


Research Article

Examining the Knowledge Levels of Classroom Teacher Candidates about Global Warming

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Keywords: Classroom teacher candidates, global warming, knowledge level 10.18009/jcer.1095595**Publication Language:** English**Abstract**

The aim of this research is to examine the knowledge levels of classroom teacher candidates about global warming. The survey model was used in the study. The sample of the study consists of a total of 324 teacher candidates studying in the Kastamonu University Faculty of Education. The research was carried out in the fall semester of the 2019-2020 academic year. Global warming knowledge scale was used as a data gathering tool. In the analysis of the data, t-test for independent groups, one-way analysis of variance (ANOVA) and Bonferroni test were used. According to the findings, it has been determined that there was a significant difference in favor of female teacher candidates according to the gender variable who have been studying at the fourth grade level. However, when the knowledge levels of classroom teacher candidates studying at different grade levels on global warming were examined, it was determined that there was a significant difference between the scores of the first grade teacher candidates and the second, third and fourth grade teacher candidates in favor of the second, third and fourth grade teacher candidates.



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Introduction

People and the environment have been in a constant interaction and this interaction continued in partial harmony until the industrial revolution. However, with the industrial revolution, the possibilities and conditions for people to dominate and intervene in nature have been prepared, and the possibility of environmental problems to pose a life-threatening threat to living things has increased with the destruction of the ecological balance (Görmez, 2007). Since the 1800s, when industry and technology activities were first used in the world, the earth on which all living creatures live has begun to suffer more and more each day.

The human population in the world is increasing very rapidly. This increase brings with it many problems. The resulting problems that reflect negatively on the environment. As a result of rapid population growth, all natural resources, both underground and aboveground, have started to decrease and deplete day by day. In particular, the excessive

increase in the use of fossil fuels, the increase in the population, and the excessive and unconscious use of all natural resources on earth have revealed many environmental problems. These environmental problems have accumulated for centuries and have become a threat to living things. As can be understood from the examples given, it is obvious that the biggest cause of these problems is human beings. In order to minimize the damage to nature and environment, it is extremely important that individuals gain some knowledge, skills and responsibilities starting from the pre-school period and that these knowledge, skills and responsibilities are reinforced and continued in the next education stages. The realization of this situation can only be possible by giving an effective environmental education to human beings who are always intertwined with nature.

In terms of the potential importance of global warming, which is an environmental problem that concerns the whole world, the education to be given to the society on this issue is very important (Boyes & Stanisstreet, 1992). Along with the increase in the amount of some types of gases that accumulate in the atmosphere as a result of different activities of human beings and are described as "greenhouse gases", the temperature increase in the parts of the atmosphere facing the earth and the surface of the earth is described as global warming. Global warming occurs as a result of the increase in the situation expressed as the greenhouse effect. (McKinney & Schoch, 2003). In other words, it can be said that the greenhouse effect is one of the prerequisites for global warming. The excess of the greenhouse effect on the world is one of the most important factors that cause the start of the global warming process.

