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Proje Tabanlı Öğretim Yönteminin Öğrencilerin Elektrik Konusu Akademik Başarılarına, Fiziğe Karşı Tutumlarına ve Bilimsel İşlem Becerilerine Etkisinin İncelenmesi

The Effect of Project Based Learning on Science Undergraduates' Learning of Electricity, Attitude towards Physics and Scientific Process Skills

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Öz

Bu çalışmada, proje tabanlı öğretim yönteminin Fen Bilgisi Öğretmenliği birinci sınıf öğrencilerinin elektrik konusu başarıları, bilimsel işlem becerileri ve fizik dersine karşı tutumlarına etkisinin incelenmesi amaçlanmıştır. Yarı deneysel eşdeğer olmayan gruplar ön test son test deney deseninin kullanıldığı çalışmanın, örneklemini 2006-2007 eğitim öğretim yılında Atatürk Üniversitesi Bayburt Eğitim Fakültesi Fen Bilgisi Öğretmenliği programına kayıt yaptıran doksan birinci sınıf öğrencisi oluşturmaktadır. Fizik dersinin elektrik konusu bu öğretim yılının ikinci dönemi boyunca deneysel grupta proje tabanlı öğretim yöntemi, kontrol grubunda ise öğretmen merkezli geleneksel öğretim yöntemi kullanılarak işlenmiştir. Veri toplama aracı olarak elektrik konusu başarı testi, fiziğe karşı tutum testi ve bilimsel işlem başarı testi olmak üzere üç çoktan seçmeli test kullanıldı. Bu üç çoktan seçmeli test, dönemin başlangıcında ve sonunda her iki gruba ön test ve son test olarak uygulandı. Ayrıca, proje tabanlı öğretim yönteminin uygulandığı deneysel gruptaki sınıf atmosferini ortaya koymak için dönem boyunca araştırmacı tarafından tutulan gözlem notları ve deneysel gruptan seçilen beş öğrenciyle yapılan 30-40 dakikalık mülakatlardan faydalanılmıştır. Üç testten elde edilen ön test ve son test verileri tekrarlanmış ölçümler, çok değişkenli varyans analizi yöntemi ile analiz edilmiştir. İstatistiksel analiz, öğrencilerin fiziğe karşı tutum, elektrik başarısı ve bilimsel işlem becerisi açısından, deney grubu ve kontrol grubu arasında istatistiksel olarak önemli farklar olduğunu göstermiştir. Ayrıca nitel bulguların deneysel sonuçlarla paralellik taşıdığı, proje tabanlı öğretim yönteminin öğrencilerin öğrenmelerine katkı sağladığı ve onların fiziğe karşı tutumları ve araştırma becerilerinin gelişimine yardımcı olduğu düşüncesini desteklediği belirlenmiştir.

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Abstract

In the study, it was aimed to investigate the effect of project based learning on the first year science undergraduates' attitudes towards physics, electricity achievement, and development of scientific process skills. In these quasi-experimental nonequivalent groups pretest-posttest design study, the sample consisted of total of 90 first year science undergraduates (prospective teacher) enrolled in the Science Teacher Training Department in Bayburt Education Faculty in 2006–2007 academic year in Turkey. The electricity title was taught through project based learning in the experimental group, while traditional teacher-centered instruction was followed in the control group through the second semester. The data was collected through three different tests; Electricity Achievement Test, Attitude towards Physics Test and Scientific Process Skills Test. The tests were administered to the experimental and the control group students at the beginning and end of the course as pretest and posttest. In addition, to explore further the in-class atmosphere of the experimental group, the observation notes taken by the researcher through ten weeks and the semi-structured interviews of 30-40 min conducted with the purposely selected five students from experimental group. Pretest and posttest scores collected by the three tests were statistically analyzed applying the repeated measures multivariate analysis of variance (MANOVA). The statistical analysis showed that there were statistically significant differences between experimental and control group with respect to students' attitude toward physics, electricity achievement and scientific process skills. Furthermore, it was found from the qualitative data that the experimental results support the idea that the project based learning enhanced the students' learning and helped their attitudes towards physics and research skills to improve.

Key words: Attitudes towards Physics, Electricity Achievement, Project Based Learning, Prospective Teacher, Scientific Process Skills, Undergraduate.

