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PRE-SERVICE PRIMARY TEACHERS' ECOLOGICAL FOOTPRINT AWARENESS: ARE THERE DIFFERENCES BASED ON GENDER, EDUCATIONAL LEVEL OF PARENTS, AND LONGEST LIVED PLACE OF RESIDENCE

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Abstract

The purpose of this research is to determine pre-service primary teachers' level of ecological footprint awareness. The study also investigated whether there are differences in ecological footprint awareness based on gender, educational level of parents, and longest lived place of residence. "Ecological Footprint Awareness Scale" which was developed by Coşkun & Sarıkaya (2014) was employed to collect the data. The scale is a 5 point Likert type instrument which is composed of five dimensions related to food, transportation and residence, water consumption, energy consumption, and waste management. Seventy four pre-service primary teachers in their third year of study in Faculty of Education at a medium size University located at northeast part of Turkey participated in the study. Analysis of the data was performed by employing t-test and one-way analysis of variance (ANOVA) by utilizing SPSS statistical package. Results of the study revealed that the pre-service teachers' awareness on ecological footprint is at a medium level; highest levels of awareness found in energy (X= 4,15) and water consumption(X= 3, 75) dimensions. Least level of awareness detected in food dimension(X=3,03) of the scale. Results of the study showed that pre-service teachers' awareness level did not change based on gender with

the exception of energy dimension of the scale (t=2,24, p <0.05) in favor of females. The results also showed that ecological awareness level of the pre-service teachers changed based on parents' education in energy and food dimensions of the scale and did not change based on the place of residence.

Keywords

Ecological Footprint Awareness, Pre-Service Teachers, Gender, Parents' Education, Residence

1. Introduction

It is known that our planet has been suffering from damages due to various human activities such as industrial wastes and misuse of the energy sources over the past three decades. Consequently, remaining lifetime of our world is decreasing. Environmental problems affect the present and future of humanity. For the continuity of the vital resources for future generations, it is necessary to limit the human activities that are harmful to the environment and to increase the activities that make positive contributions to the nature.

An important concept related to ecological problems in recent years is the *ecological footprint*. Wackernagel & Rees (1998) suggested the concept of ecological footprint in association with sustainable life in the 1990s. The simplest way to define ecological footprint would be to call it the impact of human activities measured in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated (WWF). More simply, it is the amount of environment necessary to produce the goods and services necessary to support a particular lifestyle. Ecological footprint is calculated using the following formula:

Ecological footprint = Consumption x Necessary production area.

When measuring the ecological footprint, human actions such us driving to work, doing laundry, or watching TV in an air-conditioned room which contribute to natural resources withdrawn from the Earth are considered. The withdrawals are categorized in six areas:

- **Carbon:** A measure of carbon emissions, represented by the amount of forest land that would be needed to sequester carbon dioxide emissions, not including the fraction that is absorbed by the oceans and leads to acidification.
- **Cropland:** The amount of cropland used to grow plants for food, fiber, animal feed, and commodities including oil, soy and rubber.

- **Grazing Land:** The amount of grazing land used to raise livestock for meat, dairy products, hide and wool.
- **Forests:** The extent of forests required to supply timber, pulp and fuel wood.
- **Fishing Grounds:** The estimated primary production required to support the fish and seafood caught in freshwater and marine environments.
- **Built-up Land:** The amount of land covered by human structures, including transportation, housing, industrial structures and reservoirs created by dams.

Another measure which is related with sustainable life is biocapacity of the Earth. Biocapacity could be defined as Earth's ability to produce natural resources, provide land for humans to build on, and absorb waste such as carbon emissions. Comparing ecological footprint and the total biocapacity tells us about the future of our planet. For a sustainable life ecological footprint should not exceed the Earth's biocapacity. However, according to 2014 calculations, ecological footprint is 1,6 times of the biocapacity which means that it would take 1.6 Earths to produce all the renewable resources we use. Moreover, the human population is expected to use the equivalent of 2 Earths of renewable resources per year by 2050. Through changes in technology and land management practices, biocapacity has increased about 27% in the past 50 years. However, it has not kept pace with human consumption: humanity's ecological footprint has increased about 190% over the same time period (WWF). Therefore, it is now imperative to reduce the ecological footprint of the humanity in order to live a sustainable life.

