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Analysis of Science Teacher Candidates’ Environmental Knowledge, Environmental Behavior and Self-Efficacy through a Project called “Environment and Energy with Professional Science Education”

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Abstract

Environmental education can be defined as raising environmental consciousness among every segment of society, bringing for the awareness to environment-friendly, permanent and positive behavioral change. Individuals who are environment-friendly, aware of the environmental problems and seeking solutions when needed can be educated by the teachers who have sufficient knowledge and experience and know the importance of environmental education. In line with this purpose, then a true project titled as ‘Environment and Energy with Pro-Fe(Science)ssional Education’ has been put into action. As stated in the feedback of the participants, it has been of the opinion that this project is remarkable and useful in regards with supporting applied training and practice. In this context the purpose of this study is to identify the effect and permanence of the TUBITAK (Scientific and Technological Research Council of Turkey) project titled as ‘Environment and Energy with Pro-Fe(Science)ssional Education’ on environmental knowledge, environmental behavior and self-efficacy beliefs of environmental education. The study based on quantitative research was carried out in accordance with pre-test, post-test and retention test design. Participants of this study consist of 37 teacher candidates selected through purposeful sampling among 286 students, who applied to the project held between the dates 17th - 23rd June, 2014. As data collection tools, “Environmental Knowledge Test” developed by Köşoğlu (2009), reliability co-efficient of which is calculated as (α) 0.64 and “Environmental Behavior Scale” with (α) 0.79, and “Self-Efficacy Beliefs Through Environmental Education Scale” developed by Özdemir (2009) with 0.76 were used. SPSS programme was used to analyze the data and One-way ANOVA for independent variable was applied to demonstrate the differences between the means cores. LSD was used for multiple comparison test. Data analyses reveal that there is a significant difference in favor of post-test and retention test as a result of pre-test, post-test and retention test analyses of the Environmental Knowledge Test, Environmental Behavior Scale and Self-Efficacy Beliefs Through Environmental Education Scale. In the other words, it has been observed that with the environmental education project, statistically significant increase was found in the participants’ environmental knowledge scores, environmental self-efficacy beliefs scores and environmental behavior scores. This case asserts

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that activities carried out and applied training are effective and permanent. It is expected that teacher candidates will use this experience in their professional and future life.

Keywords: Pro-Fe(Science)ssional Education, Environmental Education, Environmental Behavior and Self-Efficacy.

1. Introduction

The simplest definition of the environment can be defined as the external environment where all living creatures lived and maintained their relationships in the lifelong (Çepel, 1992: 38; Erturk, 1994: 6; Ministry of Environment, 1998: 1).

Environmental problems which began to threaten humanity and the planet, especially in the latter half of the 20th century makes you feel better the feeling have emerged new perspectives on human-nature relationship and interpretations. In particular, environmental problems, and these problems’ threatening the rate of interest to our lives the concept of environment has increased. Environmental problems which being able to pull up to the start of the industrial revolution, today they are the most widely spoken in any area and has become one of the popular topics (Parlak, 2004).

The starting point for finding solutions to environmental problems, begins with to accept and to create awareness for environmental problems of individuals. To this awareness in individuals knowledge, values and to develop positive attitudes towards the environment should be added. Education, as it is in every respect also for the environment is the first at the point of awareness, consciousness and should be consulted in the development of a positive attitude. The person who does not receive the necessary training and not to have awareness about the environment surrounding the future of society is not to be expected to act with a sense of safety.

Environmental Education, by increasing environmental awareness of the individual and society to behave sensitive to the environment as well as providing after environmental problems occur, then people's individual or as an organization, decision-making process to participate by providing the solution of environmental problems, they will contribute to the solutions of these problems. In this framework the main goal of environmental education is to bring awareness to the community of a new human type, morality and consumption consciousness is to train human model as consuming as needed, feeling of responsibility toward future generations, sensitive to environmental issues in conscious.

By these researches, environmental education and nature-based experience in various aspects of the application are set to be effective and with the educational experiences in nature passed a strong relationship between children's perceptions of the environment is emphasized in particular. In this context, Kals and his friends, (1999) has determined that positive impact the nature of environmental education experience carried out mainly for students' emotional closeness to nature, interests and behavior. Bogner (1998) and Bögeholz (2002), has shown that a positive impact of the non-school environmental education program to increase students' environmental knowledge and actions towards the environment.

Demirsoy, emphasizes the importance of field studies by words "TUBITAK project participants to nature education, when they look at the bottom of a flower by bending they begin to understand the mechanics of nature. Even to save a person like that is very important. In this way, the first time in Turkey, a real sense, what is nature conservation, how to be a scientist and natural philosophy, is being taught by practicing in the field." (Yanık, 2006).

