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ANALYSIS OF SCIENCE TEACHER CANDIDATES' ATTITUDES, BEHAVIOR AND SELF-EFFICACY TOWARDS RENEWABLE ENERGY AND ENVIRONMENT

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ABSTRACT: In this study, it is aimed to analyze attitudes, behavior and self-efficacy levels of science teacher candidates towards renewable energy and environment. The study is conducted over three research questions. These are, "Is there a significant difference among pre-test, post-test and retention-test scores of science teacher candidates regarding environmental behavior and environmental self-efficacy?" Participants of this study consist of 37 science teacher candidates, who applied to the project titled as 'Environment and Energy with Pro-Fe(Science)ssional Education' held between the dates 17th-23rd June, 2014. Pre-test, post-test and retention-test of renewable energy, environmental behavior and environmental self-efficacy are used to determine changes in attitudes, behaviour and self-efficacy of Science teacher candidates towards these variables. The scales used as data collection tools are respectively, "Environmental Behavior", "Renewable Energy Attitude" and "Self-Efficacy Beliefs through Environmental Education". In the light of findings obtained from data, post-test scores are found to be higher than pre-test scores and retention-test scores are observed to be lower compared to post-tests. According to analysis of variance and Bonferroni multiple comparison test, statistically significant difference is found between post test - retention test and pre-test scores. When the obtained results are considered, it is concluded that 8-day-nature education makes a major contribution to the participants' attitudes towards renewable energy, environmental behaviour and environmental self-efficacy.

Key words: Science education, environment, renewable energy, attitude, behavior, self-efficacy.

INTRODUCTION

Nowadays, renewable energy and environmental issues are one of the very popular subject. With the developing technology, the increasing of environment pollution and consequently the protecting of environment is very important. The gaining and giving the environmental consciousness and awareness, which ensured to be sustainable, are necessary for they can have a healthy life of future generations. The traditional energy kinds (such as fossil fuels) provide the greatest contribution to environmental pollution. The transfering to individuals the need using renewable energy to a healthy environment and it is extremely important to ensure their awareness in this regard. The studies are being conducted on the raising the teacher candidates' awareness, especially in science education, related to renewable energy and environmental issues and the investigating of their attitudes, behaviors and self-sufficiency (Önder and Kocaeren, 2015). The reason for preferred of teacher candidates in scientific studies is to reach a common and widespread community by the transferring their knowledge to their students in the future. Accordingly, in an article published by Önder and Kocaeren in 2015 year (Önder and Kocaeren, 2015) a study is included on environmental information, behavior and self-sufficiency of teacher candidates. In this study, the obtained data by applying "Environmental Education Self-efficacy Test", "Environmental Knowledge Test" and "Environmental Behavior Test" to the science teacher candidates consisted of 37 people were analyzed. According to the analysis results, between applied pretest and posttest scores it was found that there are significant differences.

In 2015, published by Önder and Kocaeren in another study to create awareness of renewable energy to 37 participants tests such as environmental behavior test, environmental perception test, renewable energy attitude test were applied. When the obtained results are evaluated it can be said that there are significant differences between the applied pretest and posttest scales ana these studies increase the level of knowledge of teacher candidates dramatically positive. The presented this study to literature was prepared via the project titled as

"Environment and Energy with Pro-Fe(Science)ssional Education" supported by TUBITAK (Önder and Kocaeren, 2015). It is aimed to investigate the differences between the applied pretest, posttest and permanence test scores on renewable energy, attitude, environmental behavior and self-efficacy issues to science teacher candidates consisting 37 people. In scope of work, these scales were used in order to specify changes in teacher candidates' attitude, behavior and self- efficacy on the environment and renewable energy the scales such as "Environmental Behavior Scale", "Renewable Energy Attitude Scale" and "Environmental Education Self-Efficacy Scale". The presented in this article, which the above-mentioned and as a continuation of studies performed by our group, the questions which diverting us to do this research are given below.

1.   Is there a significant difference between renewable energy attitude pretest, posttest and permanence test scores of science teacher candidates?
2.   Is there a significant difference between environmental behavior pretest, posttest and permanence test scores of science teacher candidates?
3.   Is there a significant difference between environmental education self-efficacy pretest, posttest and permanence test scores of science teacher candidates?

METHOD

2.1. Working Model

This study was performed as a weak experimental design. The research based on poor experimental design is the study without a control group.