INTRODUCTION

The learning environment of the course is based on a constructivist approach, and designed to enable the students to construct their knowledge through active learning, and through interaction with teacher and other students (Frank and Barzilai, 2004).Based on constructivist view, many instructional strategies are used in teaching and learning in various educational contexts. Project Based Learning (PBL), Problem Based Learning, Inquiry Based Learning (IBL) and Cooperative Learning are the most basic strategies among them (Karaman and Çelik, 2008). The currently most favored pedagogical and innovative model for teaching design is project based learning (Dym et al., 2005). For over 100 years, educators such as John Dewey have reported on the benefits of experiential,

hands on, students- directed learning. Most teachers, knowing the value of engaging, challenging projects for students, have planned field trips, laboratory investigations, and interdisciplinary activities that enrich and extend the curriculum. The roots of PBL lie in this tradition. But the emergence of a method of teaching and learning called Project Based Learning is the result of two important developments over the last 25 years. First, there has been a revolution in learning theory. Research in neuroscience and psychology has extended cognitive and behavioral models of learning- which support traditional direct instruction- to show that knowledge, thinking, doing, and the contexts for learning are inextricably tied (Markham, Larmer and Ravitz, 2003).

Project Based Learning has been defined in many ways. For this reason there exists no single definition. In the given definitions, PBL has been referred to as a "model", "approach" or a "technique", or as "learning" or "teaching". It appears that no common agreement has been reached yet. In this study, project-based learning has been considered as an "approach" (Gültekin, 2007). PBL is a learning approach that considers project as a part of infrastructure. Project means thinking, imaging and functioning. If PBL based on thinking, imaging and functioning, it underlines to train creative individuals who take responsibilities of their own learning. PBL is very important for qualities of the individuals' behavior and it requires different learning process. Projects are complex tasks, based on challenging questions or problems, that involve learners in design, problem-solving, decision making, or investigative activities; give learners opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations (Altun, Turgut and Büyükkasap, 2007).

Project Based Learning is a comprehensive approach to instruction in which students of any age, working individually or in groups, conducts an in-depth investigation of a real-world topic. When teachers successfully implement PBL, students can be highly motivated, feel actively involved in their own learning, and produce complex, high-quality work (Blumenfeld et al., 1991). PBL may be applied in individual courses or throughout a curriculum, the projects can be combined with traditional teaching, projects may be carried out as individuals or in small groups and projects can vary in duration

from a few weeks up to a whole year (Mills and Treagust, 2003). Students spend the majority of their time working on their own or in small groups activity that lasts for a particular period of time, which results in a product, a demonstration or a performance. Student finds their own sources, conduct their own research, and secure their own feedback (Thomas, 2000). PBL offers a creative and effective way to meet curriculum objectives and address standards. This session will feature appropriate resources, lesson ideas and sample projects that address math, language, science, social studies concepts and skills (Woldman, 2003). Considering these definitions, PBL can be defined as a learning approach based on students' working for a period of time in order to intensively investigate the real world issues or problems in an interdisciplinary approach so as to produce something concrete through individual efforts or pair-work. Judging from these definitions, PBL can be said to consist of four basic elements; extended time frame, collaboration, an investigation or research and a task-based performance or a demonstration (Grant and Branch, 2005; Gültekin, 2007).

One goal of the PBL is to develop students to manage themselves (Mergendoller et al., 2006). PBL helps students to develop long-term learning skills (Grant and Branch, 2005). Students gain information literacy skills and develop thinking skills (Baldock and Chanson, 2006; Massey and Burnard, 2006; Lou and MacGregor, 2004). Since students deal with relevant issues, their motivation is increased (Baldock and Chanson, 2006; Frank et al., 2003; Lou and MacGregor, 2004; Marti et al., 2006; Weenk et al., 2004). The PBL students also demonstrated greater self-confidence and improved learning abilities (Shepherd, 1998). Provides the opportunity to reflect and involve students' beliefs and values (Mergendoller et al., 2006). The most evident results of PBL are increasing feeling of pride with regard to achievement and personal development of students (self-confidence, responsibility, self-esteem etc.), increasing ratio of attendance, and empathy with others (Altun, 2008; Carr and Jitendra, 2000). With PBL, a wide range of skills can be developed simultaneously.

As prospective teachers, teacher candidates are to improve themselves from some points of the field of study, pedagogical formation and overall background knowledge.

Therefore, with the help of the project-based teaching method, the pedagogical formation and knowledge of the field of study will help students in the faculty of education later in their professional life (Pelsma and Neufeldt, 2002). It is an effective instructional approach that can equip graduates with the necessary value and technical skills to contribute the workplace from day one. Increasingly, project-based learning is used as an instructional approach to prepare students to succeed in today's dynamic workplaces (Gonzales and Nelson, 2005).

