-regulation skills of those with an opportunity to learn through a web-based intelligent trainer among the students receiving mathematics education during a semester.

It is observed that web contents prepared in accordance with project-based teaching in mathematics teaching have a positive effect on the success of students, even in limited numbers. Based on this finding, it was intended to determine the effect of the web-based presentation of the contents prepared in accordance with the project-based teaching in mathematics teaching in our country on student success. Since it has not been investigated previously, this study is original from this aspect.

METHOD

The aim of the Study

The aim of the study is to determine the effect of the web-based presentation of the "Conscious Consumer Arithmetic" subject of the "Numbers and Algebra" unit of 11th-grade fundamental level mathematics lesson, which was chosen because it was appropriate for project-based teaching, on the mathematics success of students, and to determine students' opinions on the project process. In this context, the answers to the following research questions were searched:

1. What kind of contents should be prepared for the presentation of acquisitions of 11th-grade fundamental level mathematics curriculum "Conscious Consumer Arithmetic" subject on the Web according to the project-based learning approach?

2. Is there a significant difference between the pre-test and post-test scores of the experimental group of students participating in mathematics teaching presented on the Web and the control group of students not participating in it according to the project-based learning approach?

3. According to the project-based learning approach, what are the opinions of students participating in mathematics teaching presented on the Web regarding the lifecycle of project studies?

Method

Qualitative and quantitative research methods were used in this experimental study. Within the scope of qualitative research, the 11th-grade fundamental level mathematics curriculum was examined, the "Conscious Consumer Arithmetic" subject included in the "Numbers and Algebra" unit was selected because it would enable students to experience the situations that would require them to encounter problematic situations related to daily life, perform reasoning and make decisions about them, the acquisitions appropriate for the subject were listed, activities were prepared in order to teach these acquisitions web-based; moreover, open-ended questions were asked to determine the opinions of students about the project study process, and the answers were analyzed by performing the content analysis.

Within the scope of quantitative research, the pre-test and post-test were applied to the experimental and control groups to assess their mathematics success.

Participants

The schools in which the Fundamental Level mathematics lesson is taught in the 11th grade in Yozgat province and teachers were determined in order to respond to the research questions, and the study was carried out with the students of the teachers who volunteered to participate in the study. It was determined that 11 teachers in total taught the fundamental level mathematics lesson in Yozgat province, and 6 of these teachers

volunteered to participate in the study. 6 teachers were divided into two as the experimental and control groups in accordance with the randomness rule. 44 students of 3 teachers constituted the experimental group, and 48 students of the other 3 teachers constituted the control group. In other words, the study was carried out with a total of 92 students. The experimental group consisted of 16 female and 28 male students, and all of the students in the control group were male.

The teachers in the experimental group had the students carry out web-based activities after having the students acquire content knowledge regarding the acquisitions. The teachers in the control group taught with the methods specified in the current mathematics curriculum.

Data Collection Tools

The Fundamental Level Mathematics curriculum prepared and published by the Ministry of National Education, Head Council of Education and Morality was examined in order to respond to the first research question.

Within the scope of the second research question, two separate tests, each of which contained 10 questions worth 10 points each, were prepared by a faculty member working at the department of mathematics education to assess the mathematics success of the experimental and control groups. The number of the questions and the difficulty level of the questions in the tests were equal to one another, but the questions were different from each other. Some of the questions are given below as an example.

Table 1. Examples of pre-Test-Post-Test Achievement Test Questions

Some of the pre-test questions	Some of the post-test questions
There are 36 girls and 44 boys in a classroom. What percentage of the classroom consists of female students?	32% of a group wear glasses. There are 17 people who are not wearing glasses in this group, so how many people are there in the group?
A group sharing the same house shares the rent expense of TL 420 equally. When 2 more friends settled in the house, the rent expense per capita decreased by 40%. Accordingly, how much is the house rent per capita in the last case?	Erhan paid 25% of the television he bought for 800 lira in advance. Erhan will pay the remaining debt by 6 equal installments, so how much lira is each installment?
When a product is sold at a 40% discount over the marked price, a 20% profit is made over the cost price. What percentage of profit is made from a sale of this product without the discount?	A seller wants to buy 60 eggs for 200 liras and sell with 25% profit. But some of the eggs are broken. He gained the profit he considered by selling unbroken eggs with 40% profit and broken eggs with 10% loss, so what is the number of unbroken eggs?

