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AN INVESTIGATION OF FUTURE EDUCATIONAL LEADERS' METAPHORIC PERCEPTIONS REGARDING SUSTAINABILITY ACCORDING TO THEIR KNOWLEDGE LEVELS

Research article

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Abstract

This study aims to investigate metaphors of pre-service teachers, the potential future educational leaders, regarding sustainability according to their knowledge level of sustainability. The study utilized the convergent research method, one of the mixed-method research designs based on both quantitative and qualitative data. The participants consisted of 867 pre-service teachers from different departments of the Faculty of Education in a public university in Turkey. The data were collected via "The Knowledge Test" developed by (Gökmen, 2014) and "The Metaphor Determination Form" (Yıldırım, 2013**)**, whose reliability and validity studies were also conducted. Cluster analysis was used to analyze the quantitative data and the pre-service teachers were categorized according to their knowledge level of sustainability. Content analysis was used to analyze the qualitative data and using the results obtained the pre-service teachers' metaphors were categorized. The results revealed that the pre-service teachers' knowledge levels of sustainability were above the middle-level. The cluster analysis results showed that the pre-service teachers were categorized into three groups: low, middle, and high. The pre-service teachers created 32 meaningful metaphors under four different categories (vital, economic, social, and will-o-the-wisp). The results also showed that the metaphors created by the pre-service teachers significantly varied by their knowledge level of sustainability.

Keywords: pre-service teachers, sustainability, metaphor, educational leaders

1. Introduction

Sustainability is frequently used in many different fields of daily life. Despite its frequent use, it might be hard to fully comprehend the sustainability concept due to very distinct definitions made by different disciplines. The literature puts forward many reasons for this situation. Some of them are the lack of a comprehensive definition well accepted by all shareholders (Pissorius, 2013), far different definitions of sustainability within the scope of economic, social, and ecological fields, especially for sustainable development (Bolis, Moriaka & Sznelwar, 2014; Cieges, Ramanauskiene & Startiene, 2009; Dale, 2011; Mebratu, 1998) and the contradiction between some of these definitions (Cieges, Ramanauskiene & Startiene, 2009).

The holistic approach existed at the core of sustainability strengthens the concept; however, dissimilarities in its definitions, which make it difficult to establish a connection between definitions, cause a failure in fulfilling sustainability goals. Scientists might be afraid of defining sustainability due to a complexity stemming from the simplicity of the concept. Salas‐Zapata, Rios‐Osorio, and Cardona‐Arias (2017) made a literature review on sustainability and found that more than 90 percent of the studies do not define sustainability

even though they contain the sustainability concept in their title. Furthermore, the recent use of the concept in the educational systems of developing countries increases difficulties in understanding the concept. Tanrıverdi (2010) investigated the primary education curricula of the Turkish Educational system and found that a definition or information regarding sustainability is almost not included in courses.

Sustainability, in the simplest sense, can be defined as maintaining the current situation, providing its continuity, and supporting it (Onion, 1964). Sustainability is the use of natural products and energy in a way that does not harm the environment, according to the Oxford Dictionary. The definition of the concept accepted by all shareholders was first made in a report titled Our Common Future by World Commission on Environment and Development (WCED) in 1987, The WCED report used sustainability together with development. The report was later mentioned as the Brundtland Report dedicated to Gro Harlem Brundtland, who was the chairman of the WCED's commission at that time. The report defined sustainability as "the development that meets the needs of the present generation without compromising the ability of future generations to meet their needs". The punchline of the report was the emphasis on the need for a change in human behaviors to realize sustainability goals (Maskell, 1999), yet it was not precisely stated how to do so. Nevertheless, it soon led to the elaboration of the importance of education. The Delors Report (1996) identified four pillars in education for sustainability and Learning to Know ranks first among them.

