The Effect of Project Based Learning Method Supported by Prediction – Observation – Explanations on the Attitude and Behaviors Towards Environmental Problems

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Abstract

The purpose of this study is to investigate effect of project based learning method which is supported by prediction- observation- explanation (PBL supported by POE) method on attitude and behaviour towards environmental problems. The other aim of this study is to reveal experiment group students' views towards learning method. In this research called explanatory mixed method had been applied. In this study, Attitude Scale towards Environmental Problems, Behaviour Scale towards Environmental Problems and a semi-structured interview question are used as data collection tool. **T**he findings obtained from the research show that there is a significant difference in favor of the experiment group among the point averages of the attitude and behavior posttest of the groups. When the findings regarding the questions posed to prospective teachers are examined, it is seen that prospective teachers explain that their attitudes towards environmental problems and behaviours aimed at preventing, eliminating those problems change positively after the application.

Keywords: Environmental problems, project based learning method, prediction-observation-explanation method, attitude, behavior

Introduction

The humankind who has not realized that it has polluted and consumed the environment for many years faces with many problems in its relationships with the environment together with the globalization of environmental problems. This causes the world countries facing with a great threat to recognize the environmental problems entirely and to take measures in order to eliminate these problems. The most important one of these measures is probably to give an independent environmental education which can help the individuals gain the environmental consciousness and awareness to announce the problems to the masses and to take relevant measures (Kavruk, 2002). It is necessary to take advantage of the education to get the individuals gain the desired skill, knowledge, attitude and behaviour in the cognitive, affective and psychomotor domains to solve the existing environmental problems (Geray, 1998).

The environmental education is an approach which lasts lifelong, is interdisciplinary and has the aim of developing a world population who is conscious of the environment and the matters related to the environment, who is sensitive to the environment and the problems related to the environment and who has knowledge, skill, attitude, motive, personal and social duties and responsibilities which can help solve the environmental problems and prevent the occurrence of new problems (Moseley, 2000). When the cognitive, affective and psychomotor purposes/objectives of the environmental education are considered, prospective teachers who continue their undergraduate education should take the environmental education aimed at realizing these three objectives (Erten, 2006).

It is known that the teachers are the role models for the students especially in the period of primary education. The children of that age imitate every behaviour of their teachers, try to behave,

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speak and get dressed like their teachers. In this respect, the teachers should realize these impacts they have on the students and should organize their behaviours to develop the environmental-oriented attitudes and behaviours of the students. Because the irresponsible behaviours and the attitudes developing negatively which are also causes of irresponsible behaviours underlie the many environmental problems (Bradley, Waliczek, and Zajicek, 1999). Today, the solution of the environmental problems is possible only with the change of the individual behaviours and the change of the behaviours requires the change of attitude and value judgment (Erten, 2005). For this reason, the environmental education which will be given to the prospective teachers should be designed to enable them to raise the environmental awareness of the individuals whom they will raise in the future and also to make these individuals gain the positive environmental-oriented attitudes and behaviours. In this respect, the environmental education should be given with the suitable strategies, methods and techniques in connection with the daily life in the manner that it develops the environmental-oriented awareness, attitude and behaviour in individuals. Because there are significant relationships between the environmental education given at the school and the consciousness/awareness of the environmental problems, being sensitive to and interested in these problems and exhibiting behaviours aimed at eliminating the problems (Şimşekli, Ergül, and Şanlı, 2001; Ünal, Mançuhan, and Sayar, 2001).

The environmental education given formal education institutions in our country is unfortunately not at the sufficient level. Because, the environmental education involves some definitions and explanations related to the environment concept and it is tried to get the individuals gain these definitions and explanations with the traditional teaching methods. However, teacher-centered teaching methods should be abandoned and student-centered teaching methods should be preferred to expect success from the environmental education and get individuals gain the desired behaviours. Since the environmental education is an interdisciplinary education, the most important mission of it is to help the students analyze the complex environmental problems critically, which is possible only by trying different methods and techniques (Uzunoğlu, 1997; Mastrilli, 2005).

