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ANALYZING ATTITUDES TOWARDS CLIMATE CHANGE AND ENVIRONMENTAL PROBLEMS BY USING VARIOUS METHODS

Çeşitli Yöntemler Kullanılarak İklim Değişikliği ve Çevre Sorunlarına Yönelik Tutum Analizi

Volkan DURAN* **Mehmet Ali ÇELİK**

Öz

Bu çalışmanın amacı çeşitli yöntemler kullanılarak iklim değişikliği ve çevre sorunlarına yönelik tutumları incelemektir. Bu araştırma, hem nitel hem de nicel verilerin kullanıldığı karma yöntemli bir çalışmadır. Bibliyometrik analiz için dokümanlar Scopus indeksinden seçilmiştir. Bu araştırmanın örneklemi, kolayda örnekleme yöntemi kullanılarak, Iğdır Üniversitesi Fen-Edebiyat Fakültesi Coğrafya Bölümünde öğrenim gören 190 öğrenci içerisinden belirlenmiştir. Araştırmada elde edilen bulguları, literatür doğrultusunda tartışmak ve literatürle eşleştirmek amacıyla bibliyometrik ağ analizi uygulanmıştır. Bulgular, öğrencilerin epistemolojik olarak çevre hakkında yeterli bilişe sahip olmadıklarını göstermektedir. Bu durum beraberinde çevre sorunları hakkında yetersiz bir farkındalık ortaya çıkarmaktadır. Bir başka deyişle epistemolojik tuğlanın eksik olması beraberinde çevre bilinci eksikliğine yol açmaktadır. Bibliyometrik ağ analizi sonuçları, günümüzde ekolojik sorunların küresel düzeyde olmasına rağmen, çevre sorunları bağlamında tutarlı bir küresel ağ araştırması olmadığını göstermektedir. Son olarak, hem bibliyometrik analiz hem de öğrenci cevapları, çevre sorunlarının sosyal boyutlarını görmezden geldiklerini ve sadece fiziksel nedenlere odaklanabildiklerini göstermektedir.

Anahtar Kelimeler: İklim Değişikliği, Çevre Sorunları, Duygusal Alan, Yapay Sinir Ağı Analizi, Yol Analizi

Abstract

The aim of this study is to examine attitudes towards climate change and environmental problems using various methods. This research is based on a mixed research design where both qualitative and quantitative data were used. The sample of this research consists of 190 students in the geography department in the Science and Letters Faculty of Iğdır University by using the convenience sampling method. The documents for the bibliometric analysis were selected from the Scopus index. Findings indicate that students' epistemologically awareness seems to be low which leads to a lack of environmental consciousness because they have a poor understanding of environmental issues. The bibliometric analysis shows that there is no coherent global network research in the context of environmental issues although today's environmental problems are at the global level. Secondly, both bibliometric analysis and student answers show that they ignore the social dimensions of the environmental problems and they can only focus on the physical causes.

Keywords: Climate Change, Environmental Issue Attitude, Affective Domain, Artificial Neural Network Analysis, Path Analysis

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INTRODUCTION

Climate change and environmental issues are shown as one of the most important problems of this century (Schneider, 2001; Scholze et al., 2006; Erlat, 2010; Türkeş, 2012; Şen et al., 2013; Çukur, 2014; Topuz and Karabulut, 2018; Sar, Avcı and Avcı, 2019). Social awareness and the attitude of the individual are very important in the solution of environmental problems and climate change (Semenza, 2008; Mavrodieva, 2019). The gigantic of the problem must be clearly explained in order to change people's attitudes and behaviors. In this context, people's attitudes and behaviors towards climate change and environmental problems should be measured with surveys and other methods.

Recent scientific literature cultivates the notion that humans are inherently emotional creatures and emotional growth has a significant impact on human development and behavior in many different ways (Brett et al., 2003). Information and data alone do not reveal the whole spectrum of human cognitive functions. Data and information aren't the sole sources of knowledge, wisdom, and ideas; they are linked to emotional states that arise simultaneously with the cognitive learning process. We do not base our choices on knowledge, but we are also influenced by feelings, which pertain to it. Most of our motivations and drives originate from our emotional states. Even though many see the emotional domain as extremely opposite to the cognitive domain and chaotic, there are levels, layers, and structures inside that domain as well. According to the affective domain taxonomy of Bloom et al., (1956), there are five stages of noticing a particular issue "Receiving/attending", "Responding", "Valuing", "Organizing", and "Characterizing" (Figure 1). Receiving refers to awareness, willingness to hear, selected attention of phenomena which is environmental problems in there. Responding refers to active participation in environmental problems. Valuing refers to the worth or value a person attaches to environmental problems. Organizing stands for the organization's values into priorities by contrasting different values, resolving conflicts between them, and creating a unique value system for environmental problems. Characterizing is related to the internalization of values and having a value system that controls their behavior regarding environmental attitudes.

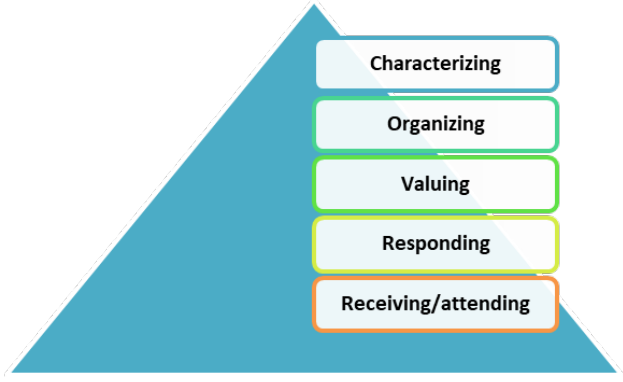

Figure 1: The Affective Domain Taxonomy of Bloom et al., (1956)

On the other hand, it should be emphasized that affective research domain is less presented than cognitive research. According to the assumption that it is difficult to differentiate the affective domain from the cognitive and psychomotor fields, hardly any research is being done in this area. For this reason, it is believed that this research contributes to the existing literature in that it explores how students' views about the environment vary depending on their emotional states. Tekin (2003: 209) went further by suggesting that instructors ignore the attainment and assessment of affective learning. The research is thought to be significant not only in terms of statistical models and mathematical analysis for affective evaluation of the students.

Today, environmental awareness and long-term economic development are necessary for both present and future generations to live comfortable lives (Roseland, 2000; Rees, 2003). Both developed and developing nations are interested in increasing public knowledge about environmental sustainability (Guo and Marinova, 2011). Education is essential to increasing public

knowledge about environmental issues, therefore each country should manage its education. New environmental problems will persist as long as global emissions levels continue to increase, as are levels of species variety loss, drought+s, and desertification. It is expected that the conclusions of this study would assist with environmental education and emphasize its importance, as well as preparation for potential studies.

Recent research on learning seems to place more emphasis on the emotional realm. It is also important to consider that individuals' emotions impact their attitudes and beliefs, as emotions are vital for an individual's well-being (Broekens et al., 2007; Lopes et al., 2004). The literature is an important source for determining the background of any research. However, it is also an important source to reveal the current epistemology and perspective regarding any concept taught in higher education. Thomas Kuhn, in his work titled "The Structure of Scientific Revolutions", claimed that the concepts, perspectives, and tools that teach scientists their profession come from "textbooks". According to him, the books in question are "inevitably persuasive and pedagogical" and teach a paradigm and way of thinking (Öztürk, 2018). In this respect, we can see such an epistemological perspective in the current scientific literature. Therefore, the reason for relating bibliometric literature review with student answers is that academic studies are reflected in higher education curricula and courses. In this respect, there should be a direct and indirect relationship with students' views in terms of content or epistemology. Therefore, the purpose of this study is to find out whether the students have required attitudes regarding environmental issues in the direction of bibliometric studies of the relevant literature.

METHODOLOGY

Environmental issues are getting more destructive day by day (Çelik et al., 2017; Gülersoy et al., 2021). This problem is shown as a great danger by many researchers. In this study, attitudes towards environmental problems are analyzed using survey and bibliometric analysis methods. The aim of this study investigates the Environmental Problems Attitudes of students in social sciences studying in terms of different variables in the direction of bibliometric analysis. the bibliometric analysis method is used in many research (Kulak et al., 2019; Çelik, 2020; Çelik et. al, 2021).

There are two types of analysis was used in this research. The first one is the bibliometric analysis. In the bibliometric analysis of this study, Wyndham Hulme was the first to utilize the "Bibliometric" approach, which is based on bibliographic data and indicates broad trends in scientific publications as well as links between these articles, under the name of "Statistical Bibliography". With the use of mathematical and statistical methodologies, this notion was utilized to assess the book or other media communication tools available. The use of the bibliometric approach is becoming more popular across a broad range of disciplines to demonstrate the evolution and development of research by showing the quantitative analysis of scientific publications (Gülmez et al., 2020). Many different tools can be used in the bibliometric analysis, but the VOSviewer program was used for this analysis in this study. In this research, the data was selected from the Scopus index. The first reason why we selected the Scopus index is that the usage of the data from the Scopus index is more compatible to work with the VOSviewer program than other indexes. Secondly, it is widely regarded as among the most comprehensive abstraction and citation databases for peer-reviewed journals in the world. In other words, when a Scopus indexed journal is referred to as such, it signifies that the works published in their journals are also referenced among the 70 million other works that are included inside the Scopus database.