Atasay and Ertürk (2008), argued that knowledge directly affects individuals' interest in phenomena. With some minor changes from one to another, knowledge constitutes the primary step of cognitive taxonomies (Bloom, 1956; Krathwohl, 2002; Smith, Woood, Coupland, Stephenson, Crawford & Ball, 1996). It is a transition to other steps and serves as a key position to carry out analysis, synthesis, evaluation, and application in particular. Knowing the concept of sustainability is of critical importance to fully understand and realize sustainability goals. Individuals' knowledge of the environment mainly shapes their behavior regarding the environment (Vicente-Molina,2013). This emphasizes more the importance of knowledge. However, studies in the related literature showed that individuals are not that knowledgeable regarding sustainability (Azapagic, 2005; Cross, 1998; Gil-perez, Vilches, Edwards, Praia, Marques & Oliveria, 2003; Spiropoulou, Antonakaki, Kontaxaki & Bouras, 2007). Individuals, by their nature, exhibit positive attitudes towards the issues they understand, adapt their behavior regarding these issues more easily, and build positive associations regarding the concepts involves in these issues. Associations of sustainability in individuals are expected to yield important clues regarding their approaches to sustainability. From this point of view, metaphors come to the forefront.

Metaphor has its origin in the Ancient Greek and refers to, in the broadest sense, defining, interpreting, and experiencing a term using another familiar term (Carew & Mitchell, 2006; Lakoff & Johhson, 2016). Keklik (1990), defined metaphor as a topic becoming nonliteral moving away from its nature. Deant-Rint and Szokolszky (1993), similarly put metaphor into words as transferring a concept, case, or object using a different concept or object. However, metaphor is more than a literary art of describing less known or unknown with a familiar discourse (Ratzan, 2005; Türker, 2009). It is indeed a consistent system that conceptualizes experiences (Lakoff & Johhson, 2016). Metaphors are effective tools to reveal how individuals perceive a concept (Dickmeyer, 1989). Individuals' match of an abstract concept with a concrete concept that they feel closest to their subconscious is of great importance to reveal their real opinions regarding that abstract concept. Metaphors are likened to a mask that molds users' faces, as stated by Kohák (1976). Researchers, in particular, may find it difficult to get negative opinions from individuals regarding an issue accepted by everyone. However,

individuals are more likely to reflect their real opinions through metaphors since they involve indirect expressions.

Lakoff and Johhson (2005), however, stated that metaphors reflect not only subconscious but also culture. Therefore, metaphors have the potential to reveal dissimilarities in the perspectives of different societies regarding sustainability. There exist some studies in the literature investigating metaphors in sustainability (Princen, 2010; Carew and Mitchell, 2006; Muşlu Kaygusuz, 2020). Carew and Mitchell (2002) in their study conducted semi-structured interviews with eight engineering students to determine their metaphors. In the interviews, they posed the questions of what sustainability, environmental sustainability, and social and economic sustainability mean. Their results revealed more different metaphors regarding sustainability that are weaving, guarding, trading, and observing limits. In a different study by Muşlu Kaygısız (2020), metaphors of 70 pre-service teachers were determined using a metaphor determination form. They determined 41 meaningful metaphors in five different categories that are Benefiting to Future Generations, Building a Balance, Continuity, Equality, and Guiding. Princen (2010) made a critical review on the use of metaphors in environmental sustainability and put an emphasis on the critical role of discourse in sustainability to create a cultural change. To that aim, Princen used two main categories for metaphors: the ones related to industrial concerns, and the ones related to ecological and social concerns,

Metaphor studies conducted in Turkey at the higher education level generally focus environment and nature rather than sustainability (Arık ve Yılmaz, 2017; Kaya, 2014; Kelleci, 2014; Meral, Küçük & Gedik, 2016). No studies encountered in the literature investigating metaphors regarding sustainability in terms of the knowledge level of sustainability and gender. In addition, being a tool that enables researchers to determine general approaches to an issue and take necessary measures (Inbar, 1996), metaphors, considering pre-service teachers specifically, can also be considered as an important part of personal information which enables the making sense and shape of professional roles in the process of transferring information to students (Pajak, 1986), which highlights the importance of education in sustainability. Gökmen, Solak, and Ekici (2019), in their study reported that education plays a key role to announce sustainability to the public, and to equip them with necessary knowledge, attitude, and behaviors. As well as the need for education in sustainability, they also stressed the importance of sustainability in solving the problems faced by education in the 21st century. This puts forward the nexus between sustainability and education. It is not possible to succeed in topics addressed within the scope of sustainability goals without education, as stated by Vare and Scott, (2007). In conclusion, education serves as a tool for successful sustainability (Hopkins & McKeow, 2002), and education of teachers in that sense should be primarily focused to raise consciousness in societies (UNESCO-UNEP, 1990).

