



## Pre-service teachers' knowledge and awareness about renewable energy



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### ABSTRACT

The present study aimed to explore the awareness and knowledge of pre-service teachers regarding renewable energy. For this aim, the study employed survey method and a total of 196 pre-service teachers studying at four different teaching profession departments in a public university in Turkey's Mugla province were enrolled in the study. Renewable Energy Awareness Scale and Renewable Energy Knowledge Level Test" were used to gather the data from the preservice teachers in the study. The quantitative data obtained from the participants was analyzed using multivariate analysis of variance, Pearson product moment correlation coefficients and simple regression analysis. The study results revealed that the knowledge level of the pre-service teachers regarding renewable energy showed differences across the departments while their awareness did not vary. It was also found that the pre-service teachers' knowledge level and awareness in this topic had a positive correlation. Thus, this topic must be given importance in the education programs must be implemented more effectively and meaningfully. In addition, more comprehensive information regarding renewable energy issues must be included in the teacher education.

### 1. Introduction

The most important need of human in every activity of daily life is energy. The energy used in every activity can be found in different forms such as chemical, nuclear, mechanical (potential and kinetic energy), geothermal, hydraulic, solar, wind, electric energy, and can be converted into each other using appropriate methods. The air we breathe and hence, the environment is affected in various ways as a result of the process by which energy is converted into another form. Fossil fuels are used in energy production because developed countries give importance to the industry and the world population continuously increases. Fossil fuels such as petroleum and coal, which are widely used, are preferred by most countries because of being cheap and of the improvements in production technologies in the last two centuries. However, as a result of burning these fuels, the concentration of greenhouse gases such as CO<sub>2</sub>, CH<sub>4</sub>, CFCs, halon, N<sub>2</sub>O, ozone, peroxyacetyl nitrate in the atmosphere increases, and accordingly the surface temperature of the earth increases, and the earth's internal heat increases by the heat dispersed from the earth's surface [14,2]. The energy production and usage based on fossil fuels leads to many negative impacts on human and environmental health. Especially the utilization of this kind of fuels results in air pollution, acid rain, global warming and climate changes [16,40,49]. Especially in climate change which is among the biggest concerns of humanity in the 21st century. This is the most important environmental problem related to energy.

As a result of the increase in the frequency and density of the heat waves, human health can be affected, the risk of malnutrition, flood, drought, and disasters can increase [40,46]. In addition, these gases pale the leaves of plants, corrode marble constructions, have a corrosive effect on iron and steel, decrease the visibility distance, and sunrays rasp the upper respiratory system and lungs of people, and may have lethal effect when in high concentrations [15]. Many scientific studies show that the CO<sub>2</sub> level 31% in 200 years, global gas emission because of energy production have increased by about 37%, and the world average temperature increased by about 0,7 °C [40,49].

Society has embarked on a quest of more sustainable production methods such as minimizing the wastes, reducing the air pollution arising from vehicles, increasing renewable energy production, protection of the natural forests and decreasing greenhouse gases emissions [43]. On the other hand, the petroleum crisis in 1973 encouraged countries to look for new energy sources and thus, a great interest towards renewable energy sources and technologies [1]. Renewable energy sources such as solar, wind, geothermal and hydraulic energy are clean energy sources which don't emit toxic and greenhouse gases that pollute the environment, which can always be used, and which renew themselves naturally. Thus, renewable clean energy usage should be supported [10,21].

A need for more energy has arisen due to the reasons like population increase, rapid development and urbanization.

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Considering the electric energy production in 2013 in our country, it is seen that approximately 71% of the electric energy is produced from fossil fuels and 29% is produced from renewable energy resources. Fossil fuels which meet a huge part of the energy need not only decrease in time but also cause severe environmental and air pollution. When it is taken into consideration that 50–75% of energy need is provided from renewable energy sources, the common and effective use of these sources must be ensured in order to reduce environmental pollution [26]. Especially the developed and developing countries change their energy policies with the aim of searching for ways of obtaining energy which is harmless to the environment and is renewable. For that purpose, these countries primarily focus on formal and informal energy education to increase the awareness of their citizens towards achieving this aim [1]. However, studies have shown that society has low awareness about renewable energy use in energy production [29,30,48]. In this case, individuals need to have knowledge about issues such as environmental sensitivity in energy production, energy sources and effective use of energy. Hence, energy education must be introduced in schools in different levels like high school, university, and other academic institutions [27]. Thus, students will be aware about the energy crisis and acquire knowledge about renewable and non-renewable energy types, the technology involved in using these sources, understanding the related political issues, and in proposing alternative strategies for the solution of the energy crisis [1]. However, it is obvious that renewable energy issue is not sufficiently included in Turkish science curricula [3,44]. In addition, studies regarding this issue show that based on the renewable energy curriculum, high school students [19,50,51], primary and secondary school students [12,28] have insufficient knowledge and awareness.

