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Research on the Effect of Certain Variables Chosen and Technology-Supported Project-Based Learning Approach on 11th-Grade Students' Attitudes towards Computers

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Abstract

The purpose of this study was to examine the effect of certain variables chosen (gender, financial state of the family, educational background of the parents, a computer available for use at home and the number of siblings) and technology-supported project-based learning approach applied in the physics course on 11th-grade students' attitudes towards computers and to evaluate the participating students' views at the end of the study about the applications they actively took part in. In order to determine the students' attitudes towards computers, the computer attitude scale was used. The study was carried out with thirty two 11th-grade students in the academic year of 2009-2010. Before starting the applications, the computer attitude scale was applied to the students as a pre-test. The three-hour physics courses were executed with simulations and animations in two course-hours and with the project-based learning approach in the other course-hour. At the end of the applications, the computer attitude scale was applied to the students as a post-test. In order to determine the students' views about the process as well as about computers, semi-structured interviews were held with them. The results of the analysis demonstrated that there was a significant difference between the computer attitude mean scores of the students before and after the experimental process in favor of the post-test mean scores. But, there were no differences among their attitude scores according to certain variables. The interviews held with the students revealed that the students had positive views about the process and computers.

Keywords: Attitude, Computer, Project-Based Learning, Electrics, Technology-Supported Learning.

Introduction

Today, the needs of individuals have changed with the developing technology. Among these needs are applications that appeal to the changes and developments in the field of education. These needs in the field of education in developed countries are met both by bring individuals into the concept of education and by benefiting from technology required by this era. New methods that make individuals active in the educational environment have been developed and applied. These methods are gathered under constructivist learning approaches. One of these approaches is the project-based learning approach. The project-based learning approach allows learners to study on their own learning structures and regards the project as an issue of sub-structure as well as helps develop, imagine, plan and build intellectual designs. The project work allows students to use their initiatives, to make choices by taking

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responsibilities, to make decisions and to follow up their desires and purposes; in addition, for all of these, the project work prepares an appropriate environment. Students have a desire to work together at and out of school for the project works (Korkmaz & Kaptan, 2002).

Today, it is inevitable to use technological developments to facilitate an individual's learning together with the methods developed in the light of student-centered studies carried out in the field of education. Computer programs have spread through out most educational institutions as the most effective technological instructional tool used in the field of education. Considering the developments in the field of educational technology, it is seen that these developments are about new approaches to program-development methods, developments regarding human-force in education, educational environments and about new technological systems (Alkan, 1984). As a result of these developments, the underlying expectation is to increase productivity in education, to improve the quality and to find solutions to possible problems. In recent years, these expectations have led to the use of computers in education (Hançer & Yalçın, 2007). The goals of computer-supported education can be summarized as follows (Doğanay, 2002:212-213):

1) Giving more effective education by increasing the productivity in education,
2) Changing the traditional teaching methods and making them more productive,
3) Making the teaching process more interesting and entertaining,
4) Helping teachers use more materials in the teaching process,
5) Storing the data and using them when necessary,
6) Facilitating learning by concretizing the abstract,
7) Helping teachers with the out-of-class activities by allowing time for the teacher,
8) Helping students understand technology required by the era.

Among the computer programs used to make education more effective are simulation and animation programs which have a high level of visual effect**.** According to Schnotz and Rasch (2005) *"Animations can be used to direct the observer's attention to important aspects of a display, convey procedural knowledge, demonstrate the dynamics of a subject matter, and allow exploratory learning through manipulating a displayed object"*. Rieber (1990) pointed out that the animation is *"the creation of visual effects with the use of graphic tools in computers and help learn and then remember the events, concepts or principles that are hard to envisage"*. Furthermore, (Salomon, 1994) indicated that the animations can have a supplantation effect on students learning. Thanks to animations, students find the opportunity to think about and concretize the events that they can not envisage. One of the other educational computer programs is simulation. Simulation is the imitation of a world process or system with the help of a computer (Banks & Carson, 1984). Similar to animations, Perros (2009) indicated that simulation models are, in general, used in order to understand the subjects which do not currently exist and cannot be seen in real-life systems. One can study the subject with simulations for various values of its input parameters. This feature of the simulations can be very useful in the managerial decision process. According to Pekdağ (2010), the ideas about simulations that they are used to prepare dynamic learning environment where the students ask and use visual and verbal knowledge to answer the questions. The difference between simulation and animation is that students can change the functioning or the current state of the process by intervening in the parameters of the system. In this way, the students can take an active role in the learning process. Studies carried out revealed that the project-based learning approach and the simulation-animation programs play an important role in making the knowledge permanent and active in the intellect, facilitating the use of information for the production and use of new ideas and for synthesis and in