Conscious teachers will enable individuals to acquire accurate information and, therefore, to discover the nature of sustainability, and to be aware of events taking place regarding sustainability (UNESCO, 2009). With this, individuals will act with a sense of responsibility, learn how to cooperate and live together, form an identity for sustainability, and play important roles for the transformation of the society. Pre-service teachers, who are the potential future educational leaders, play a crucial role for the awareness of society regarding sustainability through delivering professional training in their own fields through both in-class and out-of-class activities as well as undertaking school administrators. From this point of view, pre-service teachers, as future educational leaders, will play an active role to raise individuals who will shape society regarding sustainability.

The study investigated the metaphors of pre-service teachers regarding sustainability and sought the answers to these questions:

1. What is pre-service teachers' knowledge level of sustainability?

2. Does pre-service teachers' knowledge level of sustainability vary by gender?

3. What are pre-service teachers' metaphors regarding sustainability?

4. Do the metaphors produced by pre-service teachers vary by their knowledge level of sustainability?

5. Do the metaphors produced by pre-service teachers vary by gender?

2. Method

2.1. Research design

The study utilized the convergent research method, one of the mixed-method research designs based on both quantitative and qualitative data. This study investigated pre-service teachers' metaphors regarding sustainability in terms of their knowledge level of sustainability and gender and used both quantitative and qualitative data (Creswell, 2009). The study was designed using this method because it enables a detailed and comprehensive analysis using enriched data (Mills & Gay, 2016; Rossman & Wilson, 1991) and better depicts the entire picture for researchers (Suhenon, 2009). With this method, quantitative and qualitative methods are expected to complement each other (Creswell & Plano Clark, 2011).

The quantitative aspect of the study was designed as a survey study. Pre-service teachers' knowledge levels of sustainability were investigated in terms of the variables specified in the research questions. The analysis results were described as they exist in their natural settings and reflected in a completed and detailed way (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2012; Karasar, 2005)

The qualitative aspect of the study was designed as a phenomenology study to reveal pre-service teachers' metaphors regarding sustainability. Phenomenology studies enable an in-depth analysis of a phenomenon that cannot be controlled with individuals who closely experience this and can reflect this experience mainly using the questions of how and why (Büyüköztürk et all., 2012, Yıldırım ve Şimşek, 2011).

2.2. Participants

The participants consisted of 867 pre-service teachers from different departments of a public university in Turkey. Of these pre-service teachers, 655 (75.5%) are females and 212 (24.5%) are males. The participants were selected using the convenience sampling technique, a purposeful sampling technique, which aimed to speed up the study process and make it practical (Yıldırım & Şimşek, 2013).

2.3. Data Collection Tools

The data of the study were collected using the Sustainability Knowledge Test and Metaphor Determination form, both developed by the researcher.

2.3.1. Sustainability Knowledge Test

The Sustainability Knowledge Test developed by Gökmen (2014), aims to measure pre-service teachers' knowledge level of sustainability. The test consists of 18 five-point multiple-choice items. One can score 18 at maximum and 0 at minimum. A high score on the test indicates a higher level of knowledge in sustainability. The Kuder-Richardson 20 value calculated for this study was found .81, which is above the critical value and infers that the

scale is reliable to use in the present study (Bademci, 2005; Crocker & Algina, 1986; McCoach, 2002).

2.3.2. Metaphor Determination Form

The Metaphor Determination Form mainly involves the statement; ***"Sustainability is like ……. because ……..."*** . The first part reveals the metaphor itself and its source, while the second part indicates the reasoning behind the preference of that metaphor, with an emphasis on the second part to increase the descriptive and visual power of the metaphor (Yıldırım, 2013). The form was used to determine the pre-service teachers' metaphors regarding sustainability

2.4. Analyzing Data

The data of the study were based on both quantitative and qualitative data that were collected and evaluated simultaneously. In the analysis of the obtained data the following steps were taken.