The second part of the research is based on a mixed research design where both qualitative and quantitative data were used. The sample of this research consists of 190 students in the geography department in the Science and Arts Faculty of Iğdır University by using the convenience sampling method, which is a type of non-probability sampling method where the sample is taken from a group of people easy to contact or to reach in terms of time, money (Büyüköztürk et al., 2014).

The quantitative part of this research is based on a descriptive study carried out using a cross-sectional survey model. According to Karasar (2003), survey models are a research approach that aims to describe the present situation as it is. In the cross-sectional screening model, the aim is to define the condition of the screened case at any time (Özdemir, 2015). A

random sampling of the variables involves completing a questionnaire centering on the variables of the topic the researcher is interested in. Additionally, we use the formula of the number sample size suggested by (Tabachnick & Fidell, 2007) given as follows:

N> 50 + 8m

N: Number of participants m: number of independent variables where m= 11 (5 independent variables from the scale, 6 variables from demographic variables, and survey questions)

N> 138 where the target sample size for this study is 190 which meets the requirement.

In the quantitative study, we firstly asked, students whether they have an active interest in environmental problems as a yes/no question and qualifications and knowledge perception about environmental problems are asked as a 5-point Likert type item. Based on two questions, we analyzed The Environmental Problems Attitude Scale. We conceived those two questions like a demographic variable question like gender or departments having discrete dimensions. The Environmental Problems Attitude Scale which provided validity and reliability was developed as a result of the study conducted by Güven (2013). In this 3 point Likert-type scale, there were distinguishing conclusively strong 45 items in the scale. The Cronbach's alpha coefficient was found to be .88 by Güven (2013). It has five sub-dimensions classified according to affective domain taxonomy of Bloom et al., (1956). There are three answers in this scale as "agree", "disagree", "not sure".

Furthermore, open-ended questions were used for the analysis as well in the direction of those survey questions based on expert suggestions. The conceptual questions regarding environmental problems are given "What are the first concept or word that comes to mind when you think of environmental problem?" and "What is the first word or concept that comes to mind when you think of the environment?" to investigate the frequencies and links in the concepts in their answers. In the second part, the conceptual and emotional questions regarding climate change were asked to students. The questions are "What are the first concepts that come to mind about climate change?", "How do you feel about the effects of climate change?" and "Do you think which species will be most affected by climate change: (animals, people, plants, etc.) What are your feelings about it?".

ANALYSIS

The studies that were included in the bibliometric analysis were chosen based on three main criteria. These criteria were as follows: 1) the publication must be from social sciences, the publication must focus on environmental problems, and the publication must fall into the research or review category. Therefore, 378 document results were found in this Scopus index. In the analysis, we focus on network visualization and density visualizations. In the network visualization, items are represented by their label and by default additionally by a circle. The size of the label and the circle of an item is determined by the weight of the object. The bigger the weight of an object, the larger the label and the circle of the item. The distance between two labels in the picture roughly shows the relatedness of the journals in terms of co-citation relationships (Van Eck & Waltman, 2020). The research questions guiding the study are as follows:

1. What are the country distributions of relevant publications?

2. What are the keyword distributions of relevant publications based on co-occurrences?

In the analysis of the quantitative data, non-parametric tests were used such as Mann-Whitney-U tests, Kruskal Wallis test, Spearman correlational analysis since the data is not normally distributed according to Kolmogorov–Smirnov test results (Table 1).

Table 1: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
receiving	,144	190	,000	,956	190	,000
responding	,193	190	,000	,847	190	,000
Valuing	,145	190	,000	,933	190	,000
Organizing	,169	190	,000	,888	190	,000
Characterizing	,127	190	,000	,959	190	,000

a. Lilliefors Significance Correction

Furthermore, artificial neural network analysis for the importance of the variables as well as the path analysis in the AMOS program was used. In the analysis process, firstly the normalized importance values are examined, secondly, correlation values are investigated and finally, the causal relationships among the dimensions are examined in the path analysis which is used for the analysis of causal links (Figure 2). In the analysis, firstly the normalized importance values are examined, secondly, correlation values are investigated and finally, the causal relationships among the dimensions are examined in the path analysis. We look at those separately, because importance, correlation, and causation are not the same concepts. Some variables may have relative importance but might not have correlation and causation. For example, one might want to have a job and any job adverts might be important for him/her but the jobs that are not relevant to this person's qualifications are not correlated with his/her interests. Similarly, some jobs Indeed are correlated with one's interests but they are not causally linked with a person's current conditions. For example, the job is suitable but it is in a very far place that this person cannot get it. It should be noted that it is the main limitation of the study that those analyses reflect the conceptual distinction among those three concepts.

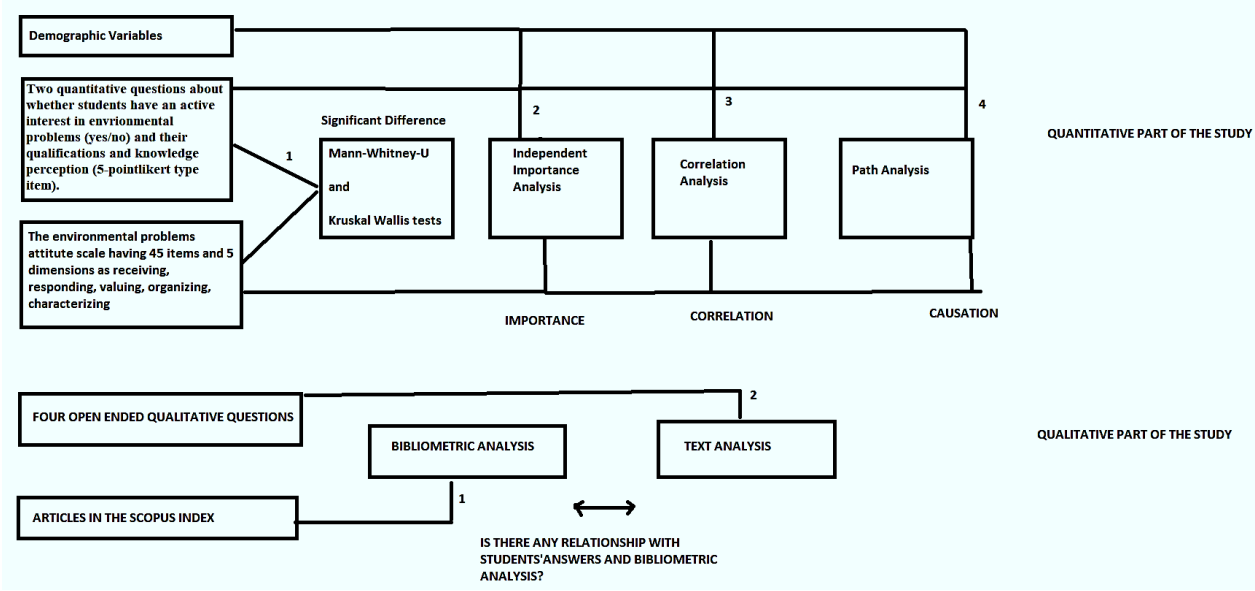

Figure 2: In the analysis, firstly the normalized importance values are examined, secondly, correlation values are investigated and finally, the causal relationships among the dimensions are examined in the path analysis.

Independent variable importance analysis performs a sensitivity analysis, which computes the importance of each predictor in determining the neural network. The combined training and testing samples are used in the analysis, or if there is no testing sample, just the training sample is used in the analysis. In this case, a table and a bar chart are generated, illustrating the relative value and normalized importance of each predictor. When dealing with large numbers of predictors or instances,

it is important to keep in mind that sensitivity analysis is computationally costly and time-consuming (https://www.ibm.com/docs/en/SSLVMB_26.0.0/pdf/en/IBM_SPSS_Neural_Network.pdf).