Carbon footprint which mainly comes from the greenhouse gases has the greatest share (%60) among the contributors of ecological footprint. Greenhouse gases such as CO2, by trapping the heat within the atmosphere, raise its temperature. Consequently temperature of waters in the world increases, which in turn causes extreme weather conditions. Because of the extreme weather conditions, natural disasters such as drought, heat waves, and flooding occur. Climate change effect persons' well-being as well as welfare. Life style choices regarding what to eat, what to buy and what vehicle to transport have a great impact on the greenhouse gases we produce which is our carbon footprint. According to WWF (2018) report, ecological footprint of a US citizen equals to footprints of 43 African citizens. The report also indicates that UAE, Qatar, Denmark, USA, Canada, Kuwait and Estonia are among the top ten countries having the largest ecological footprint. It is seen that there is a relationship between ecological footprint and economical development. However, consumption habits of the countries with larger footprints

affect the whole world. Making the footprint is smaller is crucial for the planet and the future of humanity.

Knowledge, attitude, and awareness of individuals affect their actions. It is assumed that individuals with higher level of ecological footprint awareness will have smaller ecological footprint. Primary school teachers are highly influential on the development of environmental awareness, as well as, favorable environmental attitude and behavior in students. Teachers, who will be playing an active role in creating such an attitude, should hold a high level of awareness themselves. Therefore, identifying the ecological footprint awareness of pre-service primary school teachers and planning necessary steps to promote this awareness is critical in creating environmentally-conscious future generations**.**

The purpose of this research is to explore pre-service primary teachers' awareness level of ecological footprint. The study also investigated whether there are differences in ecological footprint awareness based on gender, level of parental education, and longest lived place of residence.

2. Literature Review

There are many studies measuring ecological footprint of different participant groups. Eren et al.(2017), for example, conducted a research with a sample of academicians working at a Faculty of Agriculture. Results of the study revealed that their ecological footprint is smaller than national average, however greater the international average. The footprint was found as 3.08 global hectares which means, 2 more Earth is needed for a sustainable life. Although not found as statistically significant, differences found based on gender and academic degree: females' footprints greater than males and the professors' footprints are smaller than the associate and assistant professors. The smallest footprint was held by the academicians in departments of Zoo-technology and bio-system engineering. Akıllı et al. (2008), on the other hand, with a sample comprising of university students and academic staff (N=241) found that the ecological footprint of the sample was greater than the national and international average. Although not statistically significant, males' footprints were larger than females. They also found that the footprint was directly related to income. They concluded that the consumption of food, energy, fuel, and area of houses increase by income. Therefore demands from the environment increase, consequently resulting in negative effects on environment.

Various studies investigated the ecological footprint awareness level of teacher candidates. Results of a study conducted with pre-service classroom teachers by Coşkun & Sarıkaya (2014) revealed that ecological footprint awareness of the classroom teachers are higher in energy and water consumption dimensions and lowest in food dimension. They found gender based differences in the dimensions of energy, waste management, and water consumption of the ecological footprint awareness in favor of females. However, there was not a significant difference based on parent's education. Keleş et al. (2008) found that food dimension made the greatest contribution to ecological footprint of pre-service teachers of different majors. They did not detect any differences in ecological footprint based on gender.

Some studies investigated effects of particular educational interventions on ecological footprint awareness. Keleş (2007) found that environmental education with the application of ecological footprint calculation significantly improved awareness of sustainable life as well as attitudes and behavior towards environment. Ecological footprint calculations showed that food consumption made the greatest contribution and mobility made the least contribution to ecological footprints. Karakaş, Doğan & Sarıkaya (2016) found that activity based training developed on the basics of ecological footprint made a significant improvement on gifted students' awareness on ecological footprint. No significant differences were found on the awareness level of gifted students based on gender and grade level for both before and after the treatment. Similarly, Benzer & Şahin (2012) found that, case study and activity based instruction were effective in creating positive attitudes towards environment as well as environment-friendly behaviors in students. A study conducted by Keleş (2011) with a sample of elementary students revealed that instruction based on 5 E's model on the ecological footprint is effective in improving ecological footprint awareness**.**

3. Research Methodology

3.1 Participants

Seventy four pre-service primary teachers (males and females) pursuing their third year in Faculty of Education at a medium size state university located at northeast part of Turkey participated in this study. When pre-service classroom teachers complete the primary education program, they are certified to teach basic science, mathematics, life science, Turkish language, art, music, and physical education for Grades 1 through 4.