changing the attitudes towards computers (Yenice, 2003; Karamustafaoğlu, Aydın & Özmen, 2005**;** Ateş, Altunay & Altun, 2006). This study carried out in physics course aimed at examining the effect of the technology-supported project-based learning approach on the 11th grade students attitudes towards computers. Another purpose of the study was to investigate whether there was a difference among their attitude scores with respect to the variable of gender, financial state of the family, educational background of the parents, a computer available for use at home and the number of siblings in the family. Finally, the present study also aimed at evaluating the participating students views about the applications they actively took part in at the end of the study. In this study, research group students were chosen as subject because it was thought that the electric subjects which in the curriculum of the 11th-grade students were suitable for applications in technology supported project based learning.

Method

Sample

The study was carried out with on 11th-grade students who attended Nafiye- Şevki Cizrelioğlu High School in Diyarbakır. The study group was determined on random basis among the science classes. Both genders were represented: 21 female (65,6%) and 11 male (34,4%) students. The applications were performed during the may and june months in 2009-2010 academic year. The study were started with 34 students at the beginning and finished with 32 fully-attendant students in the end. Before the study started, the computer attitude scale was applied to the study group as a pre-test. The applications were carried out in three hours per week and continued for eight weeks. The course hours spent both on the application of the pre-test and post-test and on the process of giving information to the students about the "Project-Based Learning Approach" and animation-simulation programs are not included in this duration of eight-week time. The students in the study group were divided into a total of nine groups each of which included either three or four students. The students determined their groups on their own. The fields that the students wanted to study within the scope of the Electric subjects determined with the students in the study group were chosen. The course teacher was presented a work-file regarding the applications to be carried out in the physics course - which covered the 4th and 5th parts as well as the sections following the electric circuits in the 3rd part of the course book. In addition, the teacher was informed about the process. The activities to be carried out each week were prepared by the researchers and presented to the teacher of the course. The applications were carried out in the physics courses in three course hours each week. Of these three weekly course hours, two course hours were executed with the support of animation and simulation and one course hour with the project-based learning approach. Duration of the technology supported project based learning approach applications can be seen in Table 1 below.

At the end of the applications, the experimental group students were given the computer attitude scale as a post-test. In addition, semi-structured interviews were held with the students to take the students' views about the process and computers.

Table 1. Duration of the technology supported project based learning approach applications

Process Steps	Duration
Giving information about the project and forming the teams	2 course-hours
Simulations, animations, video and java presentations	2 course-hours (in the class)
Collecting information	6 days (out of school)
Simulations, animations, video and java presentations	2 course-hours (in the class)
Evaluating the information collected	6 course-hours (in electric lab.)
Preparing for the report and presentation	2 days (out of school)
Simulations, animations, video and java presentations	2 course-hours (in the class)
Discussing the studies with the other teams	2 course-hours (in the class)
Simulations, animations, video and java presentations	2 course-hours (in the class)
Transferring the studies into the electronic environment	1 course-hour
Simulations, animations, video and java presentations	2 course-hours (in the class)
Presentation	1 course-hour (in the class)
Simulations, animations, video and java presentations	6 course-hours (in the class)

Software Programs

During the applications, the power-point technique and various animations, simulations and java programs were used. The simulations used were interactive and open learning environments that provided feedback to the students. They were used to provide interesting, dynamic representations of electric principles. Animations used were not interactive and they were supported with voice. There were arrows, colorful-clear writings and various signs in the animation samples to make understandable the electric subjects (www.explorelearning.com, www.siencejoywagon.com, www.webphysics.davidson.edu www.members.shaw.ca, www.upscale.utoronto.com http://hermes.eee.nott.ac.uk/teaching/cal/h51emf/emf0017.html). Below, there are some samples of the animations and simulations were used during the applications.

