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Awareness about renewable energy of pre-service science teachers in Turkey

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ABSTRACT

Limited world fossil fuel reserves and the expectation that these reserves will soon be depleted, place increased importance on renewable energy resources. Therefore, it is highly critical to educate pre-service teachers, who will be bringing up future generations of school children, about renewable energy and resources. To that end, a 39 point questionnaire developed by Morgil et al. [1] have been applied to a total of 240 pre-service teachers (60 pre-service teachers each in first, second, third and fourth years) majoring in Elementary Science Teaching at a university in the Black Sea Region of Turkey, and their awareness of renewable energy topics were determined. The study has concluded that while no gender-based meaningful differences exist with respect to the awareness of pre-service teachers for renewable energy [$t_{(238)} = 0.789$, $p > .05$], there are differences based on year-of-study [$F_{(3,236)} = 16.376$, $p < .05$]. An analysis based on pre-service teachers' years of study has resulted in statistically meaningful ($p < .05$) differences being found, with respect to awareness for renewable energy, upon comparing third year students with first ($p = .000$), second ($p = .000$) and fourth ($p = .015$) year students, and upon comparing fourth year students with first year students ($p = .002$).

1. Introduction

Energy tops the primary factors required for living creatures to maintain life. There are differences among humans and other creatures with respect to the provisioning and the utilization of energy. For plants and animals, energy is a vital tool, acquired through natural means. Energy is required by humans not only to perpetuate physiological activities but also for keeping warm, heating, lighting and running industrial equipment [2]. Energy is required not only to provide for the basic requirements of life for humans, but also to direct international policies. The fact that fossil fuels will be depleted in the near future will lead to a rise in energy costs. This predicament brings up the importance of efficient use of existing resources and their recycling [3].

The majority of energy consumption today is accommodated with fossil fuels. The world fossil fuel reserves being limited in quantity and expected to be depleted due to their non-renewable nature has accelerated the shift to sources of renewable energy [4,5]. Indiscriminate use of non-self-renewing sources of energy such as petroleum, coal and nuclear energy and the pollution these resources cause with respect to the environment and the atmosphere have led to the use of renewable energy sources [6]. To ease the numerous problems stemming from the use of fossil fuels, renewable sources of energy must be utilized [7].

Renewable energy resources are those that are naturally replenished and used over and over again. Solar energy, wind power, hydraulic energy, biomass, geothermal energy, wave energy, and human- and animal-powered energy are the primary sources of renewable energy [2,8]. Unlike non-renewable sources of energy, renewable energy sources do not cause the release of poisonous gases that pollute the atmosphere and the environment, and therefore are considerably safer to utilize [2,9]. The most effective solution for environmental problems threatening the Earth, and to provide for sustainable development as well, is to use renewable energy sources. Renewable energy sources are limitless, clean, sensible, economical [10] and environmentally-friendly [2,10].

To halt global adversity, the technological and social behaviors of students need to be modified [11]. Pre-service teachers who are conscious of renewable energy and resources will enable the students they teach to also be cognizant of these facts. Therefore, the education of pre-service teachers on renewable sources of energy should be emphasized. The World Commission on Environment and Development underscores the role that teachers have in bringing about the broad scale social changes required for ecologically sustainable development [12]. Curriculums at educational institutions that train teachers should be re-structured to include

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Table 1
Results of independent *t*-test with respect to gender for the awareness scores of pre-service teachers for renewable energy.

Gender	*N*	$\overline{X}$	*S*	Sd	*t*	*p*
Male	79	154.32	18.07	238	0.789	0.431
Female	161	152.53	15.59			

topics on renewable energy and sustainable energy [13,14]. According to Açıkgöz [15], instruction on renewable energy should be included in schools, colleges, universities and other academic institutions. Certain studies indicate that education relating to energy will emerge as a new discipline in developed and developing countries [13,14].

The World Conservation Union (IUCN) [16] has emphasized that the attitudes individuals have towards sustainable living need to be changed through educational programs. As part of their formal training, all students and teachers should encounter concepts and methods relating to ecologically sustainable development [17,18]. According to Agenda 21, the environmental and ethical awareness, values, attitudes, skills and behaviors required for sustainable development are acquired through education [18].

This study aims to determine the awareness for renewable energy that pre-service teachers attending the Elementary Science Teaching Department at a university in the Black Sea Region of Turkey possess.