1. The analysis of the quantitative data were analyzed using Mean Score ($\overline{X}$**)**, Standard Deviation (Sd), Chi-square (X^2)as well as descriptive statistics such as Percentage (%) and Frequency (F).

2. The qualitative data were analyzed using cluster analysis and classification according to the knowledge level in sustainability.

3. Meaningful metaphors were detected.

4. The categories of these metaphors were determined.

5. The reliability studies of the content analysis made for the metaphors were carried out.

6. The distribution of the metaphors according to the groups (determined in the second step) was calculated.

7. Metaphors were investigated according to different knowledge levels of sustainability and gender using the chi-square test.

To better picture the analysis processes made by the study, the entire process can be detailed under three sub-headings as follows:

2.4.1. Analysis of the quantitative data

In the analysis of the quantitative data, descriptive statistics, and independent samples t-test were used to investigate sustainability knowledge according to gender. Following this, a two-stage cluster analysis was made to the pre-service teachers' scores on the sustainability knowledge test. This enables the distribution of the dataset over the homogeneous sub-groups (Çokluk, Şekercioğlu & Büyüköztürk, 2012) and collects individuals or objects that are similar to each other than others in a cluster (Hair, Black, Babin & Anderson, 2010). At the end of the two-stage cluster analysis, the pre-service teachers were classified into three groups, low, middle, and high, in terms of their sustainability knowledge scores. The Silhouette graph regarding the reliability of the cluster analysis made is depicted in Figure 1.

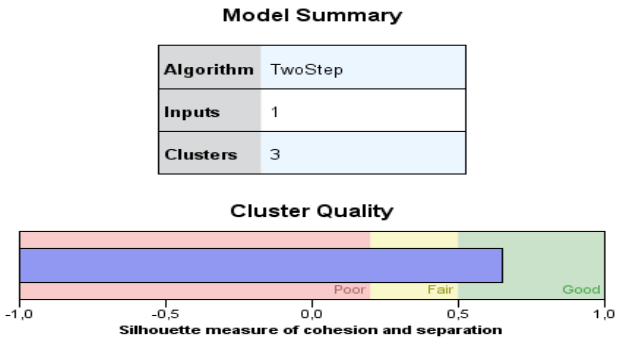

Figure 1. Silhouette graph the cluster analysis

As seen by the graph, the cluster analysis was reliable.

2.4.2. Analysis of the qualitative data

At the stage, metaphors and the categories of the metaphors were determined using content analysis. Content analysis is an attempt to make sense of voluminous data in a consistent way (Patton, 2014). Results obtained in such studies reveal some important implications in a comparison with other studies conducted on the same issue in the literature (Gökçe, 2006).

Data obtained through the Metaphor Determination Form were first investigated and the statements that do not indicate any metaphor, the metaphors indicating no justification, and the metaphors with a vague relationship between the metaphor and the justification were excluded from the analysis. Later, the metaphors were analyzed using content analysis, and categories regarding these metaphors were determined. Metaphors with a frequency of one were excluded from the analysis not to inflate the data. To increase the reliability of the results obtained by the study, two different researchers, who have expertise in sustainability, were asked to code the data. The inter-coder reliability was calculated using the formula [(Agreement) / (Agreement + Disagreement)] x 100. A value of .96 was found in this regard, which is above the critical level suggested and indicates that the two researchers coded consistently (Miles & Huberman, 2016; Tawney & Gust, 1984). NVivo12 software was used in the coding processes. Categories of the metaphors obtained at the end of the content analysis are presented in Figure 2.