2.2. Working Group

The working group forms 37 science undergraduate students participating from Akdeniz University in Antalya, Afyon Kocatepe University, Denizli Pamukkale University and Suleyman Demirel University in Isparta to the project entitled "Environment and Energy with Pro-Fe(Science)ssional Education" held between the dates 17 to 24 June 20014. 31 participants (83.8%) were female and 6 (16.2%) were male.

2.3. Data Collection Tools

In the project study performed under science and nature education schools the program and supported by TUBITAK, "Environmental Behavior Scale" developed by Kışoğlu (2009), "Renewable Energy Attitude Scale" prepared by Yücel and Morgil (1998) and "Environmental Education Self-Efficacy Scale" developed by Özdemir *et al.* (2009) were used as data collection tools. Scales were implemented at the beginning of the project, at the end of the project and as a retention test after 1 month from the end of the project.

2.3.1. Environmental Behavior Scale

In this study to measure students' environmental behavior, environmental behavior scale was used that its reliability coefficient (α) is calculated as 0.79 and developed by Kışoğlu (2009). This component of environmental literacy scale is prepared in triple Likert type (1 = never, 2 = sometimes, 3 = always) to determine what they do as often environmentally sensitive behaviors of the teacher candidates and it involves 20 behavior sentences. The scoring of expression in the scale was built as 2 points. The scoring in the scale, "Always" 3 points, "Sometimes" 2 points and "Never" is made as 1 point. Accordingly, the lowest and the highest scores on the scale can be taken as 20 and 60, respectively.

2.3.2. Renewable Energy Attitude Scale

In this study, "Renewable Energy Scale" consisting 39 Likert-type questions and prepared by Morgil and *et al.* (2006) in order to determine the attitudes of the teacher candidates related to renewable energy, which was administered to all participants. This scale "I completely agree", "I agree", "I am undecided", "I disagree", and "I never disagree", and 5-point Likert-typed 39 of gradation expression is formed. Accordingly, a teacher candiate can take 195 point as the highest score from the survey and also, 39 point as the lowest score. The reliability of the measurement tool was calculated (Cronbach-alpha) and the reliability coefficient of the test was found to be 0.85.

2.3.3. Environmental Self-Efficacy Scale

"Environmental Education Self-Efficacy Scale" is used in order to determine teacher candidates' the environmental self-sufficiency, and this scale was developed by Özdemir and et al. (2009) in this study. The reliability coefficient of this scale is 0.76 and also it explains 61.80% of the total variance. Additionally, this scale is four sub-dimensional (These are "Academic Competence Perception", "Responsibility Perception",

"Tutorial Competence Perception" and "Referring ability Perception"). This scale developed to measure environmental education self-sufficiency of participants consists of 15 questions and it is a Likert-typed with percentage (%). Resultantly, a teacher candiate can take 75 point as the highest score from the survey and also, 15 point as the lowest score.

2.3.4. Data Analysis

SPSS 21.0 software was used to analyze the data and for evaluation of the obtained results after applying of the scales. Before analysis, loss and extreme values were determined. According to the sub-problem situations, it has investigated whether there is a significant difference between single factored ANOVA and pretest, posttest and the retention test scores in the repeated measurements. If there are significant differences, Bonferroni multiple comparison test was conducted to determine these differences. A commonly used multiple comparison test that Bonferroni method depends on student t-statistic, and "equal sample number" principle does not require (Miller, 1969). Descriptive statistics were accommodated in the findings.

RESULTS and DISCUSSION

3.1. Evaluation of Teacher Candidates' Renewable Energy Attitude Pretest, Posttest and Retention Test Scores

As seen in Table 1, teacher candidates' renewable energy attitude pretest, posttest and retention test scores ($\overline{X}$) are found as 114,16; 123,58 and 123,50, respectively.

Table 1. Descriptive statistics related to teacher candidates' renewable energy attitude pretest, posttest and retention test scores.

Variables	N	$\overline{X}$	SS
Pretest	37	114,16	12,582
Posttest	37	123,58	7,062
Retention test	37	123,50	6,841

According to the obtained results, it can be said that the average of posttest and retention test scores was a little bit higher from pretest score average. As investigated in Table 2, the calculated F value was found meaningfully for unidirectional variance analysis in the repeated measurements (F (df1, df2) =10,175; p<0,01). In other words, differences between averages related to teacher candidates' renewable energy attitude pretest, posttest and retention test scores were statistically significant.

Table 2. ANOVA results related to teacher candidates' renewable energy attitude pretest, posttest and retention test scores.