In this study, the prediction-observation-explanation (POE) method which is one of the active teaching methods in teaching the subject of the environmental problems is used in the manner that it supports the project-based learning (PBL). There are some certain reasons for the choice of these methods. First of all, the group chosen as working group consists of the prospective teachers who are at nearly adult age and have some preliminary knowledge/information, attitude and behaviours concerning the environment. These attitudes and behaviours can be changed positively only if they are made to play an active role in their own learning by their own experiences. Both of the teaching methods used in the study give the individuals to construct their own learning and hold them responsible for their learning. Furthermore, the universities constitute the last step of the formal education institution for many students and professional experiences start after the graduation from the universities. When it is considered that the working group consists of the prospective teachers, each individual taking part in this group has the chance to be inducted as a teacher if they graduate. It is surely unimaginable that the teachers who are the raisers of the future societies are the individuals who only listen to the teacher passively in the universities, who do not join in the application-oriented activities during the lesson. Furthermore, if they learn these methods and their applications during the lessons, this enables them to apply these methods in their own classes when they become a teacher in the future. Another reason why the teaching methods used in the study are preferred is that contrary to the traditional teaching methods, these methods are the ones in which the audio-visual materials (animations, short films, pictures) are utilized, which are student-centered, application-oriented and enable the students to learn by doing and experience and that these methods are thought to become effective methods in realizing the objectives of the study carried out.

Purpose

The purpose of this study is to investigate effect of project based learning method which is supported by prediction- observation- explanation (PBL supported by POE) on students' attitude and behaviour towards environmental problems. The other aim of this study is to reveal experiment group students' views towards learning method.

Hypotheses towards the purposes of the research were established null and alternative hypothesis form and ANOVA test was used to test the hypotheses.

H_{01}: There is no significant difference between experiment and control group students' attitude scores towards the environmental problems.

H_1: There is a significant difference between experiment and control group students' attitude scores towards the environmental problems.

H_{02}: There is no significant difference between experiment and control group students' behaviour scores towards the environmental problems.

H_2: There is a significant difference between experiment and control group students' behaviour scores towards the environmental problems.

Method

In this research, the research model called explanatory mixed method, in which both quantitative and qualitative research methods are used together had been applied. In order to collect the quantitative data, pre test–post test control group experimental design was used. Interview technique was used to gather qualitative data in order to promote and explain the results obtained from the quantitative data.

Working group

The participants whose the data are collected are determined with a purposive sample which enables researcher to choose the ones who are believed to find to solutions to the problems of the researcher (Cohen, Manion, and Morrison, 2007). In this study, the researchers chose Gazi Education Faculty because of its being easy to access and chose environmental problems as the subject of the study. The working group of the research consists of two classes of prospective teachers (N=93) receiving environmental science and studying at the Science Education Department of Gazi Education Faculty at third grade in 2010-2011 academic year in spring term. One of these classes is determined randomly as experiment group and the other is determined as the control group. As it is aimed to collect both quantitative and qualitative data in the research, two types of participants are determined. At the phase of obtaining quantitative data, all the prospective teachers (N=93) who participated in the application are included. At the phase of obtaining qualitative data, by analyzing the quantitative data obtained from the prospective teachers in the experiment group, the point average of the prospective teachers are lined up as lower, medium and upper % 33 points and in total with 6 prospective teachers (3 men and 3 women) semi-structured interviews were done.

Data collection tools

In this study, Attitude Scale towards Environmental Problems (ASTEP), Behaviour Scale towards Environmental Problems (BSTEP), a semi-structured interview question which developed by the researchers used as data collection tool.

Attitude Scale towards Environmental Problems: While preparing the items in attitude scale used in the research, the area in question was scanned, attitude concept, sub-dimensions of attitude are reviewed, a likert type scale in line with Bloom's Taxonomy was developed by utilizing the old attitude scales (Berberoğlu and Tosunoğlu, 1995; Bradley, Waliczek, and Zajicek, 1999; Pooley and O'Connor, 2000; Özmen, Çakmakçı Çetinkaya, and Nehir, 2005; Uzun and Sağlam, 2006). In order to create the items of the attitude scale, a working paper including the subject topics "the reasons of the environmental problems", "global and domestic environmental problems" and "solving environmental problems" and the sub-topics of these subjects are given to sample group chosen randomly and

representing the universe. And prospective teachers were asked to write an essay describing their thoughts and feelings on issues. Content analysis carried out on the compositions collected and a pool of 92 items was created. In order to determine the validity of the scale, criteria and structure validity tests were performed. In order to make content validity possible, the scale was reviewed by 5 academic members for content validity, by 2 academic members for conformity with assessment and evaluation principles and by 1 academic member for grammar and clarity and a draft scale was obtained. The scale was applied on 203 students at fourth grade studying at Science Education Department of Gazi Education Faculty in order to determine the reliability of the items. Factor analysis was used in order to enable structure validity of the scale. The Kaiser-Meyer-Olkin (KMO) value of the scale is found .77 and after factor analysis the factor loads of the items in the scale were found to be between .35 and .90. Load values (lv) regarding the factors obtained as a result of the tests were given in the table below upon determining the factor number (Table 2). After determining the load values regarding factors, the number of the factors was determined and the factor number in the scale was found as five. The results obtained regarding these five factors are given in the table below (Table 1).