The assessment forms were prepared by the researcher in order to respond to the third research question of the study. Some of the project studies were suitable for being carried out via group work, some via individual study. Thus, the "Group Work Assessment Form" and the "Individual Study Assessment Form" were prepared and applied to students. In both forms, there were 3 open-ended expressions that students needed to complete. The study of Demirhan (2002, 331) was used in the preparation of forms.

In the Group Work Assessment Form, students were asked to complete the following sentences;
"The biggest problem we encountered during the studies;……",
"The field in which our group is the best; ……", and
"We could have been better as a group, however ……".
In the Individual Study Assessment Form, students were asked to complete the following sentences;
"The biggest problem I encountered during the studies; ……"
"The field in which I feel the best; ……", and
"I could have been better, however ……..".

Data Collection and Analysis

In the data collection process, teachers applied the data collection tools to all students participating in the project. All students filled in the pre-test and post-test individually. In the project studies, the students who performed group work filled in the "Group Work Assessment Form", and the students who carried out an individual project study filled in the "Individual Study Assessment Form".

The conscious consumer arithmetic unit lasting for 32 course hours in total was completed approximately in 8 weeks depending on the curriculum application process of schools. The collection of data is included in this process.

The collected data were recorded in the SPSS program. The relationship between the pre-test and post-test data was analyzed by the independent samples t-test. The assessment forms were subjected to the descriptive analysis.

FINDINGS

In the first research question, the answer to the question "What kind of contents should be prepared for the presentation of acquisitions of 11th-grade fundamental level mathematics curriculum "Conscious Consumer Arithmetic" subject on the Web according to the project-based learning approach" was searched.

The 11th-grade fundamental level mathematics curriculum prepared by the Ministry of National Education was examined to respond to this question, and web-based contents appropriate for the acquisitions included in the program were prepared. In the process of preparing web-based contents, the existing web-based application web pages were examined.

The acquisitions included in the subject of conscious consumer arithmetic are as follows;

"TD.11.3. Conscious Consumer Arithmetic

11.3.1. They will be able to create individual, family and institution's budget by taking incomes-expenditures into consideration.

11.3.2. They will be able to use the concepts of percentage, ratio, and proportion in the analysis and problem-solving process of the situations that they encounter in daily life.

11.3.3. They will be able to solve the problems which include situations periodically repeating in daily life.

11.3.4. They will be able to compare the possible alternatives in travels.

12 separate activities of 17 min. 25 sec. in total, suitable for these acquisitions included in the curriculum, were prepared. The examples of the prepared activities and their visuals are presented below.

"The serum used in the treatment of various diseases is a yellow and clear fluid. The chemical composition of the serum varies by diseases. Nurses have to determine the amount of serum to be given to the patient, in other words, the drip rate, namely the number of drops per minute. They use the D= dh/60s formula while determining it. In the formula, d is the drop factor measured in drops per milliliter, h is the volume in ml of the serum, and s is the time the serum is required to run (hour). Can the serum drop rate formula work for you if you want to design an irrigation system for your flowers in your house when you go on a holiday, think about it? Show your findings on a drawing and send them to info@bilinclituketiciaritmetigi.com by taking their photographs."

"Takgör and Bakgör Companies produce image and audio players. At the end of daily production, the players of both companies are tested, and defective products are removed and sent for repair.

The number of daily players produced by each type for two companies and the average daily rates of defective players are compared in the following tables.

Table 2. The Average Numbers Of Image and Audio Players Per Day Produced In Bakgör and Takgör Companies and the Average Daily Rates of Defective Players

Company	**Average number of image players produced per day**	**Average daily rate of defective players**
BAKGÖR Company	2000	5%
TAKGÖR Company	7000	4%

Company	**Average number of sound players produced per day**	**Average daily rate of defective players**
BAKGÖR Company	6000	3%
TAKGÖR Company	1000	2%

In which one of Bakgör and Takgör companies is the rate of total defective players lower? Show your calculations using the data given in the table above. Send your calculations to info@bilinclituketiciaritmetigi.com."