3.2 Research Instrument

"Ecological Footprint Awareness Scale" which was developed by Coşkun & Sarıkaya (2014) was employed to collect the data. The scale is a 5 point Likert type instrument which is composed of five dimensions with 40 items. In addition, there is the question of control that is not evaluated in the scale. The dimensions are related to food, shelter & mobility, water consumption, energy consumption, and waste management. Cronbach alpha reliability coefficients for the dimensions of the Ecological Footprint Awareness Scale were found by Coşkun & Sarıkaya (2014) as follows: food: 0.70, shelter & mobility: 0.76, energy consumption: 0.86, waste management: 0.81 and water consumption: 0.86).

Sample scale items are presented below:

I prefer plant based food instead of meat.

I use energy saving bulbs at home, workplace or in office rather than classical incandescent lamps

I collect domestic wastes such as cardboard, paper, metal, plastic etc. in different bags

I travel to places in walking distance on foot or by bike.

I don't run the washing machine or dishwasher if it is not completely full.

3.3 Data Collection

"Ecological Footprint Awareness Scale" was administered to pre-service classroom teachers ($N = 74$) pursuing their third year in the Faculty of Education, who were taking science methods course instructed by the researcher, during the class sessions at the beginning of fall semester of the 2018-2019 school year. Student teachers were given as much time as they desired to complete the scales.

3.4 Data Analyses

In analyzing the data, the normality test was performed. After establishing the normality condition, statistical techniques of means, *t*-test, and Analysis of Variance (ANOVA) were used to analyze the data. In order to investigate whether there is a gender difference in ecological footprint awareness of pre-service classroom teachers, scores on the scales were compared for male and female students by utilizing the *t*-test. ANOVA was performed to investigate whether there are differences in ecological footprint awareness regarding parental education and longest lived place of residence. Alpha was set at .05 level of significance for all tests.

5. Results & Discussion

Pre-service primary teachers' scores for different dimensions of Ecological Footprint Awareness Scale were presented on Table 1.

Table 1: *Descriptive Statistics for Ecological Footprint Awareness Scores of the Pre-service Primary teachers*

Dimension	N	Min	Max	Mean	SD
Food	74	1.62	4.25	3.03	0.53
Shelter& Mobility	74	1.33	4.89	3.22	0.61
Energy	74	2.80	5.00	4.15	0.47
Waste	74	2.56	5.00	3.64	0.54
Water	74	2.10	5.00	3.75	0.68

Mean scores for the dimensions of the scales change between 3.03 and 4, 15. The highest score was found for Energy dimension (4.15) and the lowest score was found for Food dimension (3.03). The scores for shelter & mobility, waste management, and water consumption dimensions are 3.22, 3.64, and 3.75 respectively.

Results of the current study showed that pre-service primary teachers have relatively high level of awareness on the ecological footprint. Their awareness level on the energy and water consumption dimensions found to be higher than the other dimensions. This result consisted with previous research reporting that the highest level of the awareness found on the dimensions of energy and water consumption and lowest level of the awareness found on the food dimension of the ecological footprint (Coşkun, 2013; Keleş, 2007; Keleş et al., 2008, Şahin, Erkal & Ateşoğlu, 2018). The low level of awareness on the food dimension might be related to college students' not having healthy eating habits as a result of study conditions (eg. not having enough time & resources to prepare nature-friendly foods). Furthermore, demographic variables such as socio-economic status and type of residential area they lived previously might have influenced their choices and habits.

Pre-service teachers' level of awareness on the *shelter & mobility* is also relatively low for this sample. The participants of this research generally do not have much choice for the transportation in the region where the college situated, and the houses or dormitories they live

are not suitable to make necessary changes to reduce the ecological footprints. These conditions might have a considerable effect on this particular finding.