The purpose of nature education passes from forming in reaching ways of to be successful individuals who make up society favorable attitudes, behaviors, thoughts, and consciousness. Several studies on the subject in the literature were found (Ürey & Yeşiltaş, 2009; Aslan, Sağır &Cansaran, 2008; Erol & Gezer, 2006).

For a quality environmental education, teachers who are role models in all levels of education as well as training generations by using teaching methods and the techniques should be required to increase their knowledge and awareness of our individual priorities. While teaching stay in life to transfer personal experience and to share acquired knowledge from the field studies and activities the fun as well and is very important for both teachers and students.
In this context, the basic purpose of this project titled as 'Environment and Energy with Pro-Fe(Science)ssional Education, supported by TUBITAK Nature Education and Science Schools Programme is to investigate the effects on teachers, improving environmentally conscious creation, and as a professional 'renewable energy and environment unit' has been described with positive contributions that would be considered studies, teacher candidates' environmental knowledge, environmental behavior and attitudes of renewable energy. In this context the problems below are investigated:

Is there a significant difference between scores of teacher candidates' environmental knowledge pretest, posttest, and retention test?
Is there a significant difference between scores of teacher candidates' environmental behavior, pretest, posttest, and retention test?
Is there a significant difference between scores of teacher candidates' environmental self-sufficient pretest, posttest, and retention test.

2. Method

2.1. Working model

In this research, quantitative methods are used. In Quantitative research methods experimental methods are used. In scientific researches Empirical research methods are the most accurate results which are obtained. In this study, pre-test-post-test control ungrouped model is used. This pattern experimental procedure effect only on a group study performed is being tested and the subjects' dependent variables related measurements prior to the application pretest and a posttest after by using tools the same subjects and the same measurement are obtained (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz ve Demirel, 2008).

2.2. Study group

The study group constitute students who participate the project education, which was held between 17-23 June 2014 Akdeniz University, Afyon Kocatepe University, Pamukkale University and Suleyman Demirel universities participating in Science undergraduate students purposive sample selected by 37 students environment and energy' project entitled. Participants, 31 (83.8%) were female and 6 (16.2%) were male.

After making the project is found eligible studying at universities in the mentioned provinces in Science Teaching undergraduate students were invited to the project prepared via the project website describing the project with a detailed brochure. The teacher candidates through the project web page of 286 students who apply using the application form appropriate to the 37 student projects were selected. As the evaluation criteria, being not to participate in the Project before, to be sensitive to the environmental issues, loving teaching profession, to be open to active-practical training, when they get knowledge and experience from this project teachers should be transferring to their school students, to enhance their awareness of the importance of being aware of conditions. Then we have completed our ideas with Science teachers who we make reference to the relevant university students in.

3. Data Collection Tools

At the end of the applied Project for measuring teacher candidates' change in environmental information Kişoğlu (2009) developed by the 'environmental knowledge scale' in order to measure environmental behavior change again Kişoğlu (2009) developed by the 'environmental behavior scale' and in order to measure change of environmental education self-efficacy Özdemir (2009) developed by the 'Environmental Education Self-efficacy' scale is used. Scales was administered again to the teacher candidates on the first day of the project, and the last day of the Project and after the Project has been completed 1 month.
3.1. Environmental behavior scale

To measure students' behavior scale of the environmental behavior was used by Kışoğlu (2009) and developed by the reliability coefficient (α) of 0.79. The components of the Environmental literacy scale, in order to define teachers' environmentally sensitive behavior which often they do the triple Likert type (1 = never, 2 = sometimes, 3 = always) and 20 Total behavior sentences are available. The scale of the statements were made out of 2 points scoring. Scoring scales are made "always" two points, "occasional" 1 point and "never" in the form of 0 points.

3.2. Sub Dimension Environmental Information And Knowledge Test

Sub-dimensions of environmental information and knowledge test has been developed by Kışoğlu (2009). Knowledge test reliability coefficient (α) was calculated as 0.64. In this sub-dimensions of environmental literacy scale, in order to measure the level of prospective teachers' knowledge about the environment and environmental issues prepared, there are 20 multiple choice questions. Test substances are four choices. The answer for each question is given 1 point for correct answers. Wrong answers were evaluated as 0 points.

3.3. Perceived Self-Efficacy Scale Environmental Education

In this study, "Environmental Education Self-Efficacy Scale" is used which is developed by Ozdemir Vd. Scale reliability coefficient is 0.76 of total variance %61.80 illustrate. Scale has four sub-dimensions ("Perception of Academic Competence", "Responsibility Perception", "Tutorial Competency Perception" and to direct perception"). Environmental education of prospective teachers' self-efficacy scale was developed to measure consisted of 15 questions, %'s, Likert-type. Maximum of 75 points from the scale, the lowest 15 scores are taken.