In the analysis of the normalized importance values from neural network analysis, correlation values are conceptualized based on the equations and they are examined by Graph commons. Graph Commons is a data mapping, publishing, and analytics platform. The platform was founded by Burak Arıkan in 2011. Analyzing, examining, and using huge quantities of data is possible. A web-based project, called Graph Commons, helps to explore, analyze, and re-use data. Graph commons, various complex relationships that are not normally visible at first glance are collaborating and data is compiled and mapped (Tapkı, 2020: 74-75). The sample of this research is thought to be compatible with neural network analysis because there is no underlined and common rules o specify the required number of participants in the literature. There are also studies conducted with different samples showing that there is no consensus for this therefore we assume that our sample is compatible with neural network analysis (Akgün, 2017; Yaraş, 2017; Yorgancı, 2018; https://www.ibm.com/docs/en/SSLVMB_26.0.0/pdf/en/IBM_SPSS_Neural_Network.pdf). In the network analysis, centrality measures the importance of actors in the network, showing which actors are at the center. The subheadings of the centrality measurement (degree, closeness, and in-betweenness) determine the position of the individual by calculating the proximity of the actor to the actions in the center. Degree centrality shows the level of the centrality of the individual by calculating the direct connections of the actor. Internal-degree centrality refers to the number of direct links to the actor, in other words, the state of other actors in the network communicating with this actor. A high in-degree indicates that the actor is preferred by other actors for communication. Betweenness centrality; is the degree to which an actor in the network is (on their way) amongst other actors (Gezen, 2018: 34-35; Uçar Altun, 2018).

The qualitative analysis was done by open-ended questions asked 35 students selected randomly in the sample in two phases. In the first phase, the conceptual questions regarding environmental problems as given "What are the first concept or word that comes to mind when you think of environmental problem?" and "What is the first word or concept that comes to mind when you think of the environment?" to investigate the frequencies and links in the concepts in their answers. In the second part, the conceptual and emotional questions regarding climate change were asked to students. The questions are "What are the first concepts that come to mind about climate change?", "How do you feel about the effects of climate change?" and "Do you think which species will be most affected by climate change: (animals, people, plants, etc.) What are your feelings about it?". For the analysis of the qualitative data, we use frequency and link analysis from Voyant Tools (https://voyant-tools.org/) that is a web-based reading and analysis environment for digital texts. It can analyze the frequencies of texts and create links through the answers. We compare students' answers with bibliometric analysis results to reveal whether there are any meaningful relationships between the two results.

FINDINGS

Bibliometric Analysis Results for the term "Environmental Problems"

As mentioned previously, 378 document results were found in this Scopus index. When categorizing those articles, the minimum number of documents per country based on co-authorship as a threshold was chosen to be 10 so that 14 countries from 88 of them could pass this threshold. As can be seen, China and the United States are the leading countries in terms of environmental problems in the context of documents, citations, and total link strength. Turkey is the third one in terms of documents and possibly the citations weaken its total link strength (Table 2).

Table 2: The Country Distributions of Relevant Publications

Country	Documents	Citations	Total Link Strength
China	97	1194	18
United States	42	725	21
Turkey	20	30	1
Brazil	19	61	1
Spain	18	150	1
Canada	16	223	8
India	16	127	6
Japan	15	214	3
Russian Federation	15	48	0
United Kingdom	13	132	6
Australia	12	198	4
Germany	10	162	4
South Korea	10	137	4
Indonesia	10	12	3

According to network visualizations based on co-authorship, there are four clusters in terms of total link strength. The first cluster includes China, the United Kingdom, and Germany. The second cluster encapsulates India, South Korea, Japan, and Indonesia. The third one embraces Australia and Canada. The Fourth one includes the United States, Brazil, Turkey, and Spain. According to density visualizations based on co-authorship in terms of total link strength, Asian countries like South Korea, Japan, and India are related to China except for the United Kingdom in terms of geography. However, the network of the United States covers a more broad region from Turkey to Spain to Brazil but the connection is not so strong as in the case of China as indicated by the yellow color in the density visualization. It seems that the information flows from China to other countries in Asia in terms of environmental problems but the United States has a more broad information range in terms of this subject (Figure 3).

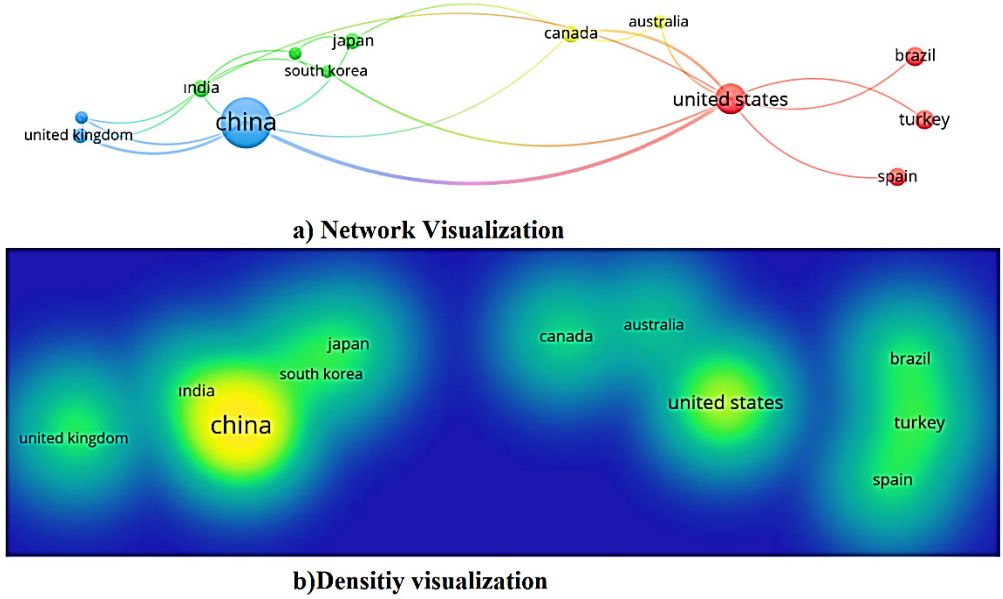

Figure 3: Network and Density Visualizations of the Publications in terms of Countries

The Second Results for the Keyword Distributions of Relevant Publications Based on Co-Occurrences

When categorizing those articles, the minimum number of documents per keyword based on co-occurrences as a threshold was chosen to be 4 so that 20 keywords from 1447 keywords of them could pass this threshold. As can be seen, the first item is the environmental problems keyword but we can ignore it because we made the research based on this keyword. Therefore, sustainable development, climate change, environment, and sustainability are the most occurred words in the articles. It should be indicated that articles mostly focus on the physical dimensions of environmental problems rather than social dimensions. The only term for the social dimension is environmental education which has a separate cluster which will be shown in the following analysis (Table 3).

Table 3: The Keyword Distributions of Relevant Publications Based on Co-Occurrences

Keyword	Occurrences	Total Link Strength
Environmental Problems	72	34
Sustainable Development	11	11
Climate Change	10	4
Environment	10	11
Sustainability	10	6
Environmental Education	7	9
Air Quality	6	2
Land Use	6	2
Water Quality	6	1
Pollution	5	6
Ecosystem	4	5
Electric Vehicle	4	1
Energy Efficiency	4	0
Environmental Policy	4	4
Groundwater	4	0
Land Degradation	4	4
Soil Erosion	4	2

According to network visualizations based on co-occurrences, there are four clusters in terms of total link strength. The first cluster includes sustainability, environmental policy, and air quality. The second cluster encapsulates sustainable development with water quality. The third one embraces the environment and pollution. The Fourth one includes climate change, land use, soil erosion, land degradation. It should be noted that environmental education has no collection with the above keywords and those keywords focus on the physical dimensions of environmental problems.

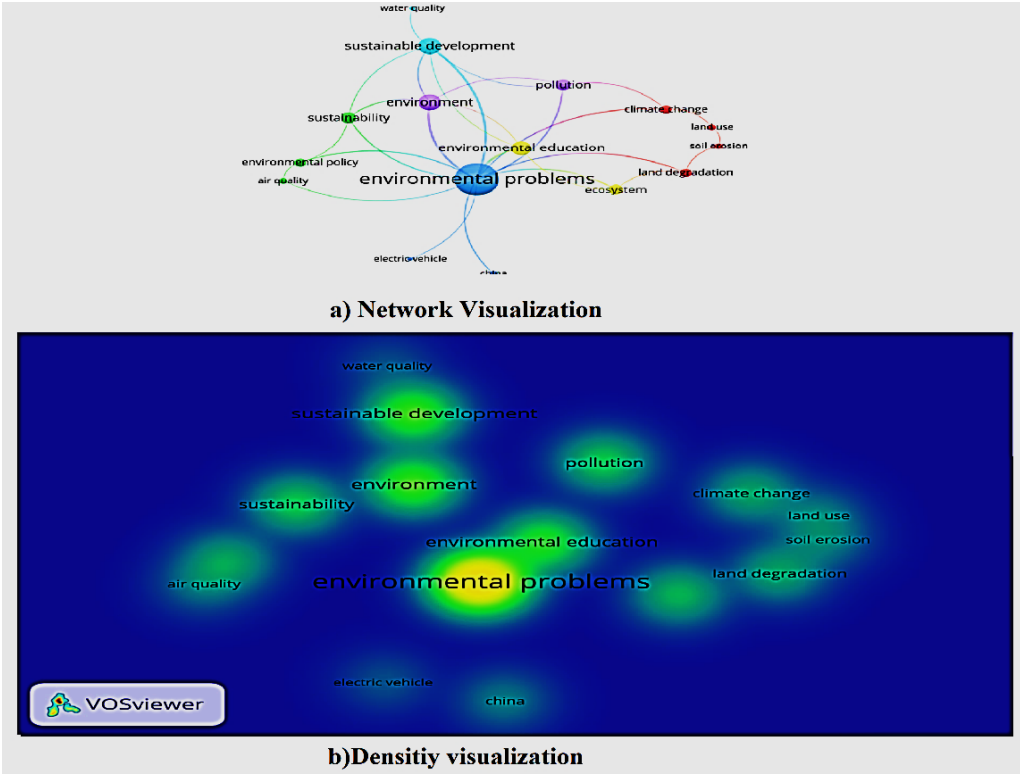

Figure 4: Network and Density Visualizations of the Publications in terms of Keywords

The Quantitative Analysis of the Data: Are There Any Significant Differences in Students' Environmental Problems Attitude in terms of Their Qualifications and Knowledge Perception About Environmental Problems?