Related Research

Meyer (1997) investigated students' challenge during project-based mathematics instruction to 14 fifth- and sixth-grade students. They drew on 5 areas of the research: academic risk taking, achievement goals, self-efficacy, volition, and affect. The research indicated that 2 patterns of student self-perceptions and behaviors: "challenge seekers" and "challenge avoiders." Challenge seekers self-reported a tolerance for failure, a learning goal orientation, and a higher than average self-efficacy in math. Challenge avoiders self-reported a higher negative affect after failure, a more performance-focused goal orientation, a lower self-efficacy in math, and a greater use of surface strategies (i.e., strategies requiring minimal processing of information). Sabaratnam and Hegde (2002) investigated the effect of project based learning on the final graduate students enrolled in Photonics Centre at NgeeAnn Polytechnic, Singapore. The students chosen to do their final-year project in photonics and laser technology and didn't have any photonics background at all at the start of their project. The research indicated that the students gained immense knowledge and hands-on experience in photonics and laser technology. Papastergiou (2005) investigated a project-based learning environment and its impact on student teachers. The participants were 46 student teachers. The research indicated that the PBL approach has been motivational and effective regarding the acquisition of design and development skills. The participants became more interested in and self-confident about project subject, although they encountered certain difficulties. Baldock and Chanson (2006) investigated the pedagogical impact of real-world experimental projects undertaken as part of an advanced undergraduate fluid mechanics subject at an Australian university.

The projects were organized to complement traditional lectures and introduce students to the challenges of professional design, physical modeling, data collection and analysis. The research indicated that the students were exposed to a professional design approach involving a high level of expertise in fluid mechanics, with sufficient academic guidance to achieve carefully defined learning goals, while retaining sufficient flexibility for students to construct their own learning goals. Student feedback indicated a strong motivation for courses that include a well-designed project component.

There is no enough study related to effect of PBL on prospective teachers' attitude towards physics and electricity achievement. Although there are studies concerning effect of PBL on students' some higher order thinking skills, there is no any study science process skills. So this study aimed to investigate the effect of project based learning on science undergraduates' (prospective teacher) learning of electricity, attitude towards physics and scientific process skills.

Research Question

Is there a difference between experimental and control groups according to the prospective teachers' attitude towards physics?

Is there a difference between experimental and control groups according to the prospective teachers' electricity achievement?

Is there a difference between experimental and control groups according to the prospective teachers' scientific process skills?

METHODS

Quasi-experimental nonequivalent groups pretest-posttest design was used. The sample consisted of 90 first year science undergraduates (ages 16-20) enrolled in the Science Teacher Training Department in Education Faculty in 2006–2007 academic year. There are 43 students in experimental group (26 male, 17 female) and 47 students (27 male, 20 female) in control group.

Methodology

During the course, using the project based learning approach in the experimental groups' students prepared projects on titles selected themselves appropriated to the course curriculum. Experimental groups' student's separated nine project groups. All project groups consist of four or five students. When members of groups have different ability, skills, knowledge level and characteristic, groups' work are more efficient and productive (Gödek 2004; Lightner et al. 2007). Therefore, all the students that will create a project in a certain group have different levels of knowledge, skills and abilities. In this study, in order to arrange the groups, some of the characteristics of the students are determined. These features of the students are related to attitude towards research, electricity achievement, scientific process skills, team working attitude and attitude towards physics. So, students were assigned to team working groups according to the variables such as physics achievement, attitude towards physics, gender, and attitude towards research to obtain the intergroup homogeneity. Developed attitude towards research scale and the other scales obtained from the literature (electricity achievement scale, scientific process skills scale, team working attitude scale, attitude towards physics test) were applied before group. Data was collected by using "attitude towards research" scale developed by the researchers. Reliability coefficient, α, was determined to be 0.74.

Instrument

Scientific Process Skills Test, Attitude Towards Physics Test and Electricity Achievement Test were used as a pre test at the beginning of semester and as a post test at the end of the semester. Attitude Towards Physics Test developed originally by (Eryılmaz, 2004), it is a Likert type scale consisted of 24 items, was used to obtain the effect of project based learning on undergraduates' attitudes towards physics. To explore the influence of PBL on students' scientific process skills, Scientific Process Skills Test, which is a Likert type scale composed of 36 items, developed by originally (Okey, Wise and Burns, 1985) and translated and adapted to Turkish by (Özkan, Aşkar and Geban, 1991). In addition, students' electricity achievements' were measured using "Electricity Achievement Test", a scale composed of 21 items, developed by (Tekiroğlu, 2005).

To explore the in-class atmosphere of the experimental group, the observation notes taken by the researcher through ten week and the semi-structured interviews of 30-40 min conducted with the purposely selected five students from experimental group were used. Interviews were recorded, transcribed and then analyzed. Content analyze was used for analyzing data.