4. Data analysis

At the analysis part the tests which are applied to applied teachers the 'environmental knowledge scale', 'environmental behavior scale' and 'Environmental Education Self-efficacy' scale taken from the pretest-posttest and retention test scores show a statistically significant difference whether analyzed. In the analysis of single-factor ANOVA for related samples was used. LSD analysis was used to compare groups that the difference between the mean scores.

5. Findings

5.1. Teacher candidates' environmental knowledge pretest, posttest and retention test scores to evaluate

| Variables       | N  | X     | Ss  |
|-----------------|----|-------|-----|
| Pretest         | 37 | 11.70 | 2.197|
| Posttest        | 37 | 13.78 | 2.110|
| Retention Test  | 37 | 13.70 | 2.106|

Analyzing Table 1, depending on the nature education programs, participants' environmental knowledge pretest scores $X = 11.70$, posttest and retention test mean score of 13.78 points $X = X = 13.70$ is calculated as an average.
Analyzing Table 2, environmental knowledge pretest, posttest and retention test results of the analysis in the difference between the mean scores were statistically significant (F (2-108) = 11.247, p < .01).

As a result of the analysis, which is a significant test of the mean analysis was conducted to find difference between the phenomenon of LSD multiple comparison.

Analyzing Table 3, teachers candidates at the end of the nature of education result of the pretest, posttest and retention test scores in which it is conducted to demonstrate the difference between the groups LSD multiple comparison test results, the posttest with the permanence test and pretest statistically significant difference was found. These differences were in favor of the posttest and retention test. In other words, teacher participants with applied to the nature education project has been a significant increase in knowledge scores.

5.2. Teacher candidates' environmental behavior pretest, posttest and retention test scores to evaluate

Table 4 examined the nature education programs, depending on the environmental behavior of the participants pretest scores X = 41.51, posttest mean score of X=49.57 the retention test scores X = 48,32 are calculated.
Analysis of the mean significant difference in the results of tests to find out what LSD multiple comparison analysis was performed.

**Table 6. LSD analysis results related to the phase behavior of O points**

| (I)Grups | (J)Grups | Mean Difference(i-j) | SH   | p    |
|----------|----------|-----------------------|------|------|
| Pretest  | Posttest | -8,054*               | 1,379| .000 |
| Retention Test | Posttest | -6,811*               | 1,379| .000 |
| Posttest | Pretest  | 8,054*                | 1,379| .000 |
| Retention Test | Posttest | 1,243                 | 1,379| .369 |
| Retention Test | Pretest  | 6,811*                | 1,379| .000 |
| Retention Test | Posttest | -1,243                | 1,379| .369 |

* Significant at difference 05

Analyzing Table 6, teachers the nature of education as a result of environmental behavior pretest, posttest and retention test scores the difference between the groups in which it is conducted to demonstrate the LSD multiple comparison test results, the posttest with the permanence test and pretest statistically significant difference was found. These differences were in favor of the posttest and retention test. In other words, teachers applied to the environmental behavior of respondents with nature education project has been a significant increase in scores.

5.3. Teacher candidates' environmental self-efficacy pretest, posttest and retention test scores to evaluate

**Table 7. Participants' environmental behavior of the pretest, posttest and retention test scores, relating to descriptive statistics**

| Variables       | N  | X     | SS  |
|-----------------|----|-------|-----|
| Pretest         | 37 | 46.70 | 4,054|
| Posttest        | 37 | 54.86 | 6,347|
| Retention Test  | 37 | 53.70 | 7,306|

Analyzing Table 7, depending on the nature education programs, participants' self-efficacy pretest scores around X = 46.70, posttest mean score of X = 54.86 retention test mean score was calculated as X = 53.70.

**Table 8. Participants’ environmental self-efficacy pretest, posttest and retention test scores and ANOVA results**

| Variables       | Sum of Squares | Sd  | F   | p    |
|-----------------|----------------|-----|-----|------|
| Within Groups   | 1442,649       | 2   | 19,654| .000 |
| Between Groups  | 5963,784       | 108 |      |      |
| Total           | 5406,432       | 110 |      |      |

When analysing table 8 the environmental self-efficacy pretest, posttest and retention test results of the analysis in the difference between the mean scores were statistically significant (F (2-108) = 19.654, p < .01).

Analysis of the mean in the results of tests to find out what significant difference LSD multiple comparison analysis was performed.