The Kruskal Wallis test shows that there is no significant difference between students ' environmental problems attitudes in terms of their qualification perception and knowledge about environmental problems (Table 4).

Table 4: The Kruskal Wallis Test Results in terms of Their Qualification Perception About Environmental Problems

Test Statistics[a,b]					
	Receiving	Responding	Valuing	Organizing	Characterizing
Chi-Square	2,420	7,120	6,730	4,062	6,020
Df	4	4	4	4	4
Asymp. Sig.	,650	,128	,149	,394	,190

[a.] Kruskal Wallis Test [b.] Grouping Variable: qualification perception

Are There Any Significant Differences in Students' Environmental Problems Attitude in terms of Their Active İnterest in Environmental Problems

The Mann-Whitney U Test shows that there is no significant difference between students' environmental problems attitudes in terms of their active interest in environmental problems in receiving, responding, organizing and characterizing dimensions (Table 5).

Table 5. The Mann-Whitney u Test Results in terms of Their Active Interest in Environmental Problems

Test Statistics[a]					
	Receiving	Responding	Valuing	Organizing	Characterizing
Mann-Whitney U	2580,600	2777,600	2250,500	3325,500	3100,000
Wilcoxon W	8000,400	4922,100	4395,500	8784,500	5250,000
Z	-2,610	-1,949	-3,720	-,170	-,900
Asymp. Sig. (2-tailed)	,089	,049	,000	,860	,360

a. Grouping Variable: active

Independent Variable Importance Analysis

In the analysis of the neural networks, the input variables are selected as demographic variables like region, gender, field (geography) as well as their perceptions such as their active interest, their attitude their qualification perception about environmental problems. The output variables are receiving, responding, valuing, organizing, characterizing. There are two hidden layers in the neural network structure given as in figüre 5. The activation function is sigmoid and the error function is the sum of squares. The optimization algorithm is the gradient descent method. IBM® SPSS® Neural Networks uses nonlinear data modeling to discover complex relationships and derive greater value from your data. Take advantage of multilayer perceptron (MLP) or radial basis function (RBF) procedures[1]. Neural networks learn the true function by constructing representations that are a mixture of basic and sophisticated features[2].

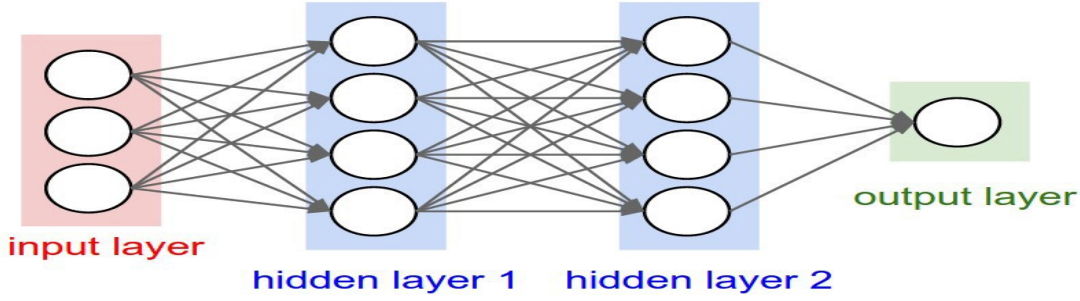

Figure 5: The General Structure of the Neural Networks Used in This Study[3]

Artificial neural networks can adapt to changes in environmental conditions by changing their connection weights. Neural networks can give different results in each trial of calculation based on the patterns. In this respect, neural network structure was performed eight times without changing the parameters (Tepehan, 2011). The neural network analysis shows that the most important values seem to belong to demographic variables rather than perception and attitudes. The first important factor is the region, the second one in the field (geography) and the third one is gender for environmental problems attitude (Table 6). Independent variable importance analysis performs a sensitivity analysis, which computes the importance of each predictor in determining the neural network. However, the results sometimes may vary for each analysis because of the internal structure and pattern of the data. Therefore, we look at the average values for ten trials to ensure the importance of hierarchy in the analysis.

1 https://www.ibm.com/products/spss-neural-networks Retrieved from: 21.06.2021

2 https://towardsdatascience.com/coding-neural-network-forward-propagation-and-backpropagtion-ccf8cf369f76?gi=d49266410d1b retrieved from 21.06.2021

3 https://towardsdatascience.com/coding-neural-network-forward-propagation-and-backpropagtion-ccf8cf369f76?gi=d49266410d1b retrieved from 21.06.2021

Table 6: Normalized Importance Analysis

Variable	Normalized Importance								
	1'st trial	2'nt trial	3'rd trial	4'th trial	5'th trial	6'th trial	7'th trial	8'th trial	Average
Region	93,00%	100,00%	98,00%	44,90%	98,00%	50,00%	90,00%	91,50%	83,18%
Field (Geography)	100,00%	77,00%	78,30%	79,90%	96,50%	95,00%	40,10%	52,80%	77,45%
Gender	89,70%	54,13%	32,45%	72,00%	74,50%	62,20%	97,00%	60,50%	67,81%
Active	30,00%	75,60%	20,10%	93,00%	78,00%	42,00%	50,30%	90,00%	59,88%
Knowledge	55,00%	65,00%	24,45%	56,00%	47,00%	30,23%	45,60%	80,40%	50,46%
Attitude	73,20%	40,00%	22,10%	60,20%	30,70%	32,90%	25,00%	67,90%	44,00%

Spearman Correlational Analysis for the Scale

When the mean values of the students' answers were investigated, it can be proposed that their level could be associated with responding level since they have the highest scores compared to others (Figure 6).

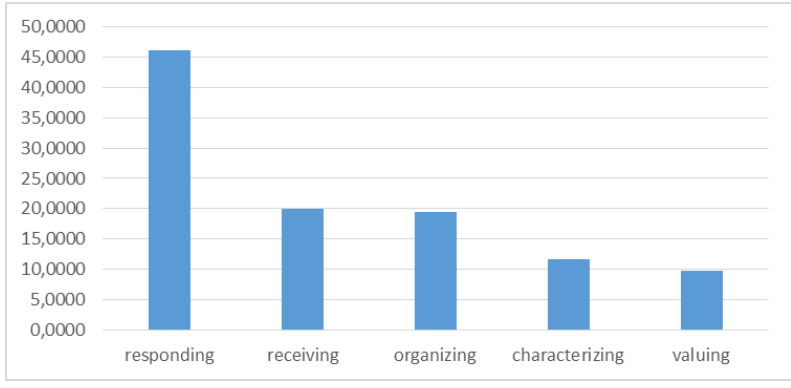

Figure 6: The Mean Values of the Students' Answers

Spearman's correlational analysis of the sub-dimensions of the Environmental Problems Attitude was given in Table 7. It is seen that most of the sub-dimensions have a weak correlation with each other.

Table 7: Spearman's Correlational Analysis

Correlations							
			receiving	responding	valuing	organizing	Characterizing
Spearman's rho	Receiving	Correlation Coefficient	1,000	,234**	-,129	-,194*	,132
		Sig. (2-tailed)	.	,002	,094	,012	,086
	Responding	Correlation Coefficient	,234**	1,000	,290**	,113	,475**
		Sig. (2-tailed)	,002	.	,000	,145	,000
	Valuing	Correlation Coefficient	-,129	,290**	1,000	,307**	,420**
		Sig. (2-tailed)	,094	,000	.	,000	,000
	Organizing	Correlation Coefficient	-,194*	,113	,307**	1,000	,194*
		Sig. (2-tailed)	,012	,145	,000	.	,011
	characterizing	Correlation Coefficient	,132	,475**	,420**	,194*	1,000
		Sig. (2-tailed)	,086	,000	,000	,011	.

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

To understand the real structure behind the correlational analysis to create a model for this, a graph showing the connections and weights was drawn by the researchers. It was observed that the receiving dimension has two connections, the responding dimension has three connections, valuing dimension has three connections, organizing has three connections, and characterizing has three connections as well in which connection refers to the significant correlation at the 0.01 level or 0.05 level (2-tailed) in there.