Table 1.
Results Related to the Factors

Factor	Eigenvalues	Percent of variance	Percent of total variance
1	8.30	18.44	18.44
2	6.01	13.36	31.80
3	2.68	5.96	37.75
4	2.53	5.62	43.37
5	2.43	5.40	48.77

As it is seen in the table 1, the eigenvalue of these size factors are found as 8.30, 6.01, 2.68, 2.53, and 2.43 respectively. These 5 factors explains % 49 of the total variance. The variance rate which is above the accepted % 41 (Kline, 1994) is thought to be enabling the scale to be used as a scale consisting of five factors. In order to enable the criteria validity of a scale, after leaving the ones having extreme ended points based on the scale points as lower and upper group, the difference between the averages of these two groups are tested for being significant. At the end of the tests, 45 items with .05 level significant different in its lower and upper group points, and whose distinctiveness indexes (rjx) between .21 and .64. Load values and distinctiveness indexes of the 45 items in attitude scale are given in table below (Table 2).

Table 2.
Distribution Factors Substances Load Values and Indices Discrimination

Factor 1			Factor 2			Factor 3			Factor 4			Factor 5		
it.	lv.	Rjx	it.	lv.	Rjx	it.	lv.	rjx	it.	lv.	rjx	it.	lv.	rjx
1	.78	.59	13	.38	.22	2	.49	.27	9	.77	.25	5	.68	.26
4	.64	.52	15	.36	.21	3	.50	.38	14	.76	.21	19	.36	.28
10	.71	.60	16	.86	.40	6	.39	.23	29	.68	.31	21	.66	.27
11	.67	.44	20	.76	.47	7	.65	.31	39	.69	.29	28	.65	.29
17	.66	.42	26	.87	.41	8	.46	.30				42	.35	.35
22	.71	.57	27	.72	.40	12	.50	.30						
23	.59	.48	31	.90	.44	18	.70	.30						
24	.74	.57	33	.81	.48	36	.50	.28						
25	.63	.47	34	.80	.44									
30	.64	.62	41	.45	.23									
32	.75	.56	44	.82	.46									
35	.81	.62												
37	.73	.57												
38	.51	.48												
40	.83	.64												
43	.80	.62												
45	.38	.38												

Later each of the items of in the scale was transferred to table of specifications in line with Bloom's Taxonomy and content validity of the test was found adequate. Lastly in order to enable the reliability of the scale internal consistency and related analyzes were carried out and the consistency coefficient of the scale was found as .88 Cronbach alpha value.

Behavior Scale towards Environmental Problems: While preparing the items in behaviour scale used in the research, the area in question was scanned, readiness and behaviour concept, sub-dimensions of behaviour are reviewed, a likert type scale in line with Bloom's Taxonomy was developed by utilizing the old behavior scales (Lomigo, 2002; Ballantyne and Packer, 2005; Erten, 2006; Yavuz, 2006; Holden, 2007). In order to create the items of the behaviour scale, a working paper including the subject topics "the reasons of the environmental problems", "global and domestic environmental problems" and "solving environmental problems" and the sub-topics of these subjects are given to sample group chosen randomly and representing the universe. And prospective teachers were asked to write an essay describing their behaviour, behavior of applications for everyday life and especially exemplary behavior in order to solve environmental problems on issues. Content analysis carried out on the compositions collected and a pool of 75 items was created. In order to determine the validity of the scale, criteria and structure validity tests were performed. In order to make content validity possible, the scale was reviewed by 5 academic members for content validity, by 2 academic members for conformity with assessment and evaluation principles and by 1 academic member for grammar and clarity and a draft scale was obtained. The scale was applied on 203 students at fourth grade studying at Science Education Department of Gazi Education Faculty in order to determine the reliability of the items. Factor analysis was used in order to enable structure validity of the scale. The KMO value of the scale is found .79 and after factor analysis the factor loads of the items in the scale were found to be between .51 and .97. Load values (lv) regarding the factors obtained as a result of the tests were given in the table below upon determining the factor number (Table 4). After determining the load values regarding factors, the number of the factors was determined and the factor number in the scale was found as six. The results obtained regarding these six factors are given in the table below (Table 3).