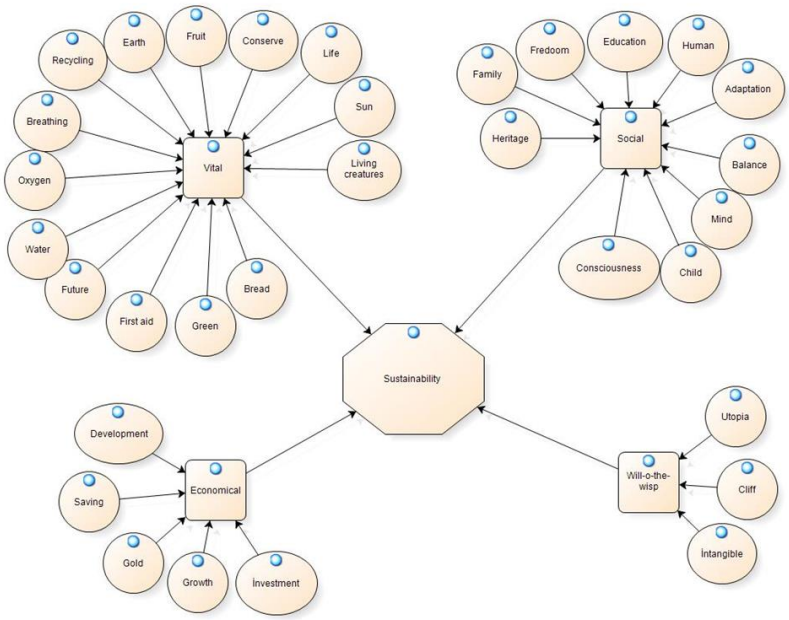

Figure 2. Pre-service teachers' metaphors regarding sustainability

In figure 2, the figure of the model obtained by NVivo12 software, a qualitative analysis software, is depicted. 32 meaningful metaphors were obtained in four different categories. In the findings part, examples of metaphors from each category are provided with excerpts of the pre-service teachers' statements.

2.4.3. Simultaneous processes of quantitative and qualitative data

At the final stage of the data analysis, the frequencies of the metaphors stated by the pre-service teachers from the low, middle, and high groups, which were all formed through the cluster analysis according to their sustainability knowledge were determined. This final stage calculated the frequencies of the male and female pre-service teachers' frequencies separately to investigate the gender variable. The chi-square test was performed to determine the change of the pre-service teachers' metaphors regarding sustainability according to the knowledge level (low, middle, and high) and gender.

3. Results

The results of the study can be stated and illustrated as follows:

Table 1. *Descriptive Statistics on the Pre-service Teachers' Knowledge Test Results*

	N	Minimum	Maximum	$\overline{X}$	Sd
Total	867	0	17	9.45	3.03

Table 1 presents the descriptive statistics of the pre-service teachers' scores on the sustainability knowledge test. The pre-service teachers scored 0 at minimum and 17.0 at maximum, with a mean of 9.45 and a standard deviation of 3.03. The pre-service teachers' mean scores on the sustainability knowledge test and their standard deviation showed that they have the knowledge level above the average.

The change of the pre-service teachers' sustainability knowledge scores according to gender

was investigated in Table 2.

Table 2. *Independent samples t-test results on the change of the pre-service teachers' sustainability knowledge scores according to gender*

Gender	N	$\overline{X}$	ss	t	sd	P
Female	655	9.41	2.96	-.719	865	.473
Male	212	9.58	3.24			

As emphasized by Table 2, the female pre-service teachers had descriptively higher sustainability knowledge scores than those of the male pre-service teachers. Independent samples t-test was performed to determine whether this difference is significant or not. The test results revealed that the difference found between the female and male pre-service teachers is not significant [t(65)- knowledge score = .-719; p>.05].

The cluster analysis was made to the pre-service teachers' scores on the sustainability knowledge test and the results were presented in Table 3.

Table 3. *Two-staged Cluster Analysis Results on the Sustainability Knowledge Test*

Cluster	N	$\bar{x}$	%	Sd
Low-group	111	3.53	12.8	1.41
Mid-group	249	7.94	28.7	1.11
High-group	507	11.49	58.5	1.33

As seen in Table 3, three different groups were determined at the end of the cluster analysis. The group with the low knowledge level was called Low Group, the one with the middle knowledge level was called Middle Group, and the one with the high knowledge level was called High Group. The analysis results showed that Low Group consists of 111 pre-service teachers with a mean score between 3.53±1.41, Middle Group consists of 249 pre-service teachers with a mean score between 7.94±1.11, and High Group consists of 507 pre-service teachers with a mean score between 11.49±1.33.

The metaphors created by the pre-service teachers regarding sustainability were given in Table 4.