Data Analysis

The data obtained from electricity achievement, attitude towards physics and scientific process skills tests gained by experimental and control groups before and after intervention were statistically analyzed. First, experimental data were subjected to repeated measurements multivariate variance analysis by using SPSS package program. Teaching method and two measurements at different times were considered between subject variable and within subject variable, respectively. Such kind of an analysis method would be the right choice as it would take into account this correlation when determining the impact of independent variable. When there is a significant correlation between dependent variables in particular. First, pearson correlation analysis was conducted in order to see whether there were significant correlations between dependent variables. Then, analysis was conducted to see whether the data verify repeated measurements multivariate variance analysis assumptions (MANOVA). Assumptions like multivariate and univariate normality, linear relation of dependent variables, existence of multivariate and univariate extreme values, equality of covariance matrixes, equality of variances in different groups etc. were tested one by one. After these variances were tested and required corrections related to normality and extreme values were made, repeated measurements were statistically analyzed according to MANOVA, whose results are provided in "findings" section.

FINDINGS

Firstly, correlation quotients and significance levels were calculated to determine whether there were significant correlations between dependent variables in statistical terms. This calculation showed that statistically significant correlations at 0.01 level existed between

dependent variables. These statistically significant difference detected between dependent variables were taken into consideration and it was decided that repeated measures MANOVA analysis should be conducted; after this stage, effort was paid to determine whether the data verified MANOVA assumptions. First of all, it was determined that there were no missing values; then, extreme values were determined and replaced with the closest values of relevant variables. Significance level of Shapiro-Wilks test, which was conducted separately to see whether dependent variables distributed normally, was found to be above 0.05. Again, values of the other two variables used for normality test (distortion and lowness tests) were between -1 and 1, which shows that there is no violation of normality. In addition, Mahalanobis distances were calculated to determine whether there were multi-variable extreme values; it was determined that no distance exceeded the 16.2 value, which is equivalent to 0.001 significance level. This means that there is no multi-variable extreme value (deviation value). Another MANOVA assumption that equality of variance-covariance matrixes is ensured is displayed by means of Box test (Box' M=45,86, F=2,02, sd2=21, sd2=27992, p=0.004>0.001). Levene test, which was conducted for equality of variances of dependent variables, showed that variances of variables could be accepted as homogenous; the diffusion graph drawn for linearity test displayed that the changes between dependent variables could be accepted as linear. Finally, VIF (1.10-1.13) and tolerance (0.75-0.93) statistics calculated in order to see whether there is a possible collinearity between variables showed that there is not an important collinearity between dependent variables. In addition, values showed that changing in time is significantly related to application among three dependent variables. In Table 1, average and standard deviation values for each level of experimental and control groups are provided. In addition, profile graphics for three dependent variables are given in Figures 1, 2 and 3. When we look at these graphs and average values, the impact of the application can be seen more clearly. When we look at electricity achievement figure for experimental and control groups (T3) it is clearly seen that the plots of experimental and control groups are not parallel (Figure 1). As can be seen from Table 1, class average for experimental group was 9.41 for pre-test; this value increased to 15.02 after application; on the other hand, the change was from 9.85 to 12.00 for control group (F=31.67, p=0.000,

η2=0.265, df1=1, df2 =88). This means that the impact of application is statistically higher and different in experimental group compared to the control group. In other words, this finding can be interpreted as indicating that application had a bigger impact in terms of success on experimental group compared to control group. There was also significant interaction between time and groups in scientific process skills test (F=50.012, p=0.000, η2=0.362, df1=1, df2 =88). In other words, the application did not have similar impact on groups; groups were affected by this application in different ways. It can be seen from the profile graph (Figure 2) drawn for scientific process skills that the plots of experimental and control groups intersect; there is significant non-parallelism. When we look at Table 1, it is seen that pre-test average of experimental group increased to 27.02 from 17.98; the increase was to 20.77 from 19.92 in control group, which shows that the impact of the application was significantly higher in control group compared to experimental group. Finally, when we look at attitude-dependent variable, it is seen that there is statistically significant attitude towards physics as well as group interaction, which is similar to others (F=21.452, p=0.000, η2=0.196, df1=1, df2 =88). For attitude towards physics dependent variable, pretest average of experimental group increased to 88.65 in the post test from 78.02; the value decreased to 80.25 from 80.82 in control group. When we look at the profile graph (Figure 3), significant non-parallelism is observed similar to other graphs. In the case of attitude towards physics variable, it can be seen that the impact of application is statistically more significant in experimental group compared to control group.