Table 3.
Results Related to the Factors

Factor	Eigenvalues	Percent of variance	Percent of total variance
1	7.37	18.42	18.42
2	5.19	12.99	31.40
3	4.93	12.32	43.72
4	3.22	8.04	51.76
5	3.01	7.53	59.29
6	2.99	7.47	66.75

As it is seen in the table 3, the eigenvalue of these size factors are found as 7.37, 5.19, 4.93, 3.22, 3.01, and 2.99 respectively. These 6 factors explains % 67 of the total variance. The variance rate which is above the accepted % 41 (Kline, 1994) is thought to be enabling the scale to be used as a scale consisting of six factors. In order to enable the criteria validity of a scale, after leaving the ones having extreme ended points based on the scale points as lower and upper group, the difference between the averages of these two groups are tested for being significant. At the end of the tests, 40 items with .05 level significant different in its lower and upper group points, and whose distinctiveness indexes (rjx) between .24 and .58. Load values and distinctiveness indexes of the 45 items in behaviour scale are given in table below (Table 4).

Tablo 4.
Distribution Factors Substances Load Values and Indices Discrimination

Factor 1			Factor 2			Factor 3			Factor 4			Factor 5			Factor 6		
it.	lv.	rjx	it.	lv.	Rjx	it.	lv.	rjx	it.	lv.	rjx	it.	lv.	rjx	it.	lv.	rjx
1	.97	.57	5	.66	.34	3	.86	.36	2	.55	.25	6	.68	.24	7	.78	.27
11	.96	.56	14	.69	.34	4	.86	.38	9	.82	.27	15	.84	.33	8	.67	.35
17	.90	.50	20	.76	.56	13	.96	.33	10	.73	.28	18	.66	.29	27	.62	.28
26	.88	.50	24	.71	.57	16	.82	.43	12	.51	.26	34	.76	.40	28	.75	.29
30	.95	.56	31	.77	.58	21	.96	.33	19	.53	.24				29	.78	.35
33	.90	.50	32	.72	.35	23	.90	.29	22	.69	.28						
35	.93	.52	36	.69	.29				25	.79	.27						
39	.94	.54	37	.73	.38												
			38	.70	.43												
			40	.70	.35												

Later each of the items of in the scale was transferred to table of specifications in line with Bloom's Taxonomy and content validity of the test was found adequate. Lastly in order to enable the reliability of the scale internal consistency and related analyzes were carried out and the consistency coefficient of the scale was found as .85 Cronbach alpha value.

Semi-structured interview question: The data aimed at the qualitative aim of the study are collected with the semi-structured interview technique enabling precise and detailed definitions made with prospective teachers (Punch, 2005). An interview form was prepared by the researcher and during the interview the order in this form was followed. The data obtained as a result of the interviews, are recorded with a voice recorder upon the permission of the participants with the aim of converting into a written text in electronic environment. In the findings, prospective teachers are given a code name as the sentences of them will be transferred directly and without being changed.

Data collecting process

Before passing onto the real application, a pilot study was carried out in order to determine the usability of the educational activities to be used in the study and the applicability of the lesson plan. The results obtained as a result of the analysis of the data collected after pilot study are guiding for the real application. By determining the problems faced during pilot study, the necessary changes about lesson plans, the educational methods application steps, teaching process and activities in the teaching process were made. Firstly, ASTEP and BSTEP which validity and reliability studies were completed were applied as the pre test on both of the groups.

The real application was performed within the context of the environment science lesson which is given at the sixth academic term in the undergraduate program of the science teaching department. The subject of environmental problems which is in the content of the lesson was taken and separated into "the reasons of the environmental problems" (2 weeks), "global and domestic environmental problems" (2 weeks), "solving environmental problems" (3 weeks) and the application continued for 7 weeks. The environmental problems subjects were taught to experiment group in the PBL supported by POE method and the control group Traditional Teaching (TT) methods (simple lecturing, question-answer, discussion) supported by Multi Media (MM). At the end of the application, the scales which are applied as the pre test at the beginning of the research were applied to both of the groups as the post test. The experimental design regarding the application is given in the Table 5.

Table 5.
Experimental Design of the Application

Group	Pre test	Method	Post test
Experiment	ASTEP, BSTEP	PBL supported by POE	ASTEP, BSTEP
Control	ASTEP, BSTEP	TT supported by MM	ASTEP, BSTEP

The data regarding pre and posttest points belonging to two groups which are collected from the scales at the end of the real application are transferred to the tables by being analyzed by statistical analysis methods and the differences between the groups in terms of efficiency of the methods applied are examined.

Lastly interviews with 6 participants chosen from experiment group were made interviews and qualitative data regarding teaching method were collected.

