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Pre-service social studies teachers' interpretations of ecological footprint introduction

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Abstract

The purpose of this research is to examine the perceptions of social studies teacher candidates regarding their ecological footprint. The research utilized a qualitative model to determine the perceptions of social studies teacher candidates regarding their ecological footprint. The design of the research is based on phenomenology (phenomenological research). The study group of the research consists of 55 students studying in the 1st, 2nd, 3rd, and 4th grades in the department of social studies teaching at a university located in the Central Anatolia Region. In the study, metaphor was used as a data collection tool to determine the perceptions of pre-service social studies teachers about ecological footprint. The research took place during the fall semester of the 2023-2024 academic year at a university located in Central Anatolia. A total of 100 students participated in the study, and 54 of them created valid metaphors. The content analysis method was employed to analyze the valid metaphors. Participants' metaphors about ecological footprint were categorized. Expert opinions were sought for the established categories. In this study, in which the interpretations of pre-service social studies teachers regarding ecological footprint were examined, it was observed that pre-service teachers had limited knowledge about ecological footprint.

1 Introduction

Investing in the future by protecting the environment where humans live now makes a livable world possible. When it comes to investment, it is obvious that the biggest investment is to educate society. For this reason, it is necessary to gain attitudes, values, and skills about how to be a sustainable environmental education through curricula. "Since environmental education is an education that addresses the cognitive, affective and psychomotor areas of students, it is expected that individuals will develop attitudes towards the environment while transferring information about the environment, as well as the transformation of these attitudes into behavior" (Öztürk & Zayimoğlu Öztürk, 2016, p.1535). In particular, the social studies curriculum should be implemented in this respect. To gain environmental awareness, students' environmental knowledge should also be at a certain level (Akınoğlu & Sarı, 2009). Humans have interacted with nature for generations (Karatekin & Aksoy, 2012). In this case, it will continue for generations. Countries' environmental impacts can potentially affect everywhere globally in the long term, not

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in the short term and in a specific region. (Mızık & Yiğit Avdan, 2020). For this reason, the concept of ecological footprint appears. The concept of ecological footprint was first used by Dr. Mathis Wackernagel, Prof. William Rees, and colleagues (Eren et al., 2017; Demirel, 2022; Güngör, 2019; Haberl et al., 2001). The concept of ecological footprint reveals the impact of human beings on the earth (Moffatt, 2000). In other words, Ecological Footprint, in other words, shows people's consumption habits. (Özgen & Demirci Aksoy, 2017). At this point, the ecological footprint has been on the agenda due to the negative impact of human beings on the earth (Sivrikaya, 2018). Of course, it is also possible to minimize this negative impact. Ecological footprint plays a major role in raising individuals' positive awareness of the environment. (Güngör & Cevher Kalburan, 2022). Ecological footprint calculations also provide convenience in evaluating countries' resources (Demirel, 2022). "According to the results of research on ecological footprint, it has been revealed that the ecological footprints of developed countries are larger than other countries, that they use more biological productive areas, and that the capacity of the planet cannot bear this burden if these countries continue the same consumption habits" (Akıllı et al., 2008, p. 2).

The ecological footprint potentially focuses on six elements (Wackernagel & Monfreda, 2004; Sivrikaya, 2018):

1. Carbon sequestration footprint
2. Agricultural land footprint
3. Forest footprint
4. Pasture footprint
5. Built-up area footprint
6. Fishing grounds

Concretely revealing the ecological footprint of individuals' impact on the environment will have a positive impact on raising environmental awareness in individuals (Üçüncü & Yılmaz, 2019). In this sense, individuals can review their effects on the environment with an ecological footprint and make arrangements for their needs in this sense (Kurtuldu, 2019). It can be said that ecological footprint calculations positively affect individuals' ability to develop certain habits and attitudes.