Table 2: *Ecological Footprint Awareness Scores of the Respondents by Gender*

Dimension	**Gender**	**N**	**Mean**	**SD**	**t**	***p***
Food	M	20	2.85	0.54	1.78	*0.078*
	F	54	3.09	0.51		
Shelter & Mobility	M	20	3.05	0.43	1.47	*0.144*
	F	54	3.28	0.65		
Energy	M	20	3.95	0.44	2.24	*0.028**
	F	54	4.22	0.46		
Waste	M	20	3.59	0.82	0.31	*0.756*
	F	54	3.66	0.55		
Water	*M*	*20*	*3.64*	*0.62*	*0.85*	*0.393*
	F	*54*	*3.79*	*0.70*		

Current study showed a statistically significant difference based on gender in energy dimension of the ecological footprints: females holding higher level of awareness compare to males. Females' level of awareness in other dimensions, although not statistically significant, is also found higher than males. This finding might be related to females' more taking care of household chores and caring more about the nature. Indeed, research by Özdemir et al. (2004) and Şama (2003) supports this idea, showing that females are more knowledgeable than males about the environmental issues and they are more interested in environment.

There are other studies reporting similar results. For example, Sarıkaya (2013) with a sample of 376 pre-service primary teachers found that there are gender differences in the dimensions of energy, waste management, and water consumption in favor of females. Similarly, research by Şahin, Erkal & Ateşoğlu (2018) with a sample of pre-school pre-service teachers reported gender differences in ecological footprint awareness. This result is consistent with studies conducted in different countries revealing that men consume more energy than women

(Medina & Toledo-Bruno, 2016; Räty and Carlsson-Kanyama, 2009). However, findings of this study inconsistent with that of some other research (Ağaç & Yalçın, 2017; Akıllı et al.(2008), Özgül et al., 2008; and Keleş , 2011) which did not detect any differences based on gender on ecological footprints. Different results obtained from the studies on the subject could be attributed to the characteristics of the samples such as their major in college and socio-economic status.

Table 3: *Ecological Footprint Awareness by Mother's Level of Education*

Dimension	**Education (graduated school)**	**N**	**Mean**	**SD**	**F**	***p***
Water	Primary	44	3.831	0.630	1.822	*.151*
	Middle	12	3.916	0.740		
	High	11	3.509	0.582		
	University	7	3.342	0.869		
Food	Primary	44	3.096	0.508	2.834	*.044**
	Middle	12	2.968	0.461		
	High	11	3.147	0.502		
	University	7	2.517	0.626		
Transport	Primary	44	3.156	0.624	1.232	*.305*
	Middle	12	3.314	0.543		
	High	11	3.505	0.588		
	University	7	3.063	0.583		
Energy	Primary	44	4.207	0.422	3.829	*.013**
	Middle	12	4.166	0.602		
	High	11	4.248	0.435		
	University	7	3.609	0.276		
Waste	*Primary*	*44*	*3.651*	*0.489*	*0.129*	*.943*
	Middle	*12*	*3.666*	*0.712*		

	High *University*	*11* *7*	*3.666* *3.523*	*0.600* *0.495*		

Table 3 shows that awareness scores of PST's whose mothers' holding primary, middle, or high school degree were found close to each other. However, scores of PST's whose mothers holding higher education degree are found lower than the other groups. The difference, on the other hand, found to be statistically significant in only two dimensions: food and energy.

Table 4: *Ecological Footprint Awareness by Father's Level of Education*

Dimension	Education (graduated school)	N	Mean	SD	F	*p*
Water	Primary	27	3.911	0.608	2.038	*0.116*
	Middle	14	3.600	0.764		
	High	17	3.894	0.738		
	University	16	3.462	0.569		
Food	Primary	27	3.120	0.545	0.702	*0.554*
	Middle	14	3.071	0.474		
	High	17	2.977	0.550		
	University	16	2.890	0.545		
Transport	Primary	27	3.345	0.772	0.556	*0.646*
	Middle	14	3.174	0.577		
	High	17	3.156	0.493		
	University	16	3.138	0.408		

Energy	Primary	27	4,271	0.485	4.212	*0.008**
	Middle	14	4,085	0.492		
	High	17	4,309	0.407		
	University	16	3,833	0.353		
Waste	*Primary*	*27*	*3,679*	*0.536*	*1.965*	*0.125*
	Middle	*14*	*3.539*	*0.500*		
	High	*17*	*3.862*	*0.574*		
	University	*16*	*3.444*	*0.476*		

Table 4 shows that, in all dimensions of the ecological footprint awareness scale, scores are closer for PST's whose fathers are primary, middle or high school graduate, while the scores for the PST's whose fathers holding college degree are considerably lower than the others. However, the difference was found statistically significant only in energy dimension.