Data analysis

Quantitative data was analyzed by using the Microsoft Excel 2007 spreadsheet program and SPSS 15 statistical analysis program. Investigate whether there is a normal distribution of quantitative data, descriptive statistical techniques (mode, median, arithmetic mean, standard deviation) were used. Central tendency (Mean, mode and median) and central distribution (standard deviation, variance, skewness and kurtosis) belong to scale scores have been reported. In addition, scores obtained from scales put into processing bottom, middle, top 33% in form of slices. Two-Factor ANOVA test for the mixed measurements was benefitted in the analysis of quantitative data and significance level was admitted as .05.

Content analysis of qualitative data analysis methods were selected for the analysis of qualitative data. Qualitative data obtained from the research was solved by following the steps that specified by Miles and Huberman (1994) and Yıldırım and Şimşek (2008). The interview results have been made in writing and documents were analyzed with HyperRESEARCH™ 2.6.1. qualitative analysis program.

Results

Results and conclusion related to quantitative data

In quantitative research both parametric and non-parametric statistical methods can be used to analysis of the data. Quantitative data obtained from all applied tests and scales during the research should reflect the normal distribution in order to use parametric analysis methods to analyze the data (Sim and Wright, 2002). For this reason, some analyzes were conducted to determination statistical method to be applied the data obtained from attitude scale and investigated whether scores show the normal distribution (Table 6).

Table 6.
Descriptive Data on Pre and Post Attitude Scale Scores

Test	Group	N	M	Sd	Medi.	Mode	Kurt.	Skew.	Var.
Pre	Experiment	40	45.42	6.07	45	43	-.84	.18	36.20
	Control	53	46.81	5.48	47	47	.40	-.08	30.12
Post	Experiment	40	69.27	5.91	69.5	71	.87	.31	34.92
	Control	53	59.08	6.69	60	60	.56	-.56	44.88

When we look into Table 6, both the average regarding pre test, mode and median values of the experiment group, and mode, average and median values about pre test points of control group is very close to each other. Then again the average regarding the post test, mode and median values of the experiment group and the average, mode and median values about the posttest points of control group is almost the same. The fact that average, mode and median values are very close to each other is interpreted as that the data have a normal distribution (Köklü, Büyüköztürk, and Çokluk Bökeoğlu, 2006). When the kurtosis and skewness values in the Table 6 are examined, it is seen that the values are between -2 and +2 interval and the data are distributed normally (George ve Mallery, 2003). Also for both of the groups as the sample magnitude $n > 30$, it is assumed that the data are distributed normally according to the central limit theorem (Gosling, 2004; Russell and Purcell, 2009).

In the analysis of the data which are decided to be having a normal distribution as a result of the descriptive statistics parametric tests were used. In the analysis regarding pre and post attitude scale of the experiment and control groups in order to determine the efficiency of the application, two factor ANOVA test (two way ANOVA for mixed measures) was used for mixed measures.

Table 7.
Attitude Scale Pre-Test and Post-Test Scores On the ANOVA Test Results

Source	KT	Sd	KO	F	p
Between subject	4433.161	92			
Group	885.301	1	885.301	22.707	.00
Error	3547.860	91	38.987		
Within subject	19521.095	93			
Measurement(Pre/Post)	14865.439	1	14865.439	432.785	.00
Group*Measurement	**1529.955**	**1**	**1529.955**	**44.542**	**.00**
Error	3125.701	91	34.348		
Total	23954.256	185			

Hypothesis 1 was tested. According to the data in the Table 7 it is seen that attitude point averages of the prospective teachers in experiment group where PBL supported by POE method is used and in control group where TT supported by MM method is applied showed a significant difference. In other words, the common effects of the repetitive measure factors and taking part in the experiment and control group on the attitude points of the students are found to be significant [$F_{(1, 91)} = 44.542$, $p < .05$]. The results of ANOVA test was rejected null hypothesis in favor of the alternative hypothesis.

Then it has been determined whether behaviour scale scores show the normal distribution. Some analysis were done for this reason to determination statistical method to be applied the data obtained from behaviour scale and investigated whether scores show the normal distribution (Table 8).