First of all, the number of connections or correlations is not adequate to evaluate the structure underlying the correlational analysis since maybe certain dimensions have more connections but less correlation, some of them have a fewer connections but greater correlation. The interpretation of the range of the correlation coefficient was, therefore, utilized to evaluate the strength of these values where the categorization was created as follows:

Very weak correlation or no correlation if $r < 0.2$

Weak correlation between 0.2-0.4

A moderate correlation between 0.4-0.6

The high correlation between 0.6-0.8

If 0.8 >, it is interpreted that there is a very high correlation.

To concretize those ranges, we assign numbers for each range just as in 5-point Likert type scales. According to this, very weak correlation takes 1 point, weak correlation takes 2 points, moderate correlation takes 3 points, high correlation takes 4 points and finally, very high correlation takes 5 points. It is interpreted that if the correlation is positive, each range takes a positive point, otherwise they take a negative point. We can consider nodes as sub-dimensions.

and we can define each connection strength of nodes can be represented as Ls and define the formula for this as follows:

$$Ls=c_i \times p_j \qquad \text{Eqn 1}$$

Hence, the strength of the connection was calculated by the formula given below:

$$S_{sub-dimension-i} = \sum L_s = \sum_{i=0}^{n} c_i \times p_i \qquad \text{Eqn 2}$$

Where S stands for strength of the connection, ci connection number, pi refers to the connection point. To understand how the formula works, let us look at the strength of the connection of the receiving dimension. There are 1 positive weak connection and 1 negative very weak connection. One is a negative correlation so that it takes-1, hence our formula for the sub-dimension of responding can be given like this:

$$S_{receiving} = \sum_{i=0}^{n} c_i \times p_i = 1 * (-1) + 1 * 2 = 1$$

Therefore we find

$$S_{responding} = \sum_{i=0}^{n} c_i \times p_i = 1*2+1*3+1*2=7$$

$$S_{valuing} = \sum_{i=0}^{n} c_i \times p_i = 1*2+1*3+1*2= 7$$

$$S_{characterizing} = \sum_{i=0}^{n} c_i \times p_i = 1*3+1*3+1*1=7$$

$$S_{organizing} = \sum_{i=0}^{n} c_i \times p_i = 1*-1+1*1+1*2=2$$

The neural network analysis was used to highlight the relative importance of each sub-dimension using a model that has two hidden layers, one of which has an activation function of hyperbolic tangent and the other of which has an activation function of the sigmoid. Through the use of an optimization method known as gradient descent, a set of hidden layers was developed, the hidden layer of which has the hyperbolic tangent activation function and the output layer of which has the sigmoid activation function. Table 8 below shows the findings of correlations with the values of the importance levels are calculated based on the average values of three trials since neural networks can give different results in each trial of calculation based on the patterns. We can modify the strength of the connection was calculated by the formula given equation 2 where ik stands for the point from importance level based on the following values:

$$\text{If } 0 \leq i_k < 20, \text{then } i_k = 1$$

$$\text{If } 20 \leq i_k < 40, \text{then } i_k = 2$$

$$\text{If } 40 \leq i_k < 60, \text{then } i_k = 3$$

$$\text{If } 60 \leq i_k < 80, \text{then } i_k = 4$$

$$\text{If } 80 \leq i_k \leq 100, \text{then } i_k = 5$$

Table 8: The Neural Network Analysis of the İmportance Level of Each Sub-Dimensions Based on the Average Values of Three Trials for the Importance Levels with Correlations

			Receiving	Responding	Valuing	Organizing	Characterizing
Spearman's rho	Receiving	Correlation Coefficient	1,000	,220**	-,120	-,180*	,112
		Sig. (2-tailed)	.	,002	,094	,012	,086
		Importance level	------	65,3 %	40,2%	37,4%	41,10%
		Importance level point	------	4	3	2	4
	Responding	Correlation Coefficient	,220**	1,000	,270**	,113	,484**
		Sig. (2-tailed)	,002	.	,000	,145	,000
		Importance level	93,0 %	------	62 %	54 %	98,00%
		Importance level point	5	------	4	3	5
	Valuing	Correlation Coefficient	-,120	,260**	1,000	,295**	,400**
		Sig. (2-tailed)	,091	,000	.	,000	,000
		Importance level	85,7%	73,2%	------	82,9 %	74,34 %
		Importance level point	5	4	------	5	4
	Organizing	Correlation Coefficient	-,191*	,113	,323**	1,000	,187*
		Sig. (2-tailed)	,010	,140	,000	.	,010
		Importance level	23,45%	24,8%	84,2%	-----	62,44%
		Importance level point	2	2	5	-----	4
	Characterizing	Correlation Coefficient	,132	,470**	,400**	,190*	1,000
		Sig. (2-tailed)	,080	,000	,000	,010	.
		Importance level	54,1%	100,0%	93,8%	95,2%	-----
		Importance level point	3	5	5	5	-----

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

We can modify equation 1 by adding the importance level value

$$Ls = c_i \times p_j \times i_k \qquad \text{Eqn 3}$$

Therefore the new modified formula for the strength of the nodes can be represented by each node defined as a sub-dimension:

$$S_{sub-dimension-i} = \sum L_s = \sum_{i=0,j=0,k=0}^{n} c_i \times p_j \times i_k \qquad \text{Eqn 4}$$

The strength values can be found as below:

$S_{receiving} = \sum_{i=0,j=0,k=0}^{n} c_i \times p_j \times i_k = (1 * (-1) * 2) + (1 * 2 * 5) = 8$

$S_{responding} = \sum_{i=0,j=0,k=0}^{n} c_i \times p_j \times i_k$= (1×2×4)+(1×3×5)+(1×2×4)=31

$S_{valuing} = \sum_{i=0,j=0,k=0}^{n} c_i \times p_j \times i_k$= (1×2×4)+(1×3×5)+(1×2×4)= 31

$S_{organizing} = \sum_{i=0,j=0,k=0}^{n} c_i \times p_j \times i_k$ = (1×(-1)×2)+(1×1×5)+(1×2×5)=13

$S_{characterizing} = \sum_{i=0,j=0,k=0}^{n} c_i \times p_j \times i_k$= (1×3×5)+(1×3×4)+(1×1×4)=3

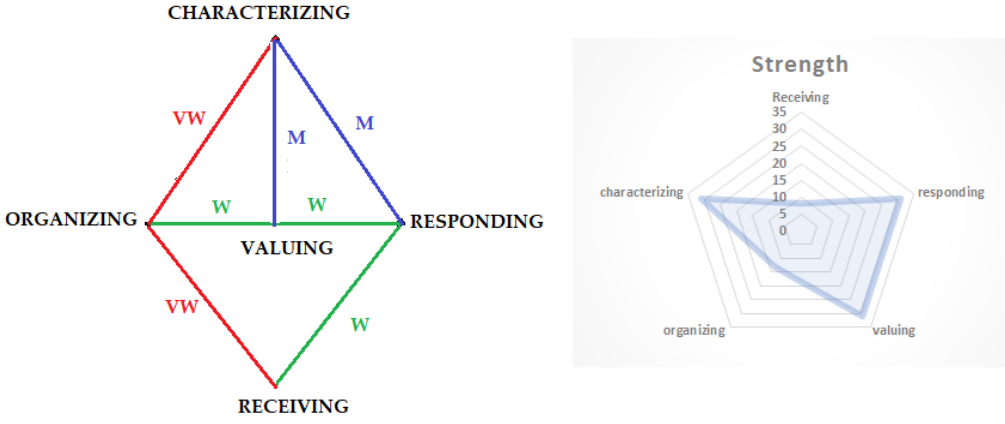

Figure 7: The schematization of the calculation of strength value of each sub-dimension and their connection graph (left) their web graph based on the strength value based on equation 2 and equation 4 (right)

We can create a table 9 based on the absolute value of equation 3 $|\mathrm{Ls} = c_i \times p_j \times i_k|$

As for the node of receiving, there are two connections:

$|Ls_{receving \rightarrow responding}| = |(1 * 2 * 5)| = 10$

$|Ls_{receving \rightarrow organizing}| = |(1 * (-1) * 2)|) = 2$

As for the node of responding there are three connections:

$|Ls_{responding \rightarrow receiving}| = |(1 \times 2 \times 4)| = 8$

$|Ls_{responding \rightarrow characterizing}| = |(1 \times 3 \times 5)|) = 15$

$|Ls_{responding \rightarrow valuing}| = |((1 \times 2 \times 4))|) = 8$

As for the node of valuing there are three connections:

$|Ls_{valuing \rightarrow responding}| = |(1 \times 2 \times 4)| = 8$

$$|Ls_{valuing \rightarrow characterizing}| = |(1 \times 3 \times 5)|) = 15$$

$$|Ls_{valuing \rightarrow organizing}| = |((1 \times 2 \times 4))|) = 8$$

As for the node of organizing, there are three connections:

$$|Ls_{organizing \rightarrow receiving}| = |(1 \times -1 \times 2)| = 2$$

$$|Ls_{organizing \rightarrow valuing}| = |(1 \times 2 \times 5)|) = 10$$

$$|Ls_{organizing \rightarrow characterizing}| = |((1 \times 1 \times 5))|) = 5$$

As for the node of characterizing there are three connections:

$$|Ls_{characterizing \rightarrow responding}| = |(1 \times 3 \times 5)| = 15$$

$$|Ls_{characterizing \rightarrow valuing}| = |(1 \times 3 \times 4)|) = 12$$

$$|Ls_{characterizing \rightarrow organizing}| = |((1 \times 1 \times 4))|) = 4$$

Table 9: Nodes and Connections According to Strength Formula Developed by the Researchers*

→	Receiving	Responding	Valuing	Organizing	Characterizing
Receiving	0	10	0	2	0
Responding	8	0	8	0	15
Valuing	0	8	0	8	15
Organizing	2	0	10	0	5
Characterizing	0	15	12	4	0

*Black numbers are taken as in red ones are taken as out

Therefore we create a network based on the values in Table 7. By taking the value of clustering resolution 0.7 we reached a model given in figure 6. It should be noted that the higher values of clustering resolution gave the same results.