**Table 9. Phase analysis results of LSD on behavior scores**

| (I)Grups | (J)Grups | Mean Difference(i-j) | SH   | p    |
|----------|----------|-----------------------|------|------|
| Pretest  | Posttest | -8,162*               | 1,409| .000 |
| Retention Test | Posttest | -7,000*               | 1,409| .000 |
| Posttest | Pretest  | 8,162*                | 1,409| .000 |
| Retention Test | Posttest | 1,162                 | 1,409| .411 |
| Retention Test | Pretest  | 7,000*                | 1,409| .000 |
| Retention Test | Posttest | -1,162                | 1,409| .411 |

* Significant at difference 05
Analyzing Table 9 teacher candidates’ the nature of the education environment as a result of self-efficacy pretest, posttest and retention test scores the difference between the groups in which it is conducted to demonstrate the LSD multiple comparison test results, the posttest with the permanence test and pretest statistically significant difference was found. These differences were in favor of the posttest and retention test. In other words, nature education teachers applied to the project participants with the environment has been a significant increase in self-efficacy scores.

6. Results, Discussion and Recommendations

Supported by TUBITAK titled as ‘Environment and Energy with Pro-Fe(Science)ssional Education’ project teachers’ environmental knowledge, environmental behavior and environmental education self-efficacy levels on the effectiveness and permanence of investigating the scope of this project, the following conclusions were reached.

Candidates' environmental knowledge and posttest scores showed an increase compared to the pretest scores, retention scores compared to the posttest scores showed very little can be said that a decline. According to the results of LSD environmental information, with the permanence test and pretest and posttest differences were statistically significant. This difference was found in posttest scores and permanence refers to the numerical increase. Teacher candidates' environmental behavior pretest scores, posttest and retention test scores compared with pretest scores and posttest scores showed a significant increase compared to the retention test scores declined slightly compared to the test scores. According to the results of the LSD analysis of environmental behavior scores and permanence test and pretest and pretest differences were statistically significant. In other words, applied to teachers with nature education project participants has been a significant increase in environmental behavior scores.

In the evaluation in terms of environmental self-efficacy, posttest and retention test scores was higher compared to the pretest scores. According to the results of the LSD analysis of environmental self-efficacy and permanence test and pretest and posttest differences were statistically significant. This difference was found in posttest scores and permanence refers to the numerical increase. Teacher candidates' environmental behavior pretest scores, posttest and retention test scores compared with pretest scores and posttest scores showed a significant increase compared to the retention test scores declined slightly compared to the test scores. According to the results of the LSD analysis of environmental behavior scores and permanence test and pretest and pretest differences were statistically significant. In other words, applied to teachers with nature education project participants has been a significant increase in environmental behavior scores.

Accordingly, if applied to science teachers participating in this project, the environment can be concluded that increasing self-sufficiency. Environmental information, environmental behavior and environmental issues in terms of self-efficacy when administered LSD multiple comparison test results, according to the pretest, posttest, and differences detected between permanence test, post-test and retention test were in favor. As a result, environmental information, environmental behavior and environmental issues in terms of self-efficacy when administered to all participants according to the results of the pretest, posttest and retention test results, it was found that statistically significant.

An overall evaluation of the results obtained, conducted an 8-day outdoor education and environmental awareness programs to the participants as well as environmental attitudes can be said to contribute significantly. In addition, the individual scores evaluating the environmental behavior and thoughts of the participants rated the environmental considerations while not detect significant differences in the students' positive attitudes towards the environment has increased and is determined to ensure permanence. These results of the project in question, the environmental awareness of individuals, extremely effective in promoting positive attitudes and behaviors indicate that. Environmental considerations applied to the scores of the participants of the program to positively impact the education of individuals prior to participating in the program have positive thoughts on the subject can be interpreted as the result of being.

Results support our work. See also, Palmberg and Kuru (2000), different environmental education programs applied (field trips, hiking, camping and adventure activities) as a result of nature experiences in the students' self-confidence has developed, especially the future outside of school to participate in activities more willing condition, which brought nature strong and empathic relationships as having more social behavior and moral judgments are demonstrating observes.

Research carried out under the active learning methods and techniques used in the activities to be included, teachers develop their knowledge and behavior towards the environment significantly affects the observed.

Based on the study results of such projects implemented with the support of TUBITAK in Turkey is likely to make significant contributions to environmental education. Science for graduate students conducting research on environment and gains knowledge gained in this way, especially to future generations and be passed on to a very
wide audience is very important. Therefore, the target audience is teachers and supporting the dissemination of similar projects is recommended.

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