Figure 1. Simulation sample regarding the electric subject in our lives: The study group students were presented a simulation sample depicting the reflections and place of electric in our lives. With this illustration, the students discussed among themselves and made various comments about the electric in daily life.

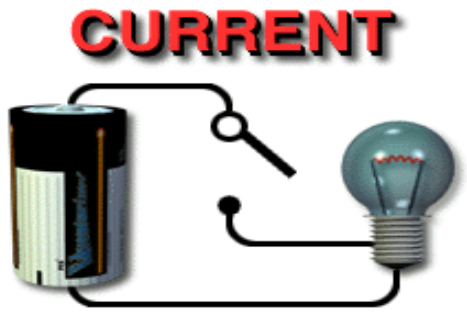

Figure 2. Animation sample regarding electric current: The animation sample about the direction of the current flow was presented to the students by the researcher, and the students discussed.

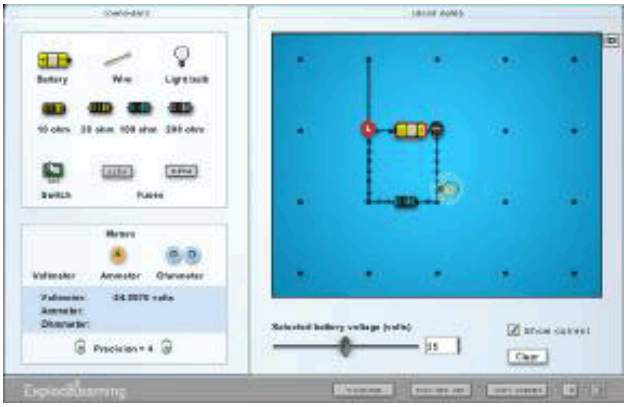

Figure 3. Simulation sample regarding electric circuits and lamps: In the simulation sample, the subjects of electric circuits and lamps were visually presented. The students tried various alternatives and connected the resistors and lamps for different situations.

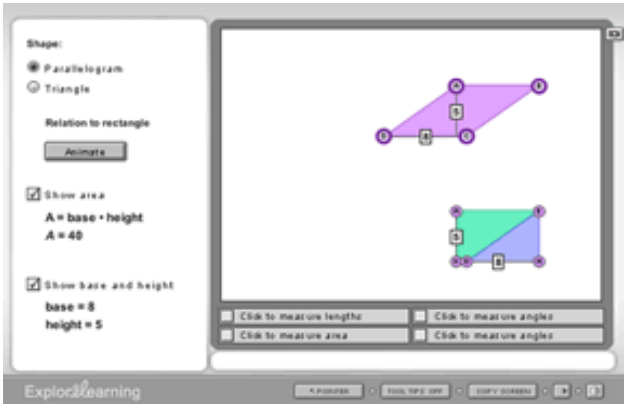

Figure 4. Simulation sample regarding parallel plates: The simulation sample demonstrated that how the parallel plates were like a condenser was presented to the students, and the movements of the plates were observed by giving different values.

Data Collection Tools and Analysis

In the study, the computer attitude scale developed by Aşkar and Orçan (1987) was used as a data collection tool**.** The reliability coefficient of the scale was calculated by the researchers as 0.89. The scale included a total of 24 multiple-choice questions. Besides this scale, a six-item questionnaire was used to determine the demographic backgrounds of the students. In addition, video and audio recording devices were used during the interviews held with the students to determine the views of the students about the process. The research data collected via pre-test and pos-test were analyzed with the SPSS 15.0 package program at the significance level of 0.05. For the analysis of the data, dependent, independent t-test and one-way anova test were used to compare groups' means.