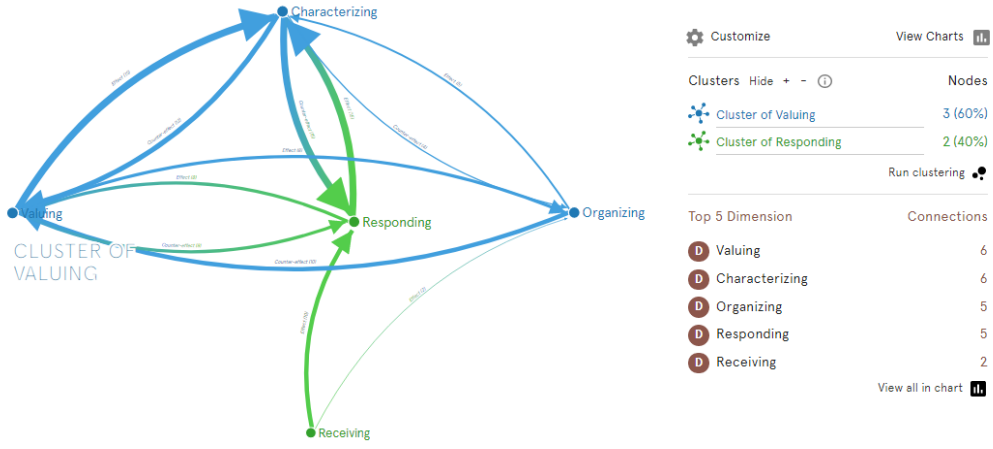

Figure 8: Clustering of the Network

Figure 8 shows that there are two clusters in the network one is the cluster of valuing and the other is the cluster of responding. Degree centrality, in-degree centrality, out-degree centrality, betweenness values of the network was given in Table 10.

Table 10: Degree Centrality, In-Degree Centrality, Out-Degree Centrality, Betweenness Values of the Network

	Receiving	Responding	Valuing	Organizing	Characterizing
Degree Centrality	2	5	6	5	6
In Degree Centra-lity	0	3	3	3	3
Out Degree Centrality	2	2	3	2	3
Betweenness	0.11	1	0.44	1	0.44

The higher the centrality value of a node, the higher the node. will be as important. Therefore, according to degree centrality, the most important factors are valuing and characterizing in this network. Secondly, responding and organizing are important factors, and receiving is the least important factor.

The Path Analysis for Results

We can create a model based on the correlation constants and strength values of each sub-dimensions as given below in Figure 9.

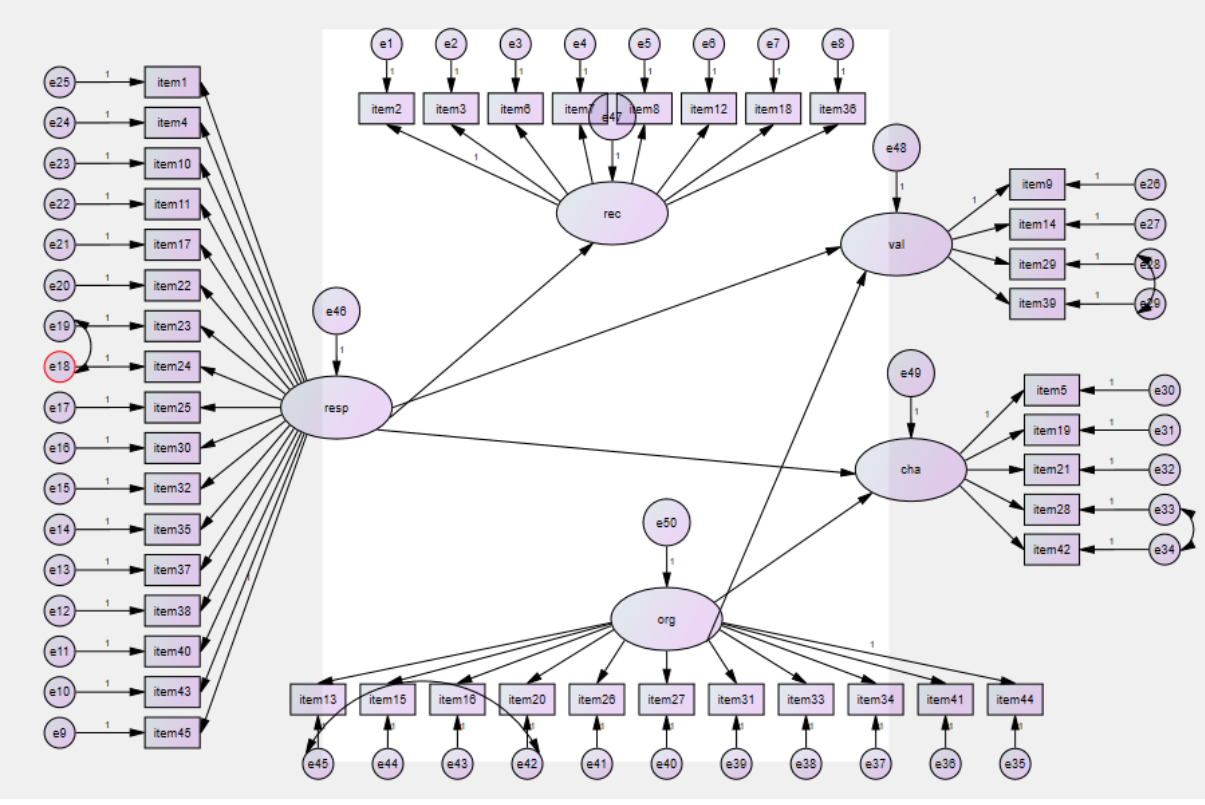

Figure 9: Path Diagram of the Model Based on the Correlation Constants and Strength Values of Each Sub-Dimensions

The path diagram of the model shows that the model is very poor in terms of many variables as given in the table below (Table 11).

Table 11: Path Analysis Results

Hypothesis	Estimate	S.E.	C.R.	P
H1: responding → characterizing	-,620	,260	-2,202	,024
H2: responding → receiving	,054	,300	,135	,870
H3: organizing → valuing	-,015	,026	-,740	,443
H4:responding→valuing	,760	,130	5,700	***
H5:organizing→cahracterizing	-,003	,027	-,148	,876

CMIN/DF= 2,100 CFI= ,500 RMSEA= ,082 AGFI= ,615 PNFI= ,350 GFI= ,657 RMR= ,046 NFI= ,370 IFI= ,520 RFI= ,330
P values less than 0.001 are indicated by ***.

Qualitative Data Analysis: The Analysis of the Survey Questions Regarding Environmental Problems

The survey question given as "What types of attitudes come to mind when you think of environmental problems?" shows that the most frequent words in the corpus of the question are given as pollution (66); nature (49); garbage (39); life (19); air (12); tree (11); cleaning (9); environment (8); greens (8); human (7); clean (6); global (6); warming (6); area (5); environmental (5); habitat (5); domain (4); forest (4); green (4); irresponsibility (4); wastes (4); ecology (3); live (3); living (3); waste (3). It can be seen that most of the attributes are physical ones which are marked as black bold words rather than social variables which are marked as the red and bold words (Figure 10).

Figure 10: Links in the Corpus of the Question "What is the first concept or word that comes to mind when you think of environmental problem?"

The most frequent words in the corpus for the question of "What is the first word or concept that comes to mind when you think of the environment?" given as follows: nature (46); life (17); tree (11); greens (8); air (6); garbage (6); pollution (6); area (5); cleaning (5); environment (5); habitat (5); domain (4); green (4); clean (3); forest (3); live (3); living (3); world (3); breath (2); environmental (2); human (2); people (2); place (2); society (2); soil (2). It can be seen that most of the attributes are physical ones which are marked as black and blod chracters rather than social variables which are marked with red characters (Figure 11).