"Hakan, who takes the photographs of various animals for the National Geographic magazine, went on a one-year expedition of discovery and took lots of photographs of penguins and their chicks.

a. Do research on penguins. Collect general information about the regions where they live, their numbers, species, and nutrition and reproduction patterns, and prepare slogans introducing penguins using this information. Decorate your slogans with various visuals by using computer programs and send them to info@bilinclituketiciaritmetigi.com.
b. During his expedition, Hakan was particularly interested in the increase in the sizes of different penguin colonies. Hakan wonders how the size of the penguin colony will change in the next few years. He makes the following assumptions to determine it:

- There are 10.000 penguins in the colony at the beginning of the year (5000 penguin pairs).
- Each of the penguin pairs brings up a chick in the spring of each year.
- 20% of penguins (adults and chicks) will die until the end of the year.

Accordingly, what is the number of penguins in the colony (adults and chicks) at the end of the first year?"

The prepared activities were rendered watchable on the Web by a company which prepares web-based content. The visuals of some of the prepared web-based contents are presented below;

Figure 1. Exemplary Web Page 1

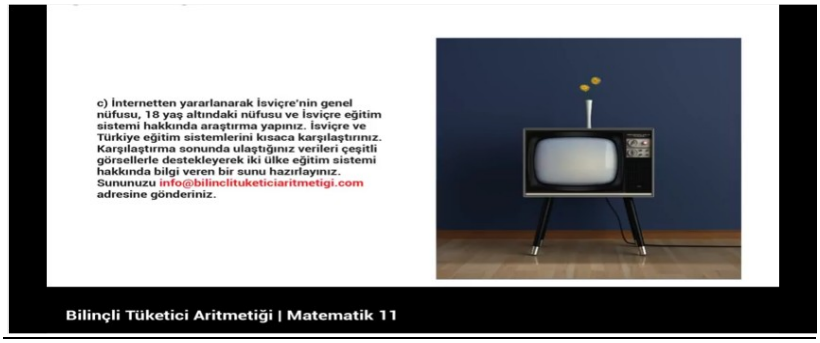

Figure 2. Exemplary Web Page 2

Within the scope of the second research question, the answer to the question "Is there a significant difference between the pre-test and post-test scores of the experimental group of students participating in mathematics teaching presented on the Web and the control group of students not participating in it according to the project-based learning approach" was searched. In order to respond to this question, the responses to the questions of;

a. Is there a significant difference between the pre-test scores of the experimental group and the pre-test scores of the control group?
b. Is there a significant difference between the post-test scores of the experimental group and the post-test scores of the control group? were searched.

As a result of the analyses carried out, the following findings were achieved:

Table 3. The t-Test Results of the Average Pre-Test Scores of the Experimental and Control Groups

	N	$\bar{X}$	S	Sd	T	P
Experimental Group Pre-test	44	11.25	8.76	90	4.95	.000
Control Group Pre-test	48	3.54	6.01			

A significant difference was found between the average pre-test scores of the students in the experimental and control groups, t(90)=4.95, p<.05. The average scores of the students in the experimental group ($\bar{X} = 11.25$) were higher than the average scores of the students in the control group ($\bar{X} = 3.54$).

When the difference between the post-test scores of students in the experimental and control groups was examined, the following result was reached.

Table 4. The t-Test Results of the Average Post-Test Scores of the Experimental and Control Groups

	N	$\bar{X}$	S	Sd	T	P
Experimental Group Post-test	44	30.80	17.51	90	8.51	.000
Control Group Post-test	48	7.29	7.36			

A significant difference was determined between the average post-test scores of the students in the experimental and control groups, t(90)=8.51, p<.05. The average scores of the students in the experimental group ($\bar{X} = 30.80$) were considerably higher than the average scores of the students in the control group ($\bar{X} = 7.29$). This finding indicates that the post-test scores of the students in the experimental group are higher. Furthermore, it can be interpreted in a way that the web-based education in which students in the experimental group participated had an impact on the post-test scores.