With the world's population reaching 9.6 billion in 2050 and 11 billion in 2100, the amount of biological capacity per capita will decline further. It will also become increasingly difficult to sustain the increase in biological capacity due to soil degradation, freshwater scarcity, and rising energy costs (WWF, 2023). In addition to the activities of various non-governmental organizations worldwide, the Paris Agreement, which Turkey signed in 2021, aims to prevent human-induced climate change. In the context of combating climate change, the agreement has created a framework to determine implementation procedures regarding national contributions, mitigation, adaptation, loss/damage, financing, technology development and transfer, capacity development, transparency, and situation assessment. At the same time, the agreement provides financing and technology transfer to developing countries in need, especially the Least Developed Countries and Small Island States, to increase the adaptation and resilience capabilities of countries exposed to the negative effects of climate change and to increase their greenhouse gas emission reduction capacities. and provide capacity-building opportunities (MFA, 2024). Turkey has signed international agreements such as the UN Framework Convention on Climate Change and the Kyoto Protocol for a livable environment. In this context, especially society needs to be educated. For this, individuals should be frequently emphasized at the school level, especially in the social studies course, to minimize our negative impact on the environment.

In our country, in addition to science and social studies courses, environmental education and climate change are included in the curriculum as elective courses in the 6th, 7th, and 8th grades in schools. (MEB, 2024). The course aims to raise awareness about waste, greenhouse gases and disasters, climate change, and the environment. In this context, the environmental education and climate change course consists of 6 units: human and nature, cyclical nature, environmental problems, global climate change, climate change and Turkey, sustainable development, and environmentally friendly technologies. (MEB, 2024)

When we look at other studies on the ecological footprint in the literature, there are studies for university students (Eraslan & Seçme, 2021; Günal et al., 2018; Günşen, 2023; Keleş et al., 2008; Küçükbaş et al., 2022; Ocak, 2022; Sivrikaya, 2018) and primary school, secondary school, high school students (Keleş, 2011; Kurtuldu, 2019; Üçüncü & Yılmaz, 2019). There are various studies on an international scale. (Lambrechts & Liedekerke, 2014; O'Gorman, Davis, 2013; Zeqir & Shahin, 2022). However, no study has been found in the literature determining the perception of social studies teacher candidates. Individuals' perception of any concept also reveals their level of knowledge. In this study, social studies teacher candidates' perceptions of the ecological footprint were determined, and they tried to determine what kind of conceptual scheme they created regarding the ecological footprint.

2 Method

2.1 Design

The research utilized a qualitative model to determine the perceptions of social studies teacher candidates regarding their ecological footprint. In qualitative research, researchers are concerned with people's interpretations (Merriam, 2013). At the same time, qualitative research reflects the participants' perspectives (Ekiz, 2015). The design of the research is based on phenomenology (phenomenological research). The phenomenological approach reveals human experiences (Merriam, 2013). Therefore, a phenomenological design was preferred in the research.

2.2 Participants

The research study group consists of 54 students in the 1st, 2nd, 3rd, and 4th grades in the department of social studies teaching at a university in the Central Anatolia Region. The research group was selected according to maximum diversity sampling. In maximum diversity sampling, it can be said that the participants have different characteristics from each other (Büyüköztürk et al., 2023). 100 teacher candidates participated in the research, but it was determined that 46 participants created invalid metaphors.

Table 1 Demographic characteristics of the pre-service social studies teachers

Variable	Category	f
Gender	Female	32
	Male	22
Grade	1	21
	2	11
	3	15
	4	7

2.3. Data collection tool and data collection

In the study, metaphor was used as a data collection tool to determine the perceptions of pre-service social studies teachers about ecological footprint. Metaphors express our perception of the

world (Morgan, 1998). For this reason, metaphor was used to determine how pre-service teachers perceive the ecological footprint.

The research took place during the fall semester of the 2023-2024 academic year at a university located in Central Anatolia. The study asked participants to create metaphors for their ecological footprint. The data was collected by filling out forms, not face-to-face interviews. Participants were given one class hour to create their metaphors for the ecological footprint. In this context, the ecological footprint is like ..... because ..... Participants were provided with written forms to fill in the blanks. They were asked to liken the ecological footprint to something and then explain why they chose that metaphor.