The source of variance	KT	Sd	KO	F	P
Intra-subject	3295,623	37	89,071		
Measurement	2229,807	1,623	1373,789	13,441	0,00
Error	6138,193	60,055	102,210		
Total	11663,623				

The performed Bonferroni multiple comparison test results to understand that, among which tests the difference between the score averages are given in Table 3. When we see Table 3, the meaningful difference was found between posttest and retention test and pretest score averages. This difference is a benefit for posttest and retention test. In other words, it can be said that with conducted environmental education was provided significant contribution to teacher candidates' renewable energy attitudes and be persistent of the learned information of teacher candidates.

In the analysis and evaluation, the effect size value was calculated. But it might be necessary to briefly describe the effect size, which is a a statistical value that show the level of deviation from the expectations defined in hypothesis of the absence of the results obtained from the sample (Cohen, 1994; Vacha-Haasse ve Thompson, 2004). Generally, the effect size is defined as the magnitude of the difference between the null and alternative hypotheses. This is an indication of the practical significance of the research results. According to result of the tests, the calculated effect size was found as (η^2=0.27) in this study. In Green' opinion (2005) it can be said that this difference has a large effect.

Table 3. The multiple comparison test results based on Bonferroni analysis related to teacher candidates' renewable energy attitude scores.

(I) Groups	(J) Groups	Average Difference (I-J)	SH	P
Pretest	Posttest*	-9.421	2.521	0.002
	Retention test*	-9.342	1.989	0.000
Posttest	Öntest*	9.421	2.521	0.002
	Retention test	0.079	1.669	1.000
Retention test	Posttest*	9.342	1.989	0.000
	Posttest	-0.079	1.669	1.000

*Difference is the meaningful at .01 level.

3.2. Evaluation of Teacher Candidates' Environmental Behavior *Pretest, Posttest and Retention Test Scores*

As seen in Table 4, teacher candidates' environmental behavior pretest, posttest and retention test scores ($\overline{X}$) were calculated as 41,51; 49,57 and 48,32, respectively.

Table 4. Descriptive statistics related to teacher candidates' environmental behavior pretest, posttest and retention test scores.

Variables	N	$\overline{X}$	SS
Pretest	37	41,51	6,127
Posttest	37	49,57	5,510
Retention test	37	48,32	6,138

According to these results, it can be said that the average of posttest and retention test scores was higher from pretest score average. As seen in Table 5, the calculated F value was found meaningfully for unidirectional variance analysis in the repeated measurements (F=22.840, p<0.01). In other words, differences between averages related to teacher candidates' environmental behavior pretest, posttest and retention test scores were statistically significant.

Table 5. ANOVA results related to teacher candidates' environmental behavior pretest, posttest and retention test scores.

The source of variance	KT	Sd	KO	F	P
Intra-subject	1607,640	36	44,657		
Measurement	1391,207	2	695,604	22,840	0,00
Error	2192,793	72	30,455		
Total	5191,64				

The performed Bonferroni multiple comparison test results to understand that, among which tests the difference between the score averages are given in Table 6. As seen in Table 6, the meaningful difference was found between posttest and retention test and pretest score averages. This difference is a benefit for posttest and retention test. In other words, we can say that with conducted environmental education was provided significant contribution to teacher candidates' environmental behavior and be persistent of the learned information of teacher candidates. Additionally, the calculated effect size was found as (η^2= 0.39) in test final. According to Green (2005) it can be said that this difference has a large effect.

Table 6. The multiple comparison test results based on Bonferroni analysis related to teacher candidates' environmental behavior scores.

(I) Groups	(J) Groups	Average Difference (I-J)	SH	P
Pretest	Posttest*	-8.054	1.132	0.000
	Retention test*	-6.811	1.357	0.000
Posttest	Pretest*	8.054	1.132	0.000
	Retention test	1.243	1.348	1.000
Retention test	Pretest*	6.811	1.357	0.000
	Posttest	-1.243	1.348	1.000

*Difference is the meaningful at .01 level.

3.2. Evaluation of Teacher Candidates' Environmental Self-Efficacy Pretest, Posttest and Retention Test Scores

As seen in Table 7, teacher candidates' environmental self-efficacy pretest, posttest and retention test scores ($\overline{X}$) were calculated as 46,70; 54,68 and 53,70, respectively.

Table 7. Descriptive statistics related to teacher candidates' environmental self-efficacy pretest, posttest and retention test scores.

Variables	N	$\overline{X}$	SS
Pretest	37	46,70	4,054
Posttest	37	54,68	6,347
Retention test	37	53,70	7,306

According to the obtained results, it can be said that the average of posttest and retention test scores was higher from pretest score average.