Groups and Project Topics:

Group A: Serial and parallel connection of resistors, factors affecting the resistance of a conductor, calculation of the resistance of water, reading the value of a resistor with the help of the color codes
Group B: Creating an electric field, various methods of producing electric current
Group C: Watson bridge, short circuit
Group D: Electrical work and heat
Group E: Making a generator, connection of generators, areas of usage
Group F: Making a fuse, areas of usage, making an engine, areas of usage
Group G: Making a condenser, serial and parallel connection of condensers, areas of usage
Group H: Electric circuits, making a mini-lamp, connection of a voltmeter into a circuit, connection of an ampermeter into a circuit, ohm's law, resistance measurement, areas of usage
Group J: Serial and parallel connection of lamps, their life time, conductor and non-conductor items, areas of usage

Figure 5. Attempts of students to prepare the experiment of electric circuit: After the students determined the materials necessary for an electric circuit, they tried to measure the resistance of a lamp with the help of the Ohm's Law.

Figure 6. Attempts of students to make a simple electrical engine: The students first determined the materials that they would use to make a simple electrical engine**.** Following this, they tried running the small electric engine they made with these materials.

Figure 7. Students' presentation of the subject of lamps in class: As can be seen, the students preparing a project about the subject of lamps presented their project products by using the power-point technique in the computer environment.

Findings

The findings obtained as a result of the application are seen in Table 2, Table 3, Table 4 and Table 5.

Table 2. Independent t-test results about the comparison of the computer attitude pre-test and post-test scores of the participating students

Source of Variance	**Mean Difference**	**Sd**	**t**	**df**	**P**
Post-Test Pre-Test	7.375	12.367	3.373	31	0.002*

When Table 2 is examined, it is seen that there was a significant difference between the computer attitude pre-test and post-test mean scores of the participating students in favor of the post-test ($p<0.05$).

Table 3. Distribution of the computer attitude pre-test and post-test scores of the participating students according to gender

Variable		Number of Students	Mean	Standard Deviation	t	p
Pre-Test	Female	21	91.52	14.831	0.204	0.839
	Male	11	90.45	12.380		
Post-Test	Female	21	99.86	14.921	0.776	0.444
	Male	11	96	9.466		

When Table 3 is examined, it is seen that there was no significant difference between the computer attitude pre-test and post-test mean scores of the participating students with respect to their gender ($p>0.05$).

Table 4. Distribution of the computer attitude pre-test and post-test scores of the participating students according to family's financial state, parents' educational background and the number of their siblings

		Source	Sum of Squares	df	Mean Square	F	Sig.
Number of Siblings	Post-test	Between Groups	1168.219	6	194.703	1.135	0.371
		Within Groups	4287.750	25	171.510		
		Total	5455.990	31			
	Pre-test	Between Groups	1746.019	6	291.003	1.735	0.154
		Within Groups	4194.200	25	167.768		
		Total	5940.219	31			
Financial State	Post test	Between Groups	878.213	5	175.643	0.998	0.439
		Within Groups	4577.756	26	176.068		
		Total	5455.969	31			
	Pre-test	Between Groups	1000.002	5	200.000	1.053	0.409
		Within Groups	4940.217	26	190.008		
		Total	5940.219	31			
Father's Educational Background	Post test	Between Groups	318.728	3	106.243	0.579	0.634
		Within Groups	5137.241	28	183.473		
		Total	5455.969	31			
	Pre-test	Between Groups	778.862	3	259.621	1.408	0.261
		Within Groups	5161.357	28	184.334		
		Total	5940.219	31			
Mother's Educational Background	Post test	Between Groups	46.538	3	15.513	0.080	0.970
		Within Groups	5409.431	28	193.194		
		Total	5455.969	31			
	Pre-test	Between Groups	385.245	3	128.415	0.647	0.591
		Within Groups	5554.974	28	198.392		
		Total	5940.219	31			

When Table 4 is examined, it is seen that there was no significant difference between the computer attitude pre-test and post-test mean scores of the students in the study group with respect to the financial states of their families, the educational backgrounds of their parents, and the number of siblings in their family ($p>0.05$).