This study revealed significant differences in ecological footprints based on parental education level: on the energy dimension with father's education and on the energy and food dimensions with mother's education. However, on the contrary to prediction, this difference is not in favor of higher educated parents. The awareness level of the pre-service teachers with higher educated parents found to be lowest for the present study. These pre-service teachers might have greater income level owing to higher educated parents. As income increases, consuming habits of people changes accordingly. However, the number of parents holding higher education degree in this particular sample is considerably low. Therefore, it might not be appropriate to draw such a conclusion. Furthermore, the higher level of education does not qualify parents as environmentally conscious individuals. They might not have sufficient knowledge related to ecology. Furthermore, their attitudes and habits might not be environment-friendly. Therefore, despite the higher level of education, their awareness might not be developed accordingly.

The research body on the subject reveals contradictory results. Şahin, Erkal & Ateşoğlu (2018) with a sample of pre-service pre-school teachers found a significant relationship between parents' education and ecological footprint awareness. Respondents whose parents had a university degree were found to have the highest ecological footprint awareness. However,

Coşkun & Sarıkaya (2013) with primary school teacher candidates did not detect any differences based on parents' education. Similarly Petroviç et al. (20012) reported no significant differences among students with different parental education background.

Table 5: *Ecological Footprint Awareness by Residential Location*

Dimension	**Residence**	**N**	**Mean**	**SD**	**F**	***p***
Water	Village	13	4.015	0.597	1.520	*0.226*
	Town	31	3.761	0.721		
	City	30	3.626	0.649		
Food	Village	13	3.153	0.584	0.435	*0.649*
	Town	31	2.996	0.553		
	City	30	3.008	0.492		
Transport	Village	13	3.512	0.684	2.643	*0.078*
	Town	31	3.258	0.417		
	City	30	3.066	0.699		
Energy	Village	13	4.394	0.452	2.213	*0.117*
	Town	31	4,114	0.430		
	City	30	4.082	0.503		
Waste	*Village*	*13*	*3.863*	*0.401*	*1.425*	*0.247*
	Town	*31*	*3.627*	*0.491*		
	City	*30*	*3,566*	*0.617*		

The present study detected differences based on residential location in favor of pre-service primary teachers who lived in rural areas, however this result was not found to be statistically significant. This finding is consistent with the study conducted by Coşkun (2013) reporting significant differences based on place of residence on *food*, *shelter* & *mobility*, and *energy* dimensions of the ecological footprint awareness.

Living in an environment very close to the nature might have an effect on developing more nature-friendly attitudes and habits in the participants. In fact, Huddart-Kennedy et

al.(2009) found that rural residents, scored higher on altruistic values, placed a higher priority on the environment, and reported higher participation in recycling and stewardship behaviors compare to urban residents. There are other studies showing that individuals who live within a city are aware of their environmental responsibility, but have lower level of positive environmental attitudes and connections. On the other hand, individuals who live in rural environments have higher level of positive environmental attitudes, a stronger nature connection, and tend to act in an environmentally conscious way (Berenguer et al., 2005; Hinds & Sparks, 2008, Kahyaoğlu& Özgen, 2012; Zengin & Kunt; 2013).

However, there are other studies reporting that the residential area of students, whether it was rural or urban, was not a significant variable in the differentiation of their attitudes towards the environment (Özen-Uyar & Yılmaz-Genç, 2016; Yürüdür et al., 2017)

6. Conclusion

In summary, this research found that pre-service primary teachers' awareness level of ecological foot print is considerably developed in energy dimension, relatively developed in water consumption and waste management. However, they have relatively low level of awareness on the *food* and *shelter & mobility* dimensions. Results of the study also revealed that there are differences in terms of gender, parents' education, and residential area in some dimensions of the ecological footprint awareness. The results obtained from the present study indicate need for improvement specifically in food dimension of the ecological footprint. Trainings specifically focused on reducing the footprint on the food dimension could be beneficial to this end. The results of the present study suggest that income level should be considered as a variable to be investigated since level of parental education has a considerable effect on income level and the reason for differences might be related to income level rather than parental education. For future research, conducting studies to investigate the effect of certain educational strategies on development of ecological footprint awareness are recommended.

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