As seen in Table 8, the calculated F value was found meaningfully for unidirectional variance analysis in the repeated measurements (F=22.144, p<0.01). In other words, differences between averages related to teacher candidates' self-efficacy pretest, posttest and retention test scores were statistically meaningful.

Table 8. ANOVA results related to teacher candidates' self-efficacy pretest, posttest and retention test scores.

The source of variance	KT	Sd	KO	F	P
Intra-subject	1618,432	36	44,956		
Measurement	1442,649	1,593	905,556	22,144	0,00
Error	2345,351	57,352	40,894		
Total	5406,432				

The performed Bonferroni multiple comparison test results to understand that, among which tests the difference between the score averages are given in Table 9. When we see Table 9, the meaningful difference was found between posttest and retention test and pretest score averages. This difference is a benefit for posttest and retention test. In other words, it can be said that with conducted environmental education was provided significant contribution to teacher candidates' self-efficacy and be persistent of the learned information of teacher candidates. Additionally, the calculated effect size was found as (η^2= 0.38) in test final. According to Green and Salkind (2005) it can be said that this difference has a large effect.

Table 9. The multiple comparison test results based on Bonferroni analysis related to teacher candidates' self-efficacy scores.

(I) Groups	(J) Groups	Average Difference (I-J)	SH	P
Pretest	Posttest *	-8.162	0.947	0.000
	Retention test*	-7.000	1.542	0.000
Posttest	Pretest*	8.162	0.947	0.000
	Retention test	1.162	1.417	1.000
Retention test	Pretest*	7.000	1.542	0.000
	Posttest	-1.162	1.417	1.000

*Difference is the meaningful at .01 level.

CONCLUSION

In scope of the project titled as "Environment and Energy with Pro-Fe(Science)ssional Education" supported by TUBITAK, the following conclusions were reached in this study investigating of the effectiveness and durability on science teacher candidates' environmental information, environmental behaviors and environmental education self-efficacy levels.

As seen in teacher candidates' renewable energy attitude pretest, posttest and retention test scores, posttest scores showed an increase compared to the pretest scores and retention test scores showed a small decrease compared to the posttest scores. According to the analysis of variance and Bonferroni multiple comparison test, a statistically significant difference was found between pretest and posttest-retention test. Found this difference is in favor of posttest and retention test. As considering the environmental behavior pretest, posttest and retention test scores, the posttest and retention test scores are higher than pretest scores. According to the analysis of variance and Bonferroni multiple comparison test, a statistically significant difference was found between pretest and posttest-retention test in order to determine that these differences are in favor of which tests. Found this difference is in favor of posttest and retention test. As investigating in environmental self-efficacy pretest, posttest and retention test scores, posttest scores showed an increase compared to the pretest scores and retention test scores showed a

small decrease compared to the posttest scores. According to the analysis of variance and Bonferroni multiple comparison test, a statistically significant difference was found between pretest and posttest-retention test. Found this difference is in favor of posttest and retention test.

Besides this statistical analysis performed effect size value (η^2) was calculated depending on three different scales. It can be said that the value of the calculated effect size in study is higher than normal value. According to the literature effect size takes values between 0.00 and 1.00. η^2 values at .01, .06 and .14 levels are considered as small, medium and large effect size, respectively (Green and *et. al.*, 1997). According to the renewable energy attitude scale applied for teacher candidates, the calculated effect size value (η^2) is 0.27. Additionally, according to the test results of scale applied for their environmental behavior the effect size value (η^2) is 0.39. Moreover, according to environmental self-efficacy test results, the effect size value (η^2) was calculated as 0.38. At the end of the study this effect size values (η^2) may be several reasons for the high. The first of these is that teacher candidates participating in the study are not encounter with detailed information about renewable energy and environment before. Secondly, in the renewable energy and environmental issues positively being of the change in the level of teacher candidates' knowledge or its increasing that affects their attitudes. Depending on the studies performed by Önder (2015); Kahyaoğlu, Daban and Yangın (2008); Kayalı (2010) it can be said that environmental information has been found to increase the environmental attitude. This may lead to overestimation of effect size value.

The overall evaluation of results achieved it can be said clearly that with the participants' performed an 8-day outdoor education programmes on the environment, contribute significantly to their renewable energy attitude, environment behavior, environmental education self-sufficiency. These results show related to this project that highly effective increasing in renewable energy attitudes, environmental behaviors and self-efficacy for environmental education of teacher candidates.

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