Awareness, values, attitudes, abilities, and behaviors which are required for a sustainable development is possible only with a relevant education program and qualified educators. The World Commission on Environment and Development highlights the importance of teachers in large-scale social changes and education of students for an ecologically sustainable development. Celikler [8], and also highlights the importance of teachers in raising an awareness in students about the renewable energy issue. Within this context, teacher education regarding renewable energy is important. Teachers who have sufficient knowledge about renewable energy will help students gain true knowledge and values related to this issue of being aware of the benefits of renewable energy to society and the environment [20,30]. However, it is seen that both teachers and pre-service teachers have negative awareness towards this issue [17,27,7–9], and their knowledge on this issue is insufficient [30,52].

Within this context, teachers who have the sufficient knowledge, and awareness regarding renewable energy are required for the purpose of producing individuals who interrogate global warming, who propose opinions in this direction, and who are interested in and develop awareness towards the use of related technologies of renewable energy that do not harm the environment. When examining the educational programs in teacher education, the relation between the knowledge and awareness of teachers about this issue must be defined at first. Accordingly, the purpose of the study is to examine and define the relations between knowledge and awareness of pre-service teachers regarding renewable energy.

The research questions were as follows:

- (1) Is there any significant difference in the knowledge level and awareness regarding renewable energy of pre-service teachers in the four departments?
- (2) Is there any correlation between the knowledge and awareness of pre-service teachers regarding renewable energy?
- (3) To what extend does the knowledge of pre-service teachers regarding renewable energy predict their awareness?

**Table 1.**

Distribution of the pre-service teachers according to their departments.

Department	Number	%
Elementary Science Education	41	20.9
Social Sciences Education	42	21.4
Early Childhood Education	23	11.7
Primary School Teaching	90	45.9
Total	196	100

## 2. Method

### 2.1. Participants

The population of the research consists of pre-service teacher who study in education faculties in 2013–2014 academic year. The sample consists of 196 pre-service teachers, 120 (61.2%) of whom were female, 76 (38.8%) of whom were male, and who are in their final year of study in Mugla Sıtkı Kocman University Faculty of Education. The sample was selected by using the stratified random sampling method. Distribution of pre-service teachers according to the departments is indicated in Table 1.

### 2.2. Research tools

The “Renewable Energy Awareness Scale” (REAS) and the “Renewable Energy Knowledge Level Test” (REKLT) were used as a data collection tool.

#### 2.2.1. Renewable Energy Awareness Scale (REAS)

This scale was developed by Morgil, Secken, Yucel, Oskay, Yavuz and Ural [34] with the aim of measuring the awareness of pre-service teachers towards renewable energy. The REAS consists of 39 Likert-type questions and Cronbach's alpha internal consistency coefficient was found to be  $\alpha = .94$ . Sentences in the scale were ranked as “5” for “completely agree”, “4” for “agree”, “3” for “indecisive”, “2” for “don't agree” and “1” for “don't agree at all”.

#### 2.2.2. Renewable Energy Knowledge Level Test (REKLT)

The knowledge test was used to measure how much an individual benefits from a particular class or educational program [39]. Twenty items were generated based on studies found in the literature [19,51]. The opinions of four experts were considered to ensure each question in the prepared draft form measured the desired target. In addition, the knowledge level test was checked by four experts in this area in terms of level, scope, content and language. Corrections were made based on the opinions of the experts. Item difficulties ranged between .39 and .65, and discrimination indices ranged between .32 and .58. The KR-20 (Kuder Richardson-20) reliability coefficient of the test whose answer options are “correct”, “wrong”, and “don't know” was found to be .84. Based on this result, the test is considered to be highly reliable [24].

### 2.3. Data analysis

Data were analyzed using SPSS 20 statistical package software. Multivariate analysis of variance (MANOVA), which is a technique that questions the effect on more than one dependent variable, was used to define whether knowledge level and awareness of pre-service teachers regarding renewable energy show any difference between the pre-service teachers in the four departments. The eta square ( $\eta^2$ ) value was taken into consideration to define the effect of the independent variable on the dependent variable. To test the relation between the knowledge level and awareness of pre-service teachers regarding renewable energy, to define relation direction and degree, the Pearson product-moment correlation coefficient statistical method was used. Besides,

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