Figure 11: Links of the Corpus for the Question of "What is the first word or concept that comes to mind when you think of the environment?"

Most frequent words in the corpus of the comparison of two answers of the questions are given as: pollution (66); nature (47); garbage (39); life (19); air (12); tree (11); cleaning (9); greens (8); environment (7); human (7); global (6); warming (6); area (5); clean (5); environmental (5); habitat (5); domain (4); green (4); irresponsibility (4); waste (4); ecology (3); forest (3); living (3); world (3); breath (2). It can be seen that most of the attributes are physical ones which are marked with bold and black characters rather than social variables which are marked the red colors.

The qualitative analysis results show that students also focus on the physical dimensions of the environmental problems just as the analysis of the keyword in literature. Links of the corpus for the answers to two questions show that the relationships among the variables are also on physical level (Figure 12).

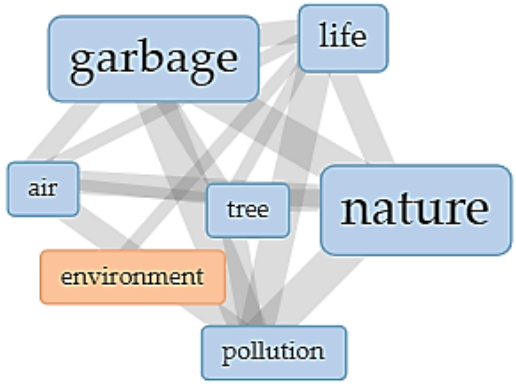

Figure 12: Links of the Corpus for the Answers to Two Questions

The Analysis of the Survey Questions Regarding Climate Change

The survey question given as "What are the first concepts that come to mind about climate change?" shows that the most frequent words in the corpus of the question are given as climate (15); change (14); greenhouse (8); increasing (8); drought (7); temperature (7); gases (6); global (6); human (6); natural (6); activities (5); atmosphere (5); effects (5); glaciers (5); melting

(5); temperatures (5); world (5); air (4); carbon (4); dioxide (4); fossil (4); gas (4); increase (4); industrial (4); life (4); pollution (4); warming (4); animals (3); caused (3); causes (3); changes (3); consumption (3); earth (3); environmental (3); factors (3); fuels (3); impact (3); negative (3); proliferation (3); resources (3); water (3); acidity (2); agricultural (2); areas (2); countries (2); damage (2); day (2); density (2); desertification (2); disasters (2); example (2); factories (2). It can be seen that most of the attributes are physical ones which are marked with bold and black characters rather than social variables which are marked the red colors which are supported by the mandala diagram and links of the corpus of their answers as well (Figure 13).

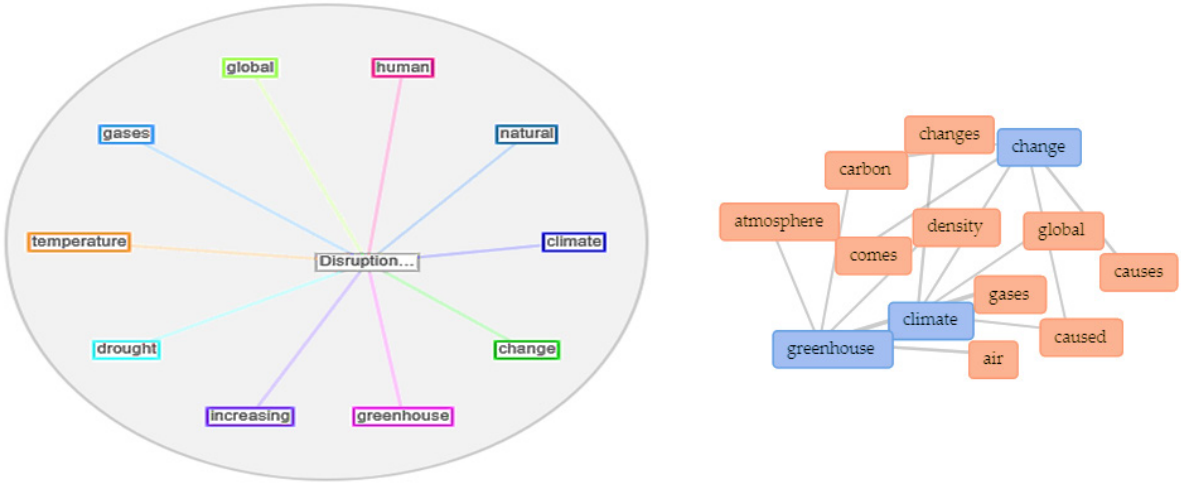

Figure 13: Mandala Diagram and Links of the Corpus for the Question Given As "What are the first concepts that come to mind about climate change?"

The survey question given as "How do you feel about the effects of climate change?" shows that the most frequent words in the corpus of the question are given as : change (11); climate (11); future (7); people (7); living (6); world (6); affected (5); day (5); life (5); things (5); animals (4); become (4); causes (4); food (4); global (4); heat (4); human (4); increase (4); pollution (4); water (4); drought (3); effects (3); energy (3); environment (3); environmental (3); extinction (3); gases (3); main (3); plants (3); precipitation (3); problems (3); regions (3); resources (3); taken (3); affect (2); beings (2); cause (2); clear (2); conditions (2); creates (2); diseases (2); economical (2); events (2); example (2); extreme (2); fact (2); fear (2); frightening (2); glaciers (2); greenhouse (2); high (2); humans (2); important (2); increases (2); live (2); livelihood (2); lives (2). It can be seen that most of the attributes are physical ones which are marked with bold and black characters rather than social variables which are marked the red colors which are supported by the mandala diagram and links of the corpus of their answers as well. It shows that their feelings are also revolving around the physical variables rather than social ones (Figure 14).

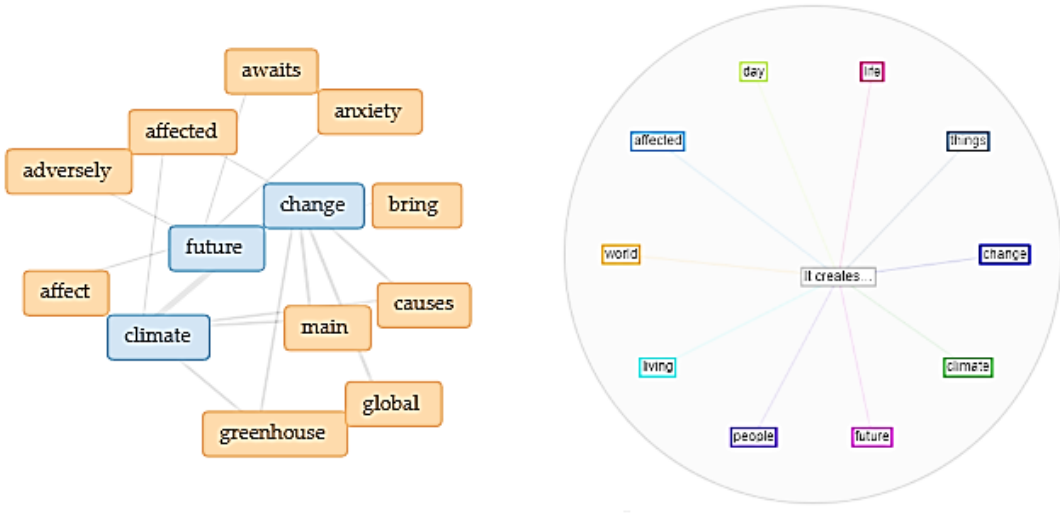

Figure 14: Mandala Diagram and Links of the Corpus for the Question Given As "How do you feel about the effects of climate change?"

The survey question given as "Do you think which species will be most affected by climate change: (animals, people, plants, etc.) What are your feelings about it?" shows that the most frequent words in the corpus of the question are given as : living (31); affected (27); animals (27); climate (20); plants (19); change (18); things (18); think (13); human (11); life (11); affects (10); species (10); people (9); humans (7); increase (6); plant (6); affect (5); water (5); balance (4); causes (4); classification (4); course (4); decrease (4); drought (4); effect (4); migrate (4); natural (4); temperature (4); world (4); adapt (3); animal (3); beings (3); chain (3); creature (3); disappear (3); earth (3); effects (3); especially (3); extinct (3); important (3); live (3); nature (3); necessary (3); precipitation (3); problem (3); agricultural (2); bears (2); become (2); cause (2); chance (2); changes (2); changing (2); conditions (2); continue (2); creatures (2); destroyed (2); different (2); difficult (2); earlier (2). It can be seen that most of the attributes are physical ones which are marked with bold and black characters rather than social variables which are marked the red colors which are supported by the mandala diagram and links of the corpus of their answers as well. It shows that their feelings are also revolving around the physical variables rather than social ones (Figure 15).