Table 8.
Descriptive Data on Pre and Post Behaviour Scale Score

Test	Group	N	M	Sd	Medi.	Mode	Kurt.	Skew.	Var.
Pre	Experiment	40	40.78	7.43	41	40	- .30	.18	55.31
	Control	53	43.28	5.57	45	45	. 01	- .38	31.09
Post	Experiment	40	63.13	4.80	63.5	65	2.0	- .37	23.09
	Control	53	43.70	5.53	44	45	.17	- .12	30.60

When we look into Table 8, both experiment and control groups' behaviour scale pre test average, median and mode scores are very close to each other. In addition the average regarding the post test, mode and median values of the experiment group and the average, mode and median values about the posttest points of control group is almost the same. The fact that average, mode and median values are very close to each other is interpreted as that the data have a normal distribution (Köklü, Büyüköztürk, and Çokluk Bökeoğlu, 2003). When the kurtosis and skewness values in the Table 8 are examined, it is seen that the values are between -2 and +2 interval and the data are distributed normally (George ve Mallery, 2003). Also for both of the groups as the sample magnitude $n > 30$, it is assumed that the data are distributed normally according to the central limit theorem (Gosling, 2004; Russell and Purcell, 2009).

In the analysis of the data which are decided to be having a normal distribution as a result of the descriptive statistics parametric tests were used. In the analysis regarding pre and post behaviour scale of the experiment and control groups in order to determine the efficiency of the application, two factor ANOVA test (two way ANOVA for mixed measures) was used for mixed measures.

Table 9.
Behaviour Scale Pre-Test and Post-Test Scores On the ANOVA Test Results

Source	KT	Sd	KO	F	p
Between subject	8123.904	92			
Group	3262.613	1	3262.613	60.699	.00
Error	4861.291	91	53.750		
Within subject	12764.876	93			
Measurement(Pre/Post)	5906.930	1	5906.930	391.220	.00
Group*Measurement	**5483.962**	**1**	**5483.962**	**363.207**	**.00**
Error	1373.984	91	15.099		
Total	20888.78	185			

Hypothesis 2 was tested. According to the data in the Table 9 it is seen that behaviour point averages of the prospective teachers in experiment group where PBL supported by POE method is used and in control group where TT supported by MM method is applied showed a significant difference. In other words, the common effects of the repetitive measure factors and taking part in the experiment and control group on the behaviour scale points of the students are found to be significant [$F_{(1, 91)} = 363.207$, $p < .05$]. The results of ANOVA test was rejected null hypothesis in favor of the alternative hypothesis.

Results and conclusion related to qualitative data

To collect qualitative data, an open-ended question is addressed to the prospective teachers for the teaching method used during application. The qualitative data collected is analyzed by using the codes and themes with the qualitative research methods and the findings related to the question are included below by directly quoting from the answers of the prospective teachers. To clarify the effectiveness of the method in the environmental education, the question "Has the method used in the lesson affected your attitudes and behaviours towards the environmental problems?" is addressed to the prospective teachers. The prospective teachers are asked to answer this question by making explanations.

When the answers given to this question are examined, it is seen that almost all of the prospective teachers explain with the quite striking expressions that their attitudes towards the environmental problems and behaviours aimed at preventing-eliminating these questions. The opinion of each prospective teacher is included respectively with the direct quotations.

Kaan; *"…teacher, I was affected for days by that video, you know, related to the story/narration of a child suffering from hunger. I said 'Good heavens!' and I actually realized the environmental pollution at that time. Girls even cried. And after, it was mentioned too much. Therefore, we try to be more careful of the environment, as class. We decided to do so. For example, we do not throw the bottles of water we drink to around, namely our wastes become our garbages, for example, we think once more while throwing them to the litterbins. Then, we think of holding them for quite a while and of throwing them into litterbin when we see a litterbin. We even search for a suitable litterbin for suitable garbage/waste. Beforehand, this did not come to my mind. For instance, I threw the caps of the bottles around, paid no attention to those small litter/garbage. I also threw the wastes like that. Let me tell these. However, i do not do so now. I hold them in my hand or put them into my pocket until I see a litterbin. In addition, there is a broken tap in the house which annoys me, it was pouring/spilling continually. I feel sorry for the water leakage from now on. I want to repair it as soon as possible. Yes, it raised awareness. I started to feel uncomfortable with the water flowing vainly, not with the sound of it. For example, too much water flew vainly from that broken tap and I feel upset for that. Beforehand, the situation was not like that, I only repaired it to prevent it from making noise. However, it is not so now. I feel sorry for the water flowing vainly from my point of view"* (2540.3783, 03.06.2011).

Nil; *"I am more careful of the products I use; I read the writings on them. I, myself do that. Because I know what is harmful to the environment anymore. I learned what these harms cause and what kind of problems occur as a result of those harms. For example, I try to prevent myself from buying deodorant while doing so, or*

from polluting the environment… Concerning the litter, I pay more attention to the wastes. I try to throw the garbage/litter into the containers by distinguishing them. I am careful of the recycling, which I did not know even its definition beforehand. I hope that the projects which we produce for these are carried out and really contribute to the solutions of the problems" (2935.3620, 03.06.2011).