2.4. Analysing the data

A total of 100 students participated in the study, and 54 of them created valid metaphors. The content analysis method was employed to analyze the valid metaphors. In content analysis, categories and codes are established, and the data obtained are interpreted based on them (Yıldırım & Şimşek, 2011). The responses of the participants were categorized and expressed through codes. Additionally, each participant was assigned a code, and their metaphors were presented as examples. Participants' metaphors were analyzed according to grade level. It was tried to determine whether there was any change in the participants' knowledge about ecological footprint according to their grade levels and the courses they took in their undergraduate education.

2.5. Validity and reliability

Participants' metaphors about ecological footprint were categorized. An opinion was taken from an expert in social studies education. Expert opinions were sought for the established categories. Subsequently, Miles and Huberman's formula for consensus and disagreement was utilized (reliability = consensus/consensus + disagreement x 100) (Miles & Huberman, 1994). As a result of the calculation, a reliable outcome was obtained with 90 percent confidence. The categories that the expert could not agree upon were permanence and continuity.

3 Findings

This section presents the findings regarding the metaphors created by pre-service social studies teachers about ecological footprints.

3.1. 1st-grade students' metaphors related to the ecological footprint

Table 2 The table below shows the metaphors of social studies for 1st-grade students regarding ecological footprints.

Table 2 Social studies teaching 1st year students' metaphors about ecological footprint

Grade	Category	Metaphor	Total number of metaphors
1	Permanent	Search history	1
	Growing	Snowball	1
		Human body	2
		Baby	1
	Aesthetics	Flower	1
	Illuminating	Lantern	1
	Influencing	Dirty water	1
		War	1

		Vehicle engine	1
		Virus	1
		End point	1
		Breath	2
	Informative	History	1
		Receipt	1
		Diary	1
		Education	1
	Continuity	Fruit	1
		Candly	1
	Usefulness	Pen	1

When Table 2 is analyzed, the metaphors of the 1st year social studies teaching students were grouped under the categories of permanent, growing, aesthetic, enlightening, influencing, informing, continuity, and usefulness. Among these categories, the most affecting category with 6 different metaphors, the informing category (f.4), the growing category (f.3), the continuity category (f.2), the permanent category (f.1), the aesthetic category (f.1), enlightening category (f.1), usefulness category (f.1).

Below are the expressions related to the metaphors created by pre-service teachers related to ecological footprint.

A2."Ecological footprint is like a pen. Because it is as much as we use"
A3. "Ecological footprint is like our search history on technological devices. Because it shows the traces we have made and left"
A8. "Ecological footprint is like a snowball. Because the snowball can grow and make large burns."
A9."Ecological footprint is like a fruit. When we eat fruits, we can recycle their waste and turn them into fertiliser."
A10."Ecological footprint is like a flower. Because the more we take care of it, the more beautiful it becomes".
A11."Ecological footprint is like a lantern. Because it shows what is invisible in the dark.
A12."Ecological footprint is like history. Because we learn from the events of the past.
A18."Ecological footprint is like dirty water. Because when we drink or use this water, it will affect our whole body."

3.2. 2nd grade students' metaphors related to ecological footprint

The table below shows the metaphors of 2nd-grade social studies students related to ecological footprint.

Table 3 Social studies teaching 2nd year students' metaphors about ecological footprint

Grade	Category	Metaphor	Total number of metaphors
	Permanent	Text	1
		Life	1
	Influencing	Mud	1
		Poison flower	1
		Tsunami	1
2		Heart	1
		Pet bottle	1
	Informative	Book	1
	Continuity	Photosynthesis	1
		Credit book	1
	Necessity	Water	1

When Table 3 is analyzed, the metaphors of the 2nd year social studies education students were categorized under the categories of permanent, influencing, informing, continuity, and necessity. Among these categories, the most prevalent metaphors include the informative category (f.1), the continuity category (f.2), the permanent category (f.2), and the necessity category (f.1).

Below are the expressions related to the metaphors created by pre-service teachers about the ecological footprint.