Table 1 Level of experimental and control groups' pre-test and post-test mean and standard deviation values

			Mean	sd
T1	Experimental Group	pre-test	17.98	3.569
		post test	27.02	4.682
	Control	pre-test	19.92	2.940
	Group	post test	20.77	4.578
T2	Experimental Group	pre-test	78.02	7.667
		post test	88.65	7.274
	Control	pre-test	80.82	7.079

	Group	post test	80.25	6.696
T3	Experimental Group	pre-test	9.41	2.249
		post test	15.02	1.981
	Control	pre-test	9.85	2.093
	Group	post test	12.00	1.413

T1: Scientific process skills, T2: Attitude towards physics, T3: Electricity achievement

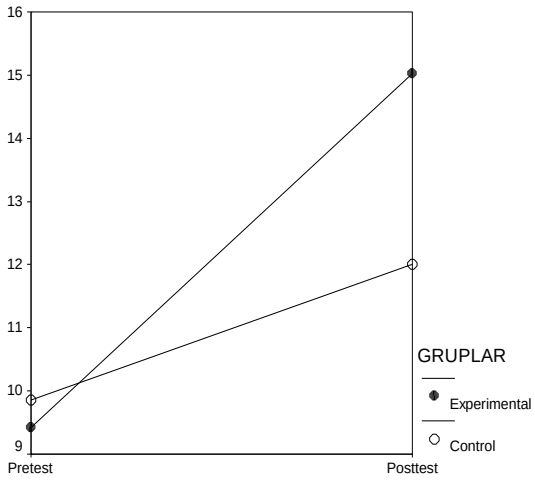

Figure 1 For Electricity Achievement Estimated Marginal Mean Values From MANOVA Model

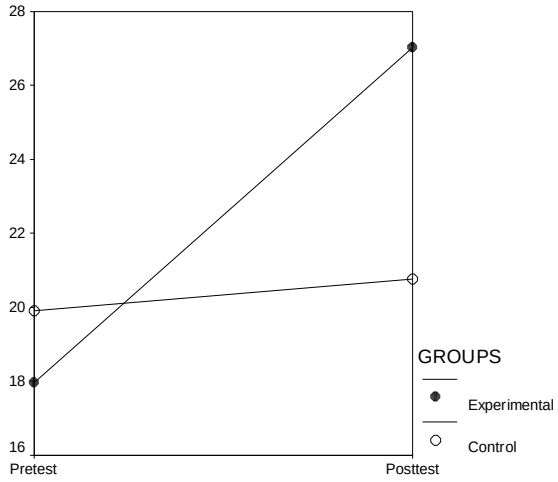

Figure 2 For Scientific Process Skills Estimated Marginal Mean Values From MANOVA Model

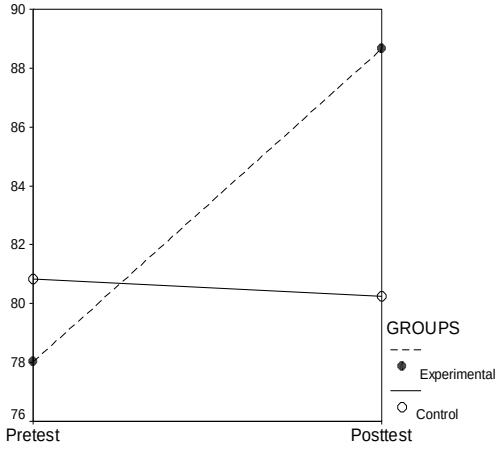

Figure 3 For Attitude Towards Physics Estimated Marginal Mean Values From MANOVA Model

In order to compile information about the incidents that students in control group faced during application of PBL (Project Based Learning) and their opinions on these incidents, an interview form developed with reference to the related literature was used (Bozdoğan and Altunçekiç, 2007; Çil, 2005). The form consists of five questions and is prepared with the purpose of determining strongest and weakest points of PBL and its impact on students. Data from interviews conducted with five chosen students from experimental group were analyzed in a manner that's impact and functioning as regards students could be displayed. Findings obtained from student interview data and analyses of researcher observation notes are supportive of the findings of experimental work. Content analyze was used for analyzing data.

Analysis of student interviews show that continuous utilization of different resources by students and their interaction within group based on cooperation occupies a significant place in the process of application of PBL. At the same time, these findings also show that PBL makes contribution to the realization of inter-disciplinary learning process. From the following extracts from student interviews, it was determined that they believed that research that they conduct to find the information needed to solve the problems that they encounter during project works, as well as utilization of the information that they reach, improved their level of knowledge, which in turn improved their learning. Emphasis was on the opinion that, when students apply the principles related to the subject that they believe that they know, they find out that their knowledge is insufficient or inaccurate; thus, it makes a better learning of concepts and subjects when they find out the accurate knowledge by trial-and-error or from their peers and other people. In addition, students stated that they made use of the subjects of other courses so that their projects had more content and were different, as a result of which projects helped them to be knowledgeable in other subjects; they attracted attention to the fact that their accumulation of knowledge was beneficial not only for the relevant project but for other courses as well.

Below are extracts from student interviews which support these opinions.

Researcher: Did project work improve you in terms of your level of knowledge? Please explain.