Ada; *"…As I see incidents at POE, watch the visuals, videos and true stories, I learned the environmental problems entirely. I also got upset. I learned that it is important to be more careful and learned the water pollution, light pollution and the severity and importance of those. For example, I heard the light pollution previously but I did not realize the pollution around me previously. But people exaggerated this too much when I look at the condition now, I can say that this condition has turned into the light pollution anymore. My point of view has certainly changed. This also affected especially my behavior. For example, I stay in the dormitory. Too much paper goes to waste in the study rooms. There are blue recycle bins on some floors which I did not know previously but I express their color now. I started to throw the papers thrown in these study rooms into the blue recycle bins on those floors. I also started to throw the papers which I have used into those bins. Indeed, I realize that the papers are there and I get upset that they stay there anymore. Moreover, I realized a thing in the market. I did not look at the recyclable capacity of it previously when I bought a plastic product, but I behave sensitively for that now. And producers start to add recycling feature to the mobile phones; even, I can prefer to buy those technological products."* (3640.4993, 03.06.2011).

Alp; *"…I certainly learned the problems anymore. What we watched were very saddening. I thought and asked 'How can I prevent?' to myself. In other words, it is influential. This changed even my point of view of people. For example, I realized the global warming. Previously, we threw out napkins, chewing gums. For example, chewing gum… it takes long years that the chewing gum vanishes in the nature, even it does not vanish into the soil. I say that I am an environmentalist from now on, I cannot throw this. Previously, I paid attention to that but lately I have thrown by saying 'Never mind'. However, I said that it clashes with the environmentalist and I hold it until I find a litterbin."* (2448.3049, 03.06.2011).

Hakan; *"…everything occurring around us, all of our interventions have dimensions for the environment. When you display this with a visual material, I think, you adapt to this method and understand everything. Especially, the visual materials used in the lessons are the things which actually teach the environmental pollution and shows that it is in our power. Thus, we try not to exhibit unfavorable, negative behaviour against the environment. For example, we try not to waste, and to prevent the water pollution. Because we know that these will also affect our future and our children. Thus, we become more careful."* (2817.3452, 03.06.2011).

Naz; *"…we were very upset. Especially, the videos... When we watched them and learned the environmental problems, we said 'Who are we?' We said 'How have we taken all the things under our sovereignty, as if there were no living creatures except us in the world?'. I can say that I woke up at that time. For example, those papers were only under my eyes previously and I ignored them… However, you can become more careful when you learn that those papers have recycling and you consider that we can use them again."* (2788.3239, 03.06.2011).

The answers taken from the prospective teachers are encoded in the form of acquisitions for the affective and psychomotor skills by the researcher and the codes and themes indicating these acquisitions and the percentage-frequency table related to the distribution of the answers which the prospective teachers give for the question to the codes and themes are given below (Table 10).

Table 10.
Percent-Frequency Distributions of Theme And Codes

Question	Theme	Code	%	f
Effect of the PBL supported by POE on different variables	Attitude	Feelings and thoughts towards environmental problems has changed	83,3	5
		Viewpoint towards environmental problems has changed	83,3	5
	Behaviour	Behaviour towards the environment has changed	66,6	4
		Pay attention to recycling	66,6	4
		Try to prevent environmental problems	50	3

When the findings related to the distribution of the opinions obtained from the answers which the prospective teachers give for the question to the codes and themes are examined, it is seen that the prospective teachers state that their attitudes and behaviours towards the environmental problems develop positively.

Conclusion and Discussion

In the study, firstly the effect of the PBL supported by POE method on the attitude towards the environmental problems is examined. The findings reveal that there is a significant difference between the attitude scale point averages in favor of experimental group [$F_{(1, 91)} = 44.542$, $p < .05$]. This significant difference which is on the level .05 between the averages shows that the attitude point averages of the students of experimental group are more than the students of the control group. Actually, the results of attitude scale reveal that there are increases in the attitude levels of both experimental and control groups. However, the increase in the attitude levels is more in the experimental group.