2. Methodology

A total of 240 pre-service teachers (60 pre-service teachers each in first, second, third and fourth years) majoring in Elementary Science Teaching at a university in the Black Sea Region of Turkey have participated in the study. The scanning method has been used in the study and a 39 point questionnaire developed by Morgil et al. [1] has been conducted. The Cronbach's alpha reliability coefficient for the questionnaire has been determined to be 0.944 by Morgil et al. [1]. The following responses have been used by the pre-service teachers for the questionnaire: "totally agree", "agree", "undecided", "disagree", and "totally disagree".

The data has been analyzed using the SPSS statistical software application. The independent *t*-test has been used to analyze the awareness of the pre-service teachers for renewable energy with respect to gender, and the One-Way ANOVA test has been used to analyze awareness based on their year-of-study. The Tukey HSD test has been used to reveal the year-of-study for the pre-service teachers that is the source of the variation. The analysis of the data collected for the responses by the participants to the phrases included in the questionnaire has been determined as percentages (%).

3. Results

The results of the independent *t*-test, conducted to analyze the affects of gender on the awareness of pre-service teachers for renewable energy, are presented in Table 1.

Table 2
Number of pre-service teachers per year-of-study, their arithmetic means and their standard deviations.

Grade	*N*	$\overline{X}$	*S*
First year	60	144.80	14.72
Second year	60	149.65	15.39
Third year	60	163.17	13.30
Fourth year	60	154.87	16.57

Table 3
Results of the One-Way ANOVA test with respect to the year-of-study for the awareness of pre-service teachers for renewable energy.

Source of variance	Sum of squares	df	Mean square	*F*	*p*
Between groups	11114.979	3	3704.993	16.376	0.000
Within groups	53394.517	236	226.248		
Total	64509.496	239			

According to Table 1, no gender-based meaningful differences exist with respect to the awareness for renewable energy of pre-service teachers in science teaching [$t_{(238)} = 0.789$, $p > .05$]. The One-Way ANOVA test has been used to analyze the effects of year-of-study on the awareness of the pre-service teachers with respect to renewable energy.

The number of pre-service teachers per year-of-study, their arithmetic means and their standard deviations are presented in Table 2, and the results of the One-Way ANOVA test are presented in Table 3.

According to Table 2, the arithmetic means for third-year pre-service teachers are 163.17 which is observed to be higher than those for the other years of study.

According to Table 3, there are meaningful differences with respect to the awareness of pre-service teachers for renewable energy based on their year-of-study [$F_{(3,236)} = 16.376$ $p < .05$]. The results of the Tukey HSD test used to reveal the year-of-study that is the source for the meaningful difference are presented in Table 4.

According to Table 4, based on pre-service teachers' years of study, the differences between third year students vs. first ($p = .000$), second ($p = .000$) and fourth ($p = .015$) year students, and the differences between fourth year students vs. first year students ($p = .002$), have been found to be statistically meaningful ($p < .05$) with respect to their awareness for renewable energy.

The science teacher undergraduate curriculum contains the courses "Special Topics in Chemistry" (5th semester) and "Environmental Sciences" (6th semester), which comprise topics relating to environmental problems and the limitations of natural resources. The awareness of third-year students was found to be meaningful with respect to renewable energy, because they had taken the said courses, compared to those for first- and second-year students who had not yet taken this course. Additionally, the awareness of fourth-year students for renewable energy was determined to be meaningful, because they had taken the said courses, compared to that for first-year students who had not yet taken this course.

The awareness of third-year pre-service teachers with respect to renewable energy compared to fourth-year pre-service teachers has been determined to be more meaningful. Although both years have taken the "Special Topics in Chemistry" and "Environmental

Table 4
Results of the Tukey HSD test with respect to the awareness scores of pre-service teachers for renewable energy based on their year-of-study.

Grade (I)	Grade (J)	Mean difference (I–J)	Standart error	*p*
First year	Second year	−4.85000	2.7462	0.292
	Third year	−18.36667(*)	2.7462	0.000*
	Fourth year	−10.06667(*)	2.7462	0.002*
Second year	First year	4.85000	2.7462	0.292
	Third year	−13.51667(*)	2.7462	0.000*
	Fourth year	−5.21667	2.7462	0.231
Third year	First year	18.36667(*)	2.7462	0.000*
	Second year	13.51667(*)	2.7462	0.000*
	Fourth year	8.30000(*)	2.7462	0.015*
Fourth year	First year	10.06667(*)	2.7462	0.002*
	Second year	5.21667	2.7462	0.231
	Third year	−8.30000(*)	2.7462	0.015*

*$p < .05$.