S1 "We searched some information in order to solve some problems that we encountered during project work, and we found out and learned by discussion. There were times when we explained each other one point that others did not understand. We made use of other courses in order to enrich the project, and we had knowledge on other courses as well."

S2 "At the beginning, we thought that we would have no difficulty in the projects that we planned. But as the project progressed, our knowledge proved to be insufficient for some tasks. We applied to several people in order to obtain necessary information. We went to electricians, carpenters and even tiremen and learned a lot from them. I can mend electrical malfunctions now."

S3 "I used for project work some pieces of information that I had but never used before and saw that either my level of knowledge was insufficient or inaccurate or incomplete. I learned true information and corrected this problem."

S4"In cases where my previous knowledge was not sufficient, I tried to complete missing information by doing research. My manual skills developed with the projects that we made."

S5 "I had the opportunity to use the knowledge that I learned. Even in some cases I noticed that I had some information which I did not know it was there. I mean, I noticed that I had knowledge on some subjects that even did not attract my attention. When I used them, I learned more. Not only about the project; I also learned knowledge from other courses."

Analysis of teacher observation notes also supports the interview findings given above. Below are some examples taken from researcher observation notes:

"In order to obtain the information required in project preparation process, students extensively used each and every resource to which they had access (internet, books, magazines, craftsmen, industrialists, other teachers and students that could be knowledgeable on the subject etc.) Group members often refer to each other and persons and tools that they use as resource in order to solve the problems that they encounter."

Analysis of interview data display that students see material shortages, failure to procure necessary materials, lack of experience in preparing project and failure to perform responsibilities within the group as problems or obstacles encountered during project work. In particular, lack of necessary materials or lack of access thereto and lack of funding required to procure these materials are believed to be the major obstacles for making different and technology-based projects. Below are extracts from some student opinions that support this belief.

Researcher: What kind difficulties did you experience during project work?

S1 "There were times that we had difficulty in finding funds for the project that we planned. We even eliminated some projects for this reason and made the one which would be the least costly for us."

S2 "We had some difficulties in working performance of our peers. From time to time our peers evaded their part of the work. We had unexpected difficulties in some projects that we planned and thought that we would complete for sure, which distorted our morale."

S3,4 "We had difficulties in procuring necessary materials. We had designed a different, more up-to-date and technology-based project, but we decided that we would not be able to do it due to lack of facilities. As this was our first project, we had some problems as to how to do the project at the beginning."

S5 "We had never done a project before, we even had not done an experiment, for which reason we had problems as to how to make the subject more visual."

Similarly, analysis of the observation notes of teacher is parallel to the findings given above. Extracts from observation notes taken by teacher throughout the semester indicate to similar problems in project preparation process that students attracted attention.

"During the first weeks of project works, students from group said that they wanted to see projects that could provide them with a model made in physics or in any field. Their justification was that they had never done an project before."

"Observation is that, as they did not take part in such an activity, during first weeks they had difficulties in tasks like work plan or task allocation, which caused relative chaos for a while."

During intra-group discussions, emphasis was on the opinion that their projects should be more equipped and oriented to producing one thing or another. However, these discussions in time caused them to think that their level of knowledge, material resources and materials at their disposal were not sufficient for the project that they planned to do, which as a result led them to choose simpler projects.

Another finding obtained from analysis of student interviews was that PBL made students learning more fun and enjoyable, allowed them to use their knowledge, and improved their interest in physics and research. Students believe that PBL raise their level of knowledge, keep their interest alive, allow them to see the fields of use of the knowledge that they learn and to have inter-disciplinary knowledge. Students think that their skills for researching, finding, learning and using required knowledge improves and their interest in doing research develops. Students attract the attention to the fact that during application of PBL method, they had the opportunity to work in cooperation with group and feel the pleasure of achieving something together and searching the topics that they wondered. Students think that PBL method should be employed in other courses as well and they state that they want to implement this teaching method on their students in their future vocational life. In addition, students stated that their interest for physics and their self-confidence improved. The result from the interviews showed parallelism with quantitative findings.

Researcher: What do you think are the strongest aspects of project-based teaching method?

S1 "It made us deliberate on subjects. It allowed us to concentrate our interest on a limited number of phenomena. For example, in the face of daily events, we started to think "can this be made into a project? "How can we make an project from this?" In that way, it helped us think on different subjects and ensured that my area of interest widened."

S2 "It allowed us to have more knowledge on subjects. It gave us the opportunity to use our knowledge of subject and made us learn better. I think that I will never forget what I learned. My interest in physics improved. I want this method to be used in every course. I will apply his method on my students in the future."