Table 5. Distribution of the computer attitude scores according to availability of a computer at home

	Computer	N	Mean	Std. Deviation	p
Post test	1	21	97.05	13.844	0.391
	0	11	101.36	12.201	
Pre- test	1	21	88.43	14.130	0.125
	0	11	96.36	12.217	

1: A computer available at home, 0: No computer at home

When the results in Table 5 is taken into consideration, it is seen that there was no significant difference between the computer attitude scores of the students who had a computer at home and of those who did not ($p>0.05$).

The Views of the Students in the Study Group about the Application Process of the Technology-Supported Project-Based Learning Approach

Throughout the research process, the students' views about the animation- and simulation-supported project-based learning approach were determined with the use of audio and video records. Although the students' views were positive in general, some of the students stated that their interactions with the computer did not change at the end of the research process.

Preference: A majority of the students indicated that they would prefer the technology assisted project based learning approach in other courses:

> *"I understood with this approach that the courses of physics, chemistry and biology are not learnt well without any experiments. I thought that I knew how to connect electric circuits that I previously learnt from the books. However, when I saw an electric circuit for the first time, I was not able to set up the circuit. I could not transfer my knowledge into practice"* (Student A).

*Reflections in Daily Life***:** It involves the reflections of computer assisted project based learning in students' daily life. The students pointed out that they began to interest to electrical devices via computer and laboratory applications:

> *"In the past, I was afraid of electric devices. When I saw the inner parts of such devices in the computer environment and touched them in the laboratory, I started to have a desire to examine such devices at home when they get out of order"* (Student B).

*Interaction with the Computer***:** It includes that how the interaction of the student with the computer influenced at the end of these activities carried out in the class. A majority of the students said that they started to use computer for learning and found it enjoyable:

> *"Previously, I had used a computer for a few times or so. Thanks to these applications, I learnt how important the Internet is. It is enjoyable and useful for me"* (Student C).

"In the past, I was quite interested in computers, so nothing much has changed for me" (Student D).

"Previously, I generally used a computer to visit certain web sites on the internet. I did not know how to use it for my lessons. Now, I have learnt how to prepare a presentation with the power-point technique in a computer, to use the word processor program and to gather information for scientific research" (Student E).

Discussion

The results of the present study in which the subject of electric in the course of physics was taught with the help of simulations and animations within the framework of the project-based learning approach revealed that almost all the participants developed positive attitudes and views regarding the computers and the process. It was striking that although most of the students in the sample group had a computer at home, their interaction with the computer was limited. In addition, it was found out that some of the students who were found proficient in computer use regarded the computer as a game device or communication tool. There were computer laboratories in the high school where the study was carried out; however, the fact that these computer laboratories were not used in educational applications might have effected the students' views and attitudes regarding computers prior to the computer-supported project-based learning approach applications. It is believed that the present study will help students consider computers not only as a communication tool but also as a scientific research and educational tool. This result is supported with a similar finding of a study carried out by Hançer and Yalçın (2007). Knezek and his colleagues (1997) conducted a 6-week study in South Texas and gave training on technology. The research results revealed that computer experience had a significant effect on computer attitudes and that educational studies and working with computers decreased computer anxiety and helped individuals develop positive attitudes. In addition, in some studies, it was found out that working with computers help develop positive attitudes towards computers (Çepni, Tas & Köse, 2006; Güler & Sağlam, 2002). Similarly, Akçay, Tüysüz and Feyzioğlu (2003), in their study titled as "An Example for the Influence of Computer-Supported Instruction in the Course of Science on Students' Success and Attitudes: The Concept of Mol and the Avogadro's Number", reported that students' attitudes towards computers changed in a positive way at the end of the research process.