When the relevant literature review is made in terms of the results of the study, no other study in which both methods are used together is found and there is not any study which shows the effect of POE method of the attitude concerning the environmental problems. The researches carried out in the different subjects and disciplines concerning the different method reveal the result that the POE method becomes effective on the attitudes of the students (Köseoğlu, Tümay, and Kavak, 2002; Chew, 2008; Bilen, 2009; Özyılmaz Akamca, and Hamurcu, 2009). Together with, there are some studies in which the effect of the PBL method which constitutes a part of the method used in the research on the attitudes towards the environment and environmental problems is examined. The results of these researches and this study show similarity in revealing the positive effect of the method on the attitude. In the study carried out by Borhan and Ismail (2011), the effect of the project based learning method on the attitudes and behaviours of students towards environmental problems is investigated and it is found that the method develops the attitudes towards the environmental problems. In the thesis study carried out by Benzer (2010), the project based learning approach also changes the attitudes towards the environment positively. As a result of the study of Schusler and Krasny (2008), it is determined that the attitudes of the students participating in the Project study towards the environment increase more than the students not participating in. In the thesis study carried out by Yavuz (2006), it is revealed that the attitudes of the students towards the environment develop with the project based learning method. Similarly, in the thesis study, Lomigo (2002) aims to reveal the effect of the project based learning method on the knowledge, attitudes and behaviours of the students related to the environmental projects. In this research, Lomigo separates the students who participate in and who do not participate in the Project studies into two groups and analyzes the difference between the knowledge, attitudes and behaviours of the students towards the environment. The results of the study reveal that there are very big differences between the attitudes and behaviours of the students who participate in and do not participate in the research towards the environment in favor of the students who participate in. Shacter and Edgerly (1999) carry out the project studies in which they utilize the environmental resources in the campus environment for the students not in the faculty of

sciences. The results of the survey directed to the students at the end of study show that there is a positive increase in the attitudes of students which are measured at the beginning of study depending on the research process and projects.

The findings obtained from the analyses conducted in order to determine if the behaviour point averages of the prospective teachers involved in the experimental and control group differ or not from beginning to end. When the findings in Table 9 are examined, there is significant difference between the point averages of experimental group for whom PBL supported by POE method is applied and the point averages of control group for which TT supported by MM methods is applied [$F_{(1, 91)} = 363.207$, $p < .05$]. From beginning of the application to end of it, a significant increase is determined in the point average of the experimental group while the point average of the control group does not show a significant increase and it is concluded that the TT supported by MM methods have a slight effect on the behaviour.

When the literature review is made, no other study in which the effect of POE method both on the behaviours towards the environment and environmental problems and on the behaviours related to the different matters is investigated is encountered. However, there are limited number of studies which aim at determining the effect of the PBL method on the behaviours towards the environment and environmental problems. The results of these studies and the results of the research concerning the behaviour bear resemblance to each other (Borhan and Ismail, 2011; Benzer, 2010; Yavuz, 2006; Lomigo, 2002). For example, in the study carried out by Erten (2006) on 1000 university students, the effects of the many creative projects which have been carried out in the lessons of environmental education or environmental consciousness all the year round and are aimed at developing environment-friendly behaviours on the environmental knowledge, attitudes towards the environment and environment-friendly behaviours of the prospective teachers. At the end of term, whether the studies have turned into the behaviour is tested by personally observing the behaviours of students and conversion-into-behaviour ratio of the knowledge learned in the studies is found. Furthermore, Howe and Disinger (1988) state that the project studies to which active participation is ensured are very important to change the behaviours and responsibility towards environment positively.

Another objective of this research is to reveal the opinions concerning the teaching method of the students of experimental group who receive education with PBL supported by POE method. With this objective, the question "Has the method used in the lesson affected your attitudes and behaviours towards the environmental problems?" is addressed to the prospective teachers. As an answer to question addressed to them, almost all of prospective teachers explain that their attitudes towards environmental problems and behaviours aimed at preventing, eliminating those problems change positively after the application. The results of quantitative data show that prospective teachers have made progress in the relevant acquisitions concerning environmental problems. The opinions in which the prospective teachers state that their attitudes and behaviours towards environmental problems develop both support the quantitative results of research and bear resemblance with the results of research in the relevant literature (Bouillion and Gomez, 2001; Morgil, Yılmaz, and Cingör, 2002; Morgil, Oskay, and Yavuz, 2004; Erten, 2006; Yavuz, 2006; Benzer, 2010; Keleş, Uzun ve Varnacı Uzun, 2010).

The positive attitudes and behaviours of the individuals towards environment, the environmentalist activities and the measures taken in order to prevent the environmental problems are highly important to solve the problems which threaten the whole world today and to prevent the occurrence of new problems. When the results of research are taken into account, it is seen that the attitudes and behaviours of prospective teachers towards the environmental problems have changed with the PBL supported by POE method used in the study. Thus, it is considered that it is necessary in the environmental education given to individuals to develop the appropriate educational environments which pay attention to the learning features and to use the student-centered teaching methods including daily life applications.

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