S3"As we approached the finale of the project, we thought that we could achieve something, which made us happy. Also our self-confidence for doing other projects improved. Now I think that we can easily do project in every subject. We became knowledgeable in project works. We had a lot of fun with our peers during project works. Our self-confidence in doing and managing something improved. We experienced the feeling of achieving something with the group. Now I like physics more"

S4 "It made us do some research in subjects that we were curious about but did never have the chance to do research. Working was so much fun, our fervor for working increased. When I become a teacher I will give projects to my students, too."

S5 "It allowed us to gain the habit of working with our peers, and made learning more enjoyable and easier. It allowed us to learn subjects better. It allowed us to use the subjects that we learned in daily life. When we wanted to use some objects that we always see but whose working principle was a mystery, we learned how they are made and understood that their working principle was not as simple as we thought. Once we had some ideas on their working principle, we came to a level where we can generate ideas and even initiate a discussion. We were producing several solutions to the problems that we encountered."

Analysis of teacher observation notes also supports the interview findings given above. Below are some examples taken from researcher observation notes:

"They were so happy when they completed their projects. Project works were enjoyable. They had the chance to use their knowledge. They did research on subjects. They learned with group members. They also learned to learn on themselves. They also made use of other courses."

In addition, existence of some cases that students attributed to intra-group interaction and unfavorable conditions, which distorted their morale and motivation during project work, can be listed among other findings obtained from interview data. Students attracted attention to the facts that they did not have any room to preserve their project products, that they lacked the knowledge and material resources to do more technology-based projects and put emphasis on the fact that these conditions eroded their motivation. Again, negative criticisms of their classmates on project preparation process and the negative impact on their performance of the group perception that other groups were more successful were other motivation-distorting causes that they demanded attention to be paid.

Researcher: What are the weak points of project-based teaching method? Why?

S1,2 "The fact that we did not have preliminary knowledge required for doing a more technology-based and scientific project had a negative impact on our fervor for doing project and made us feel that we did not know anything at all. We spent too much effort and time, but negative criticisms made by our classmates during project presentation distorted our morale."

S3,4 "We both congratulated and envied different projects made by our classmates. We found our projects rather simple, which caused deterioration in our motivation. We could not find room to preserve our project products; they were damaged while transporting them from one place to another, which distorted our fervor for doing project. A room has to be arranged for project works."

S5 "We were sad as we could not do the project that we wanted due to lack of funding. There has to be a room where we can leave the project products and where we can work every time as we wished."

Analysis of teacher observation notes also supports the interview findings given above. Below are some examples taken from researcher observation notes:

"Students had problems due to lack of a room where they could preserve their project products and work easily any time they wanted. Students complained about lack of resources which could materially support their projects."

"Sometimes they were negatively affected by criticisms of their classmates. Some students became disappointed and made self-criticism during their project presentations stating "projects of other groups are more successful than ours; why did not we think of this?"

In addition, by means of analyzing interviews, it is detected that students put emphasis on the benefits of group-work. They believe that the knowledge, skills and the feeling of socialization that they obtained by group-work had a positive impact on them. Students attract attention to the fact that project presentation was the time when they were most emotional. They believe that experiencing the feeling of success made them have more self-confidence and feel themselves valuable.

Researcher: Which part of project work that you liked most? Why?

S1 "Being able to achieve something with my friends made me so happy. We made use of different knowledge and skills that our friends had and learned a lot from them. We were so proud during project presentation. We felt ourselves happy, successful and valuable."

S2,3 " Trying to solve the problems that we encountered with other group members and with great effort earned us the feeling of unity and togetherness, which made us happy. I had the chance to know my friends closer and establish communication with them."

S4,5 "We were happier as we approached the finale of our project. We liked to see that we could create something. As we solved the problems that we encountered during project work, our self-confidence improved and we became happier."

Similarly, analysis of the observation notes of teacher is parallel to the findings given above. Extracts from observation notes taken by teacher throughout the semester indicate to similar problems in project preparation process that students attracted attention.

"They shared the knowledge that they learned with their peers. They were so happy for the experiences that they had during group work. They had fun doing project. They became happier as they achieved something. Students looked forward to the day they would display their project products to their classmates. On the day they presented their projects, they were so happy and excited."

According to the results obtained from this research, we can think that giving project to students by taking into consideration their course curriculum forced them to do research on complicated issues of the project, which made them to experience learning at desired level; it even made them to relate these concepts to new ones and generate meaningful learning. Nevertheless, another claim can be that it made sure that they used the subjects learned during courses and allowed them to deliberate on these subjects as well as doing more comprehensive research, which in turn resulted in better learning of subjects. At the same time, it can be stated that students on whom project-based teaching method was applied improved competency of using transferring to daily life knowledge; they also had better confidence in their ability to reach generalizations. Therefore we can think that students learn better as they internalize some cognitive behaviors like comprehending, applying, and analyzing knowledge.