One of the findings of the present study was the fact the computer attitude scores did not differ with respect to the gender of the participants. It could be stated that this finding obtained as a result of the applications carried out in the study is consistent with the findings of a number of previous studies. Similarly, a study conducted by Köse, Gezer, Bilen and Gencer (2007) revealed that there was no significant difference between the computer attitudes of male and female students. In a study carried out by Uzunboylu (1995) with students attending the department of Elementary School Teaching and in another study conducted by Kol (2010) with students attending the department of Pre-School Teaching, the researchers found out that the students' computer attitudes did not differ with respect to their gender. Tekindal, Ertekin and Tekindal (2010) carried out a study on the relationship between gender and computer attitudes and reported that there was no significant difference between the computer attitudes of male and female students. However, in contrast with this finding, there are other studies in related literature demonstrating that computer attitudes differ depending on gender. In a study conducted by Houtz and Gupta (2001), it was reported that male and female students had different attitudes towards computers. Similarly, according to

Kay (2007), a study he conducted in 1992 revealed that male students demonstrated more positive attitudes towards computers than female students did. The reason was, as the researcher claimed, the fact that male students used computers more than their female peers. In addition, five years later, another study carried out by Whitley (1997) revealed that the difference found between students' computer attitudes in terms of gender continued to exist.

There was no significant difference at the significance level of 0.05 between computer attitude scores and the financial state of families, the educational backgrounds of the parents, the availability of a computer at home and the number of siblings in the family chosen as the variables within the scope of the present study. In another study carried out by Tekindal, Ertekin and Tekindal (2010) and titled as "Evaluation of the Computer Attitudes of Students Attending Vocational High Schools", it was found out that there was no statistically significant difference between the students' computer attitude scores and the availability of a computer at home, the number of siblings in the family and the financial state of the family.

As revealed by the interviews held with the students in the study group and by the observations of the researchers, the students used computers only for communication purpose; in addition, it was also seen revealed that access to computers became easier with the spread of internet cafes and schools. The variable of availability of a computer at home and the avoidance of computer use as a scientific research or education tool revealed the finding that no difference was observed in the students' computer attitudes. However, when the attitude scores are considered from a different perspective, it could then be stated that the students who did not have a computer at home had higher computer attitude mean scores – though not significant - than those who had a computer at home. This finding shows that students who did not have a computer at home were more interested in computers than those who had a computer at home. When the results are interpreted with respect to all the variables chosen, it could also be stated that the study-group students who had different demographic backgrounds became aware of the benefits and importance of computers and thus changed their attitudes towards computers.

Conclusions

According to the computer-supported project-based learning approach, the results of the dependent groups t-test applied to the research data collected via the computer attitude pre-test and post-test applied to the students learning the subject of electric in the course of physics revealed a significant difference at the significance level of 0.05 in favor of the post-test scores. Depending on this result, it was found out that the students taking education based on the technology-supported project-based learning approach developed positive attitudes towards computers after the experimental process ($p< 0.05$). In addition, when the computer attitude pre-test and post-test scores of all the students participating in the study were compared with respect to their gender, no significant difference was found ($p=0,839>0,05$ and $p=0,444>0,05$). Based on the findings of the study, it could be stated that the variable of gender did not influence the computer attitudes of the students. Furthermore, there was no difference between computer attitude scores of the study-group students with respect to the financial state of the family, the educational backgrounds of the parents, the availability of a computer at home and the number of siblings in the family.

Recommendations

Based on the findings of the study, the following suggestions can be put forward:

1- It is quite important to develop positive attitudes towards the computer – which is an inevitable educational tool in this technological era – and to prepare animation-simulation

CDs and programs regarding all subjects in a way to support the content of the course books of physics and in a way to include the whole high school education as well.

2- It would be beneficial to enable students to benefit from the computer laboratories in all courses – which are currently used at pre-determined time only for the computer courses at schools.

3- It should be possible for physics teachers to benefit from computers more during lessons.

4. Constructivist learning approaches applied in educational institutions in the last five years should be supported with computer technologies to help students benefit from technology more.

5- Physics and science teachers who are expected to use computer technologies in their courses in high schools should be provided with in-service trainings regarding the use of computer programs.

6- The technological sub-structure of high schools should be structured considering the recent developments in computer technologies.

7- Studies similar to this study could be beneficial for the other courses given in high schools.

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