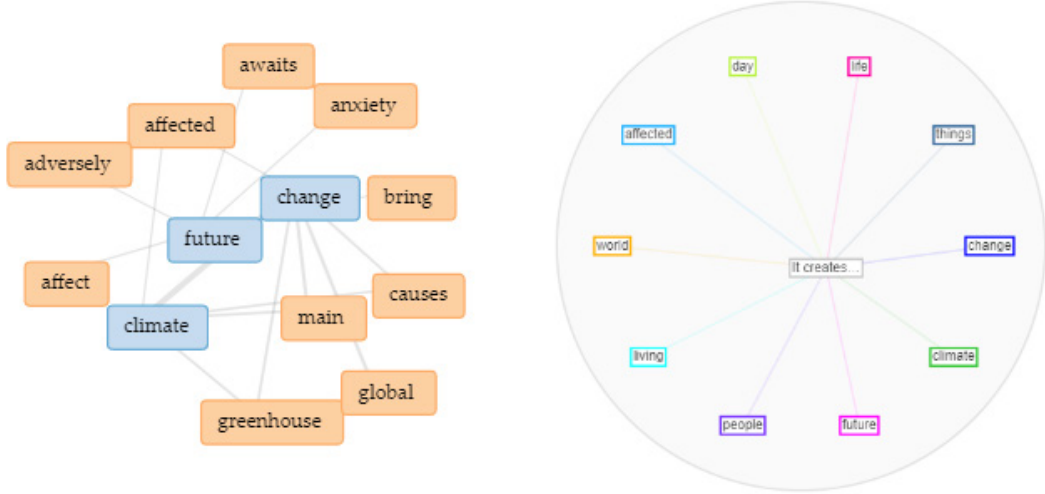

Figure 15: Mandala Diagram and Links of the Corpus for the Question Given As "Do you think which species will be most affected by climate change: (animals, people, plants, etc.) What are your feelings about it?"

DISCUSSION

According to bibliometric analysis, firstly, there is no coherent global network research in the context of environmental problems since those countries seem not to be collaboratively involved in environmental problems. In other words, collaborations seem to be weak at the global research level. However, today's environmental problems are global level. It is human intervention and globalization that can be regarded as to blame for the ever-changing nature of our planet. Our planet's temperature fluctuation, ozone hole, and probable climate change are some of the effects of environmental issues. A variety of environmental challenges are being exacerbated as a result of the fast urbanization, industrialization, deforestation, and reduction of arable land that is a result of population growth and globalization. The effect on human health and the environment throughout the world is still very troubling. About 10% of all fatalities and disease burdens are caused by unsafe water, inadequate sanitation and hygiene, air pollution, and global climate change. A significant environmental catastrophe has been caused by the above-mentioned global environmental challenges (Singh & Singh, 2017). However, it seems that at least for this sample of the literature, it can be concluded that such a global connectedness is not reflected upon the scientific literature as a measure against such threats.

Secondly, it was observed that publications usually concentrate on the physical dimensions of environmental concerns rather than social ones. The only word for the social component is environmental education which has a distinct cluster. Surprisingly, the qualitative data analysis of the students shows that they are more likely to attribute physical dimensions to environmental problems rather than social variables. The more interesting one is that participants even focus on the physical variables although their feelings toward climate change were asked. Environmental problems are those that arise as a result of human activities harming the biophysical environment. Environmental protection is the activity of safeguarding the natural environment at the human, organizational, and governmental levels, for the benefit of all parties involved, including environmental activist groups. Given that environmentalism is a social and environmental movement that tackles environmental concerns via activism, education, and other means, awareness regarding the social dimensions of the environment should be focused both on the scientific and educational levels.

Findings show that there is no significant difference between students' environmental problems attitudes in terms of their qualification or knowledge perception about environmental problems. It seems that their perceived knowledge is not so effective regarding their environmental attitudes. The reason for this can be explained that perceiving to have a piece of knowledge is different from acquiring knowledge in essence because knowledge is defined as "an individual's interpretation of information based on personal experiences, abilities, and competencies" as explained by Bollinger & Smith (2001: 9). But awareness is described as an individual's capacity to identify and focus on a certain object and its attributes (Bower, 1990) so that awareness is defined as a state that is brought about as a consequence of a continuous flow of knowledge and learning. Similarly, Amyx et al. (1994), Corral-Verdugo (1996), and Mostafa (2006) prove that knowledge generally has an influence on pro-environmental attitude (Safari et al., 2018). There are also studies in Turkish literature supporting the idea that the participants' views on nature have been changed as favorable after they take the proper education (Keleş et al., 2010; Okur-Berberoğlu & Uygun, 2013b; Yalçın & Okur, 2014). Therefore, students do have not enough environmental knowledge which in turn shows itself in the environmental attitudes in terms of their perceived knowledge levels for environmental problems. It should be noted that the quality of courses and education is of having importance in this regard. For instance, Acungil (2020) found no significant relationship was found between the status of receiving environmental education at the university and the mean of environmental attitude and awareness and environmental sensitivity.

Findings show that there is no significant difference between students' environmental problems attitudes in terms of their active interest in Environmental Problems except for receiving, responding, and valuing dimensions. In other words, results show that there is no significant difference in environmental problems attitudes, except for three parameters: the degree of a student's active interest in environmental problems, their interest in and involvement with environmental problems, and their perception of environmental problems as a source of personal value. Mean ranks for receiving dimension show that the lowest mean rank belongs to yes and the highest one belongs to no answer. Mean ranks for the responding and valuing

dimensions show that the lowest mean rank belongs to no and the highest one belongs to the yes answer. It means that they perceive themselves in responding and valuing dimensions but the contradiction of their active interest especially in receiving dimension shows that they don't have a coherent sense of environmental awareness.

The neural network analysis shows that the most important values seem to belong to demographic variables rather than perception and attitudes. The first important factor is the location, the second one in the location and the third one is gender for environmental problems attitude. It is thought that the reason for this is related to their inadequate environmental and educational awareness so that demographic variables outweigh the variables related to education and experience.

Therefore, according to degree centrality, the most important factors are valuing and characterizing in the graph of environmental attitudes. Secondly, responding and organizing are important factors, and receiving is the last important factor. In a more realistic sense, it is expected that receiving should be the most important factor in the graph because it is the basis or entrance for all the sub-dimensions of the affective domain. Therefore, students don't have a coherent sense of environmental attitudes. The path diagram of the model also supports this finding so that the model is very poor in terms of many variables. The mean values of the students support this finding that they are probably in the responding level in the affective domain.

The qualitative data shows that students consider the concept of environment in terms of neutral concepts such as nature (46); life (17); tree (11). However, students relate environmental issues with negative attitudes. The most frequent words related to environmental problems are given as pollution (66); nature (49); garbage (39) supports this. Links of the corpus for the answers to two questions show the most frequent words as pollution (66); nature (47); garbage (39). According to the results of Toprak (2017), students mostly emphasize garbage and air pollution as environmental problems and see the behavior patterns of people as the main reason for environmental problems. Therefore, it can be concluded that students adopt an eco-friendly attitude since people who hold this viewpoint are convinced that the environmental condition in the world is serious, and they feel that they must do their part to preserve it. People who hold this viewpoint are convinced that the environmental condition of the world is serious, and they feel that they must do their part to preserve it. The people who are more environmentally conscious believe that environmental conditions threaten life on earth, and they perceive this as a very serious problem. Conversely, those who are less concerned with the environment believe that environmental problems will spontaneously correct themselves (Altinigne & Bilgin, 2015; Schlegelmilch et al., 1996).

CONCLUSION

Findings indicate that students do not have adequate environmental knowledge, which leads to a lack of environmental consciousness because they have a poor understanding of environmental issues. The path diagram of the model also supports this finding so that the model is very poor in terms of many variables. This result is substantiated by the mean values of the students so that they are probably at the responding level. Using the neural network analysis, it seems that demographics are more significant compared to attitudes and perceptions. Students relate environmental issues with negative attitudes indicating that might adopt an eco-friendly attitude. In this respect, it is recommended that environmental education both taking the cognitive and affective domains into account should at least be added in the curriculums or extra activities. In such courses, rather than focusing on pure information, emotional and motivational factors should be also emphasized by movies, field trips, or proper readings. Different researches based on different research designs can also be conducted to find more deep answers to meet the needs of such a course or program.

Finally, bibliometric analysis shows that there is no coherent global network research in the context of environmental problems although today's environmental problems are at the global level because of human intervention and globalization. Secondly, both bibliometric analysis and student answers show that they ignore the social dimensions of the environmental problems and they can only focus on the physical causes. This implies that both students and scientists might still have the view of the idea of 'dominion' over nature. Thus, man is taught to see himself as the victorious conqueror of nature, as someone who has succeeded in creating order out of chaos in the wilds of the earth. In the Novum Organon, as Bacon writes: "Let the

human race recover that right over nature which belongs to it by divine bequest." (Montuschi, 2010). Possibly, because of such understanding, individuals ignore human intervention and focus on the physical chaotic sides of the environmental problems.

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