DISCUSSION AND IMPLICATIONS

Project based learning focuses on the application of physics in problem solving. Through challenging and interesting activities and projects, students further develop their skills in physics operations and in understanding concepts. Students in Applied physics and its daily usage while solving problems relevant to today's world. It can be said that project based learning facilitate students' understanding of electricity subject. It show consistency other studies about project based learning effectiveness. In a study doing by Uzun (2007), at primary school 4 and 5 classes, in the unit of "Effect Wonder and Recognize World of Living Beings", Science and Technology subject, the influence of Project based learning to academic achievement and retention level was examined. it was determined that

experiment groups were more successful than control groups and relating to this, it was realized that project based learning was effective in academic success and retention level. Doing Yurttepe (2007), a study was to examine the effects of Project-based learning on the 8th grade primary school students' success the Science lesson. The findings that have been obtained in this search can be summarized in this way; the Project based learning is important for the students learning and achievement. Findings of the research are similar to those of the other previous studies in this context. In a number of studies investigated if project based learning effect students' achievement. (Yavuz 2006; Schneider et al. 2002; Özdener and Özçoban 2004; Aladağ 2005; Frank et al. 2003; Molyneaux et al.2007; Marti et al. 2006; Massey and Burnard 2006).

It can be said that project based learning have positive impact on students' attitude towards physics. It shows parallelism with other previous studies. In a study doing by Yavuz (2006) was determined the effect of PBL method in teaching mathematics to the academic achievements and attitudes of forth years' students of primary education. At the end of the study, at the attitude of students against mathematic there is a rather substantial difference in favor of experiment group than control group was found. Doing by Çıbık (2006), a study aimed to examine the effect of project based learning approach in teaching science to the logical thinking ability and attitude towards science lesson, an experiment group and a control group was established. It was concluded that before experimental process, according to the attitude scale towards science scores, there was no meaningful difference between the students of experiment group which were applied the project based learning approach and the control group which are applied the traditional education approach. On the other hand, it was also concluded that after the experimental process, according to the final test attitude scale towards science scores there was a significant difference between the students of experiment group which are applied the project based learning approach and the control group which were applied the traditional education approach in favor of experiment group. Findings of the research are similar to those of the other previous studies in this context. In a number of studies investigated if

project based learning effect students' attitude towards course (Aladağ, 2005; Boudria, 2002; Frank et al., 2003; Gültekin, 2007; Massey and Burnard, 2006; Seloni 2005).

Finally, it can be said that project based learning enables to improve students' science process skills. There is no enough study related to effect of PBL on prospective teachers' attitude towards physics and electricity achievement. Although there are studies concerning effect of PBL on students' some higher order thinking skills, there is no any study science process skills.

CONCLUSION

During project works, PBL creates a different teaching environment by taking them out of the routine, boring atmosphere of school. This teaching environment is more interesting, fun, exciting and rewarding for students, who had fun and good time when learning in this teaching environment. This can be one reason for turning to positive their attitude towards courses. PBL allows students to use the subjects that students see during their courses by giving them relevant projects, so that they can use the knowledge they learn in daily life and see the usage field of these pieces of knowledge. It is believed that students' opinions that the knowledge they learn are useful and helpful in solving some problems that they encounter is helping them to change to positive their attitude towards courses.

PBL has some characteristics that will stop students from being monotonous and make them more dynamic. PBL supports students in learning and practicing skills in problem. Hence, it also provides opportunities for interdisciplinary learning by engaging students in applying the content of different subject areas during the various phases of the project. PBL helps students develop real world skills like the ability to collaborate well with others, make decisions and take initiative, and face complex problems solving, communication, and self-management. Students enter into a friendly competition with other groups during project works and pay effort in order to be successful. As a result of their achievements, they feel the happiness and excitement of achieving something. At the same time, students feel the pleasure of producing something and displaying something different, which in turn makes them feel valuable, skillful and knowledgeable. In that way, it can be said that

their self-confidence and feeling of competence for next project tasks is improved. It can be a contribution to turn to positive the attitudes of students towards the course.

Teachers can make sure that students do project works in areas parallel to the contents of course curriculum. Students have to pay effort in order to reach the knowledge required to solve the problems that they encounter during project works, which can generate a will for research, finding and learning by improving their interest in that particular subject. Students can compare the new pieces of knowledge obtained during their research with their old knowledge. Based on such comparisons, students can have the opportunity to correct their inaccurate knowledge, or complete missing information and earn new knowledge.

Like project-based teaching method which takes constructive approach to teachers and students alike, other teaching methods can also be taught and ensured that they are applied in classrooms. In that way, purpose can be that knowledge provided in schools in an abstract manner is turned into concrete and its area of use in daily life is seen.

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