Table 4. *Metaphors created by the pre-service teachers regarding sustainability*

Number	Metaphor	(f)	Number	Metaphor	(f)
1	Future	71	17	Education	17
2	Development	63	18	Child	16
3	Recycling	61	19	Intangible	11
4	Life	59	20	Living creatures	11
5	Utopia	57	21	First aid	10
6	Saving	51	22	Growth	9
7	Sun	49	23	Earth	9
8	Water	40	24	Freedom	8
9	Consciousness	33	25	Oxygen	7
10	Human	32	26	Fruit	5
11	Investment	28	27	Heritage	5
12	Balance	26	28	Breathing	4
13	Conserve	23	29	Adaptation	4
14	Green	23	30	Gold	3
15	Bread	22	31	Cliff	2
16	Family	18	32	Mind	2
TOTAL			32		779

As Table 4 illustrates, the pre-service teachers created 32 meaningful metaphors regarding sustainability. Among these, Future (f=71), Development (f=63), and Recycling (f=61) are the first three metaphors with the highest frequencies.

These metaphors created by the pre-service teachers were classified. Categories formed and metaphors of each category were given in Table 5.

Table 5. *Categories of the pre-service teachers' metaphors regarding sustainability*

Number	Category	Metaphors	Number of Metaphors	Number of Pre-service Teachers
1	Vital	Future, Recycling, Life, Sun, Water, Conserve, Green, Bread, Living creatures, First aid, Earth, Oxygen, Fruit, Breathing	14	394
2	Social	Consciousness, Human, Balance, Family, Education, Child, Freedom, Heritage, Adaptation, Mind	10	161
3	Economic	Development, Saving, Investment, Growth, Gold	5	154
4	Will-o-the-wisp	Utopia, Intangible, Cliff	3	70
	TOTAL		32	779

As seen in Table 5, the 32 metaphors created by the pre-service teachers were collected under four different categories. These categories and examples of each category are as follows:

Category 1. Vital: This category involves 14 metaphors stated by 394 pre-service teachers. The metaphors in this category are Future, Recycling, Life, Sun, Water, Conserve, Green, Bread, Living creatures, First aid, Earth, Oxygen, Fruit, and Breathing.

An example of the metaphors in this category is:

(PT. 45) Sustainability is like the sun because life cannot continue without the sun.

Category 2. Social: This category involves 10 metaphors stated by 161 pre-service teachers. The metaphors in this category are Consciousness, Human, Balance, Family, Education, Child, Freedom, Heritage, Adaptation, and Mind.

An example of the metaphors in this category is:

(PT. 367) Sustainability is like a child because he should be taken care of.

Category 3. Economic: This category involves 5 metaphors stated by 154 pre-service teachers. The metaphors in this category are Development, Saving, Investment, Growth, and Gold.

An example of the metaphors in this category is:

(PT. 163) Sustainability is like an investment because we might face some difficult situations if we do not get prepared for the future.

Category 4. Will-o-the-wisp: This category involves 3 metaphors stated by 70 pre-service teachers. The metaphors in this category are Utopia, Intangible, and Cliff.

An example of the metaphors in this category is:

(PT. 601) Sustainability is like a utopia because we know how to call it but cannot see its results, maybe in the future.

The change of the pre-service teachers' metaphors regarding sustainability according to the sustainability knowledge level was presented in Table 6.

Table 6. *Comparison of the Metaphoric Categories According to the Knowledge Level*

		Low-Group		Mid-Group		High-Group	
Number	Categories	f	%	f	%	f	%
1	Vital	79	20.1	134	34.0	181	45.9
2	Social	33	20.5	43	26.7	85	52.8
3	Economic	43	27.9	47	30.5	64	41.6
4	Will-o-the-wisp	37	52.9	21	30.0	12	17.1

X^2= 44.718, sd=6, *p*=.000

As Table 6 shows, the metaphors of the pre-service teachers from the low, middle, and high groups were found to be significantly different (X^2= 44.718, sd=6, p=.000).

The change of the pre-service teachers' metaphors regarding sustainability according to gender was presented in Table 7.