In the third research question, the answer to the question "According to the project-based learning approach, what are the opinions of students participating in mathematics teaching presented on the Web regarding the lifecycle of project studies?" was searched. In order to respond to this question, the content analysis was carried out on the responses that the students, who participated in individual and group work, gave to the open-ended questions.

The students who performed group work listed the problems they experienced during the study in thirty-three sentences. It was observed that these sentences were collected in the categories of_"reaching knowledge sources", "group work", "difficulty level of the questions" and "time". The category of "reaching knowledge sources" was further emphasized with fourteen sentences compared to other categories. In the thirteen of fourteen sentences in this category, the students stated that they went to the bank to get information but the officer in the bank did not deal with them. In a sentence, students stated that the source from which they wanted to get information was so busy, so they had to leave the bank without asking questions. Secondly, the students who performed group work stated that they "experienced the problems originating from group work"

with eleven sentences. Nine of these sentences are related to the inability of the students who needed to perform group work to come together. One of the other two sentences was stated as "one of the members of the group did not participate in the works", and the other one was stated as "we had a lot of discussion as a group, we could not perform group work because of discussing".

The students who performed group work stated in four sentences that they found the questions in web-based activities very difficult. Moreover, they stated in four sentences that the time given to carry out work was not sufficient; therefore, they experienced problems.

The students who performed group work listed the fields in which the group was the best in twelve sentences. When the content analysis was performed on these sentences, it was observed that they were collected in the categories of "working together", " doing research-questioning-information gathering" and “report writing”. The category of "working together" was more emphasized by students compared to other items. Students stated that the field they were the best as a group was "working together to reach a common goal" in six sentences. Students stated in four sentences that they were good at "doing research-questioning-information gathering", and that they were good at "reporting the findings" in two sentences. In a sentence, the students responded that "we were not good in any field as a group".

The students who performed group work completed the sentence of "We could have been better as a group, however..." with eighteen sentences. Students stated that group work would be more successful if "their friends in the group provided sufficient support to the work" in ten sentences, if "their houses were closer" in four sentences, if "they understood the subject better at school" in three sentences, if "they focused their attention more quickly" in a sentence.

When the responses of the students who carried out an individual study were examined, it was observed that the students listed the problems they encountered during the study in twelve sentences. Four of these sentences indicate that the students experienced difficulties in time management. It was understood that the students had difficulty in reaching the information in two sentences, that the students could not learn the subject at school, therefore, they had difficulty in project application in two sentences, that the student had serious discomfort during the project period in a sentence, that the_student could not collect information because of the lack of a computer in a sentence, the student was not sufficient in calculation in a sentence, and that the student could not control his brain in a sentence.

When the students who carried out an individual study were asked about the study subject in which they felt the best, it was observed that ten sentences were written. In six of these sentences, the students indicated that they felt better when they carried out research-work by themselves and presented their findings; in four sentences, they indicated that they felt better because they carried out a study on cars.

When the students who carried out an individual study were asked to complete the sentence "I could have been better, however....", it was observed that the students wrote eight sentences. Three of these sentences are "if I had understood the subject better at school", three of them are "if I had had more time", one of them was "if I could have focused my attention more", and one of them was "if we had not moved a house".

The findings obtained after the data analysis can be summarized as follows:

-There is a significant difference between the pre-test and post-test scores of the experimental group of students participating in mathematics teaching presented on the Web and the control group of students not participating in it according to the project-based learning approach; however, the post-test scores of both groups are quite low.

- The students who performed group work during the project studies experienced the problems originating from reaching information sources and performing group work more intensely when compared to other problems, and accordingly, they considered that group work would be better in case their friends in the group provided sufficient support to the work. The same students consider that their groups are good in terms of “working together to reach a common goal”. This situation reveals that students have difficulty in gathering, but when they overcome this difficulty, they are successful in working together, they feel good and have expectations with regard to the participation of everyone in the group in the study.

When the responses of the students who carried out an individual study were examined, it was revealed that the students experienced difficulties in time management; they felt better when they carried out research-work by themselves and presented their findings; they believed that if they had understood the subject better at school and had had more time, their studies would have been more successful.