> E3. "Ecological footprint is like photosynthesis. Because it is continuous and sustainable."
> E8. "Ecological footprint is like water. Because water is indispensable for humans."
> E10."Ecological footprint is like a heart. Because it breaks with every wrong action and thoughtless behavior, harming the heart."
> E12."Ecological footprint is like writing. Because no matter how much we erase with an eraser, the trace remains."
> E16."Ecological footprint is like a book. Because it leaves either beneficial or harmful traces on people."

3.3. 3rd grade students' metaphors related to the ecological footprint

The table below shows the metaphors of social studies 3rd-grade students about the ecological footprint.

Table 4 Social studies teaching 3rd year students' metaphors about ecological footprint

Grade	Category	Metaphor	Total number of metaphors
3	Obstacle	Swamp	1
		Chain	1
	Recognisability	Identity	1
		Shoe sole	1
	Transferred	World heritage	1
	Influencing	Food	1
		Artist	1
		Sycamore tree	1
		Wind	1
		Telephone	1
		Rainbow	1
		Emotion	1
	Protecting	Family	1
		country	1
	Necessity	Lung	1
		Oxygen cylinder	1
		Water	1

When Table 3 is analyzed, the metaphors of the 3rd year social studies teaching students were grouped under the categories of obstacle, recognisability, influencing, transferred, protecting, and necessity. Among these categories, the most affecting category with 7 different metaphors is the obstacle category (f.2), the recognisability category (f.2), the transferred category (f.1), the protecting category (f.2) and the necessity category (f.3).

Below are the expressions related to the metaphors created by pre-service teachers about the ecological footprint.

> Y1."Ecological footprint is like identity. Because; we can have many ideas about a person whose ecological footprint we know"
> Y9."Ecological footprint is like family. Because it eliminates everything positive and negative"
> Y10."Ecological footprint is like a lung. Because our lungs are important for us to sustain our lives. "
> Y12."Ecological footprint is like an artist. Because it affects the whole society".
> Y19."Ecological footprint is like water. Because water has an important place for human life.
> Y23."Ecological footprint is like a swamp. Because the deeper, larger, and more liquid the swamp is, the more it absorbs the living creature and makes it difficult to get rid of it."
> Y27."Ecological footprint is like world heritage. Because we will bequeath the environment, we live into future generations.

3.4. 4th-grade students' metaphors related to the ecological footprint

The table below shows the metaphors of 4th-grade social studies students related to ecological footprint.

Table 5 Social studies education 4th-grade students' metaphors about the ecological footprint

Grade	Category	Metaphor	Total number of metaphors
4	Influencing	Signature	1
		Boomerang	1
		Table	1
	Informative	Teacher	1
		Measuring Instrument	1
	Necessity	Oxygen	2

When Table 5 is analyzed, the metaphors of the 4th-grade social studies education students are grouped under permanent, influencing, informing, and necessity. Among these categories, the most affecting category with 3 different metaphors is the informative category (f.2) and the necessity category (f.2).

Below are the expressions related to the metaphors created by pre-service teachers about the ecological footprint.

> G1. "Ecological footprint is like a boomerang. Because our behavior can affect the generations after us."
> G4. "Ecological footprint is like oxygen. Because it is always present in the life of living things"
> G15."Ecological footprint is like a teacher. Because it gives information about many things."

3.5 1st, 2nd, 3rd, and 4nd grade students' metaphors related to ecological footprint

The table below shows the metaphors of 1st, 2nd, 3rd, and 4th-grade social studies students related to ecological footprint.