Table 7. *Comparison of the Metaphoric Categories According to Gender*

		Female		Male	
Number	Categories	f	%	f	%
1	Vital	256	65.0	138	35.0
2	Social	88	57.4	73	45.3
3	Economic	57	37.0	97	63.0
4	Will-o-the-wisp	24	54.6	46	45.4

X^2= 47.969, sd=3, *p*=.000

As seen in Table 7, a significant difference was found between the metaphors created by the female and male pre-service teachers (X^2= 47.969, sd=3, p=.000).

4. Discussion, Conclusion and Recommendations

This study investigated the metaphors of pre-service teachers, who are the potential future educational leaders, regarding sustainability according to their sustainability knowledge level and gender. The results revealed that their knowledge level of sustainability is above the average. This shows that the pre-service teachers have a fundamental regarding sustainability. However, the current situation, for pre-service teachers, in particular, is far from the desired. This result was corroborated by those of studies conducted in different parts of the world (Azapagic et all., 2005; Stir, 2006; Spiropouloui Antonakaki, Kontaxaki ve Bouras, 2007). However, the related literature also reported some contradictory results. A study by Tuncer (2008) stated that university students displayed a successful performance in describing sustainability. In a different study by Al-Naqbi and Alshannag (2017), university students were found to have a higher level of knowledge regarding sustainability. These results underline two important points.

The first is the fact that how much tools measuring knowledge level regarding sustainability feature ecological, economic, and social domains would directly affect the results. Summers et al. (2004), in their study found that pre-service teachers had a higher awareness in the ecological domain but relatively lower awareness in the economic and social sub-dimensions. Therefore, the sustainability knowledge level is expected to increase as the weight of ecology information in sustainability knowledge increases. The latter point can be whether university students take a course on sustainability in their undergraduate programs. Knowledge levels and the process of transmitting this knowledge are of critical importance for sustainability to realize its goals. Educational practices regarding sustainability mostly focused on education for sustainable development Waltner, Rieß & Mischo, 2019). Kagawa (2006), highlighted that courses in formal education programs are important for sustainability or sustainable development. The Institute for Higher Education in Turkey made some radical changes in teacher education programs in 2018. The programs used a common language and a wide range of lessons for all pre-service teachers were added. Sustainable Development and Education is among these courses. The course has these headings in its content: Sustainability concept and its areas of use; sustainability in terms social and life sciences; sustainability within the scope of social change; education and sustainability; future of the humanity and sustainability; migration, poverty, and inequality; sustainable environment; ecology, global environmental issues, and sustainability; the sustainable society in harmony with nature; population, economic system, and natural environment; technological developments, consumption patterns and environment; social responsibility practices, sustainability in terms of concrete and abstract cultural heritage; and reconsidering the human-nature relationships within the scope of sustainability. However, an evaluation of the course's contribution to understanding sustainability will not yet be realistic.

Another important result of the study was that the pre-service teachers' knowledge level of sustainability does not change by gender. This result was corroborated by those reported by Azapagic et al. (2005). However, there are also some studies in the literature reporting the contrary. A study by Al-Naqbi and Alshannag (2017) found that females, compared to males, are more knowledgeable regarding sustainability.

The pre-service teachers created 32 meaningful metaphors in four different categories. These categories were termed as Vital, Social, Economic, and Will-o-the-wisp. The pre-service teachers created the highest number of metaphors in the Vital category. In this category, the pre-service teachers mostly mentioned events, phenomena, or objects that are necessary for survival (sun, water, oxygen, etc.), and the measures needed to be taken for the continuity of these (recycling or conserve, etc.). Essentially, the items in the ecosystem were frequently

stated, which might be associated with a higher understanding of individuals towards the ecological aspect of sustainability, as stressed by Summers et al. (2004).

Metaphors in the Vital category are common with the metaphors such as tree, forest, or sun, which are included by Muşlu Kaygısız (2020) in the categories of Benefiting to Future Generations, Building a Balance, and Continuity. It seems that these metaphors coincide with the content of Princen's (2010) Spaceship Earth metaphor. Some of the pre-service teachers in this study associated sustainability with bread. This refers to the fact that metaphors can change from one culture to another (Lakoff ve Johhson 2016). According to some traditions that are still alive in Anatolia, bread is considered sacred and valued among (Durmaz, 2020). It is a noteworthy result that some pre-service teachers indicated bread as a sustainability metaphor, which is an important nutrient source for the continuity of life, as air and water. This metaphor is thought to be original in the related literature.