CONCLUSION, DISCUSSION and SUGGESTIONS

In this study carried out to determine the effect of web-based presentation of a mathematics unit suitable for project-based teaching on student success, it was observed that the application had a positive impact on the success of students. This finding corresponds to the findings of the study carried out by Lou (2004) and Love, Keinert, Shelley (2006). Lou (2004) put forward at the end of the study he conducted that positive interaction between students, who participated in a project-based online course individually and via group work, and their friends increased, their academic achievements and problem-solving skills improved. Love, Keinert, Shelley (2006) attempted to come up with a solution to the problems encountered in the application of abstract mathematics lesson content by developing a web-based model allowing students to progress at their own speed. They compared the academic success of the students who participated in the model they developed with the academic success of the students who participated in class-based teaching, and they revealed that the academic successes of the students who participated in web-based education were higher than the academic successes of the students who participated in class-based teaching.

In the analyses carried out to determine the effect of web-based presentation of a mathematics unit suitable for project-based teaching on student success, it was observed that the application had a positive impact on the success of students. However, it was also observed that the positive impact was not very high. The average post-test score of the students in the experimental group is 30.80. When the post-test applied to the students is considered to have been evaluated on the scale of 100, it is observed that the students have obtained 30 scores on average. This situation is considered to have originated from the low academic success of Yozgat province. As it was indicated by Babaoğlan (2016), Yozgat province was on the 65th rank among 81 provinces in the school success rating based on YGS-I (transition to higher education examination) in 2015, and it was on the 66th rank in YGS 2 exam, the 38th rank in YGS 3 exam, the 32nd rank in YGS 4 exam, the 52nd rank in YGS 5 exam and the 62nd rank in YGS 6 exam. As Babaoğlan (2016) stated in his study, this situation has many reasons such as indifference of the family, the lack of awareness of the family regarding the importance of education, low socio-economic level of the family, the lack of student motivation, student's not studying in a planned and programmed way, town people's not giving due importance to education. Studies on eliminating these factors which cause failure and some of which have been listed should be carried out.

When the opinions of students on the project process in the web-based presentation of a mathematics unit suitable for project-based teaching were analyzed, it was revealed that the students who performed group work experienced problems originating from reaching information sources and conducting group work during project studies. The students especially stated that the officer in the bank did not deal with them and they could not come together to perform group work. These two problematic situations stated by students correspond to the findings of the study carried out by Ayvacı and Çoruhlu Şenel (2010). The aforementioned researchers concluded in their studies that, in the process of conducting a project, "students did not receive sufficient interest from institutions and organizations", "they had difficulty in finding the authorities", "they had troubles in sharing the tasks". This situation may originate from the false perception in our country that education takes place only in a school building. Education can take place at any time, anywhere and at any place; however, the individuals who have not realized this (bank officer, parents who do not believe that students can do things together outside the school) may have considered that students cannot learn outside the school.

The students who have difficulty in gathering for group work consider that their groups are good in terms of "working together to reach a common goal". The project works carried out based on cooperation "improve working together and cooperation with friends in students and dividing into groups during study ensures intimacy with friends", which corresponds to the research finding of Alacapınar (2008:33).

The students who carried out an individual study stated that they experienced difficulty in time management. This finding corresponds to the result that "although students make individual efforts regarding time management, these efforts are insufficient, students cannot professionally use time efficiently and effectively and they cannot manage this process ", which was reached by Çağlayan and Göral (2009: 15) in their studies

measuring the time management skills of students continuing education at a vocational high school with the average age of 21 years. The fact that education is not provided for time management in formal education in our country and the fact that students have not met role models exhibiting proper behaviors are considered to cause this situation. The fact that the students who carried out an individual study believe that they would have been more successful if they "had had more time" also supports this finding.

The students who carried out an individual study stated that they felt better when they conducted individual work or presented their findings. The study of Cengizhan (2007) put forward that the academic success of students who had dependent-independent and cooperative learning styles was affected when they participated in project-based and computer-assisted teaching designs. According to the finding of Cengizhan, the students who have dependent and independent learning styles are more successful in computer-assisted teaching designs, and the students who have a cooperative learning style are more successful in project-based teaching designs. Conducting a similar study in which the relationship between the learning styles of students and individual or group work that they prefer in project-based learning is examined will be beneficial for secondary school students.

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