Table 6 Social studies education 1st, 2nd, 3rd and 4th grade student' metaphors about ecological footprint

Category	Metaphor	Total number of metaphors
Permanent	Search history	1
	Text	1
	Life	1
Growing	Snow ball	1
	Human body	2
	Baby	1
Aesthetics	Flower	1
Illuminating	Lantern	1
	Dirty water	1
	War	1
	Vehicle engine	1
Influencing	Virus	1
	End point	1
	Breath	2
	History	1
	Virus	1
	Mud	1
	Poison flower	1
	Tsunami	1
	Heart	1
	Pet bottle	1
	Food	1
	Artist	1

	Sycamore tree	1
	Wind	1
	Telephone	1
	Rainbow	1
	Emotion	1
	Signature	1
	Boomerang	1
	Table	1
Usefulness	Pen	1
Informative	Receipt	1
	Diary	1
	Education	1
	Book	1
	Teacher	1
	Measuring Instrument	1
	Teacher	1
Continuity	Photosynthesis	1
	Credit book	1
	Candly	1
Necessity	Water	1
	Oxygen cylinder	1
	Water	1
	Oxygen	1
Obstacle	Swamp	1
	Chain	1
Recognisability	Identity	1
	Shoe sole	1
Transferred	World heritage	1
Protecting	Family	1
	Country	1

When Table 6 is examined, it was determined that teacher candidates produced metaphors mostly on the influencing category regarding ecological footprint. Later, it was determined that they created metaphors in the informative category.

4 Discussion, conclusion, and recommendations

When the 1st-grade pre-service teachers' metaphors about ecological footprint were examined, it was determined that they were mostly gathered in the category of influencing and then in the category of informing. This situation suggests that 1st-grade pre-service teachers perceive the ecological footprint as a situation that affects society and, at the same time, provides social awareness. When the 2nd-grade pre-service teachers' metaphors were examined, their responses were collected in influencing, permanent, and continuous. Based on these metaphors, it was determined that pre-service teachers express that the ecological footprint affects society and, at the same time, leaves a permanent mark on the environment and is a continuous situation. 3rd-grade pre-service teachers' metaphors were mostly collected in the category of influence. Then, they were collected in the categories of necessity, protection, recognisability, and obstacle. Accordingly, pre-service teachers in the 3rd grade expressed their views on the ecological footprint's impact on society. At the same time, they stated that the ecological footprint is necessary, has a duty to protect the environment, is recognizable, and creates a social barrier. The 4th-grade pre-service teachers' metaphors were mostly collected in the influencing category when the 4th-grade level metaphors of pre-service teachers were examined. Afterward, they were collected in the categories of informing and necessity. Based on these metaphors created by pre-service teachers, they mostly focused on the dimension of ecological footprint affecting humanity and society. Then, they expressed their opinions on the informative and necessity of ecological footprint.

In the quantitative study conducted by Keleş et al. (2008), it was determined that the ecological footprint of men was more in nature. Eraslan and Seçme (2021) revealed that the ecological footprint of female students is more in nature. The study conducted by Günal et al. (2018) determined that the greatest tendency toward the ecological footprint of the participants was in the energy field. In the study conducted by Küçükbaş Duman and Atabek Yiğit (2022), the highest average for ecological footprint was related to water consumption. The study conducted by Ocak (2022) determined that pre-service social studies teachers' EAI awareness levels in the energy, waste, and water dimensions were high, while their EAI awareness levels in the food and transport-housing dimensions were lower. The study conducted by Çıkrık and Yel (2019) determined that the sub-dimension with the highest awareness level of pre-service teachers was energy, and the sub-dimension with the lowest awareness level was food. Günşen (2023) found that environmental education activity practices increased the ecological footprint awareness of pre-service preschool teachers. Based on the results of the researchers, the findings obtained in this study focused on the dimension of the ecological footprint affecting the environment through metaphors created by the prospective teachers.

In this study, in which the interpretations of pre-service social studies teachers regarding ecological footprint were examined, it was observed that pre-service teachers had limited knowledge about ecological footprint.

Based on all these results;

1. Practical and theoretical courses on ecological footprint should be included in the pre-service teachers' education curriculum.
2. Pre-service teachers should be encouraged to participate in scientific activities related to ecological footprint.
3. To provide an ecological footprint to pre-service teachers, appropriate learning environments where they can realize their social responsibilities should be created.

5 Statement of researchers

In this section, you are expected to declare the information regarding the titles given below.

5.1 Researchers contribution rate statement

The authors contributed to the study.

5.2 Conflict statement

The authors declare no potential conflicts of interest.

5.3 Support and thanks

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