In addition to the metaphors considered in the Vital category, the pre-service teachers produced metaphors such as conscious, human, family, or education, which stress the social dimension of sustainability. Conscious and education are important for pre-service teachers to relate sustainability with education because it is not possible to knowledge sustainability goals without education (Vare and Scott, 2007). This result was parallel to those reported by Muşlu Kaygısız (2020) on the metaphors in the Equality category. The pre-service teachers also produced some metaphors in the economic aspect of sustainability. Considering the concepts of growth and development, in particular, the effect of the definition made by the Brundtland Report was once again understood. Carew and Mitchell (2006), also reported similar results regarding the metaphor Sustainability as Trading. On the other hand, Princen (2010) stated that if the unsustainable societies had a single metaphor, that would be growth. It stands as an original perspective. Nevertheless, sustainability within the scope of its economic aspect aims growth without harming the environment. Another metaphoric category found by the present study is Will-o-the-wisp. The meaning of this idiom is stated in the Cambridge Dictionary as “something that is impossible to get or achieve”. Some pre-service teachers see sustainability as a phenomenon that cannot be reached and achieved. This might stem from the lack of a clear definition of sustainability or distant future inferences rather than achievable goals. Sztumski (2008) concluded that sustainability is partially fiction, illusion, utopia, and even swindle.

The pre-service teachers were clustered into three groups, low, middle, and high, according to their knowledge level of sustainability. The metaphors created by these three groups significantly varied from each other. The most striking result here is the pre-service teachers from the low group mostly produced metaphors involved in the Will-o-the-wisp category that indicates that sustainability is impossible to realize and achieve. This is not a surprising result because individuals produce positive opinions regarding the issues they are more familiar with and are more likely to avoid talking or state negative opinions regarding the issues they are not that familiar with.

The study investigated the pre-service teachers’ metaphors regarding sustainability according to gender. The results obtained revealed a significant difference between the female and male pre-service teachers’ metaphors. The female pre-service teachers mostly produced environment- and nature-based metaphors that were included in the Vital category, while the male pre-service teachers produced metaphors that were considered under the Economic category. Studies on environmental education particularly reported that females, compared to males, display more positive attitudes towards the environment (Ağtaş, Bektaş & Güneri, 2019; Akıllı & Yurtcan (2009); Aydın, Şahin & Korkmaz, (2013), Bergman, (2015); Bozdemir & Fazi, 2018; Çelikler & Aksan, 2015; Çimen & Benzer, 2019; Ek, Kılıç, Öğdüm, Düzgün & Şeker, 2009; Erdal,Kılıç & Şahin, 2012; Fremerey & Bogner, 2015; Kahyaoğlu & Özen, 2012;

Kışoğlu, Gürbüz, Erkol, Akar & Akıllı, (2017); Koç & Kuvaç, (2016); Köse, Azrak & Bayır, 2020; Milfont & Duckitt, 2010; Sadık & Çakan, (2010); Straughan & Roberts, 2019; Sutton & Gyuris, 2015).

Therefore, it is not an unexpected result that the metaphors the female pre-service teachers produced are in the environment-nature axis.

Planned education practices play a key role in sustainability to realize its goals. If education is associated with a long-running marathon through a metaphor, we will be one step closer to reaching the desired world conditions by training future teachers in a well-equipped manner regarding sustainability.

Considering all results found by the present study, particular importance should be attached to the Sustainability concept in formal education. There are some initiatives related to sustainability. Nonetheless, the basis for these initiatives have not been fully built yet, which leads to the insufficient course materials, and only a small portion of pre-service teachers had the chance to benefit from selective courses on sustainability. All these points make it inevitable to make some future arrangements to eliminate these drawbacks.

Future studies can also be conducted on the negative metaphors found by this present study. Therefore, a more detailed analysis can be made on these metaphors and the cause-and-effect relationships can be unfolded. The change of metaphors produced on the concept over time can be monitored with longitudinal studies.

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