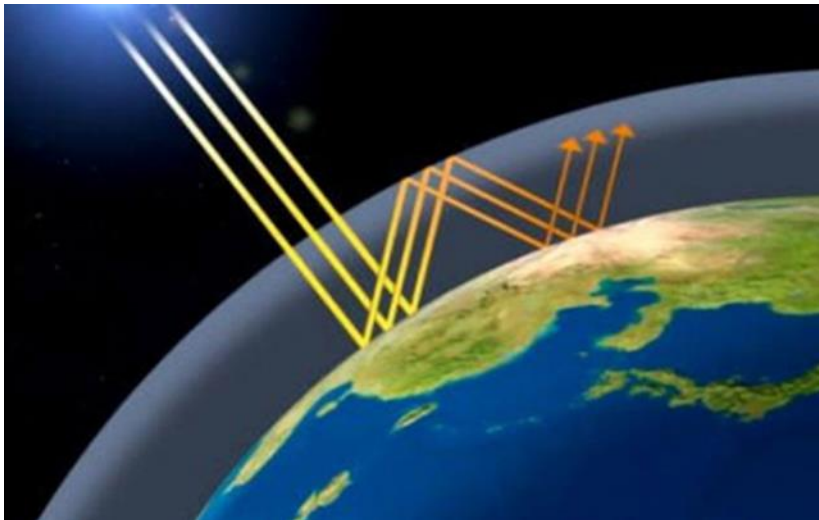


Figure 1. The occurrence of the greenhouse effect

Source: <https://www.cevreportal.com/sera-gazi-emisyonu-nedir-sera-gazi-emisyonu-hakkinda-kisaca-bilgi/>

In Figure 1, it is seen that the rays coming from the sun hit the earth and are reflected back to space from the earth. However, in areas where the greenhouse effect is observed, this process of reflection to space cannot be realized and returns to the earth as if it hit a surface. These sun rays, which return to the earth again, cause those regions to heat up more than necessary. The reason for this phenomenon is that greenhouse gases in the atmosphere transmit high-energy solar rays, but trap or do not reflect low-energy infrared rays. This situation is called the “Greenhouse Effect”.

The main greenhouse gases that cause global warming are carbon dioxide (CO₂), chlorofluorocarbon (CFC) and other halocarbons, methane, nitrogen oxides and water vapor in the atmosphere. It can be said that factors such as fossil fuel consumption, increase in the number of factories, increase in the number of industrial activities, excessive increase in the number of motor vehicles, forest fires and being late to alternative renewable energy sources are the most known factors that cause global warming, together with the increasing human population around the world. Figure 2 shows the graph of the average temperature increase experienced throughout the world since 1850.

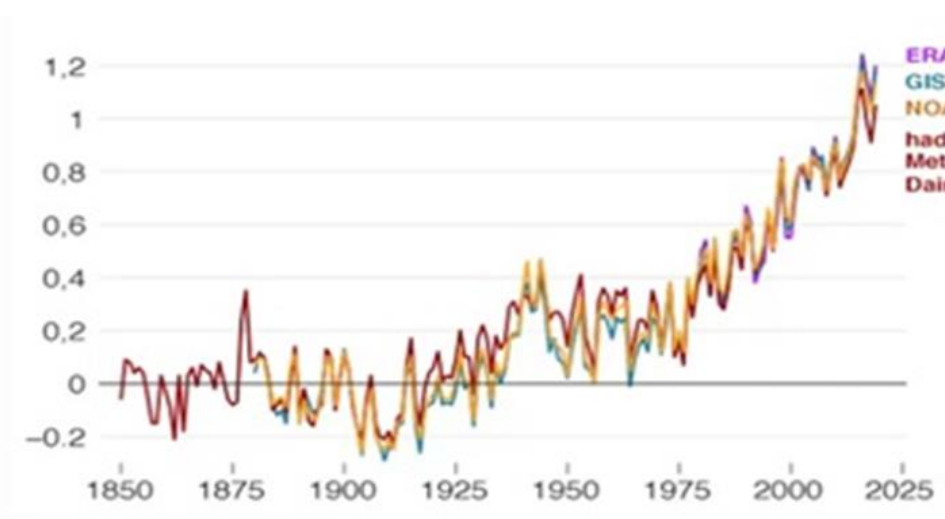


Figure 2. Average Temperature Change in the World since 1850

Source: <https://www.bbc.com/turkce/haberler-dunya-51120658>

When the graph in Figure 2 is examined, it is seen that the average temperature values between 1850-1975 are at a similar level, while the average temperature on Earth has increased rapidly, especially since the 1980s. This situation can be interpreted as the acceleration of global warming as a result of rapid developments in industry and technology, especially in recent years.

Contrary to the known climates on earth due to global warming, it is an inevitable reality that climate changes will occur. With global warming, unlike natural climate change, changes in climates occur in a very short time and suddenly. Such sudden and rapid changes in climates are expressed as “global climate changes” (Eroğlu, 2009).

Cunningham & Cunningham (2008) listed the situations that may occur as a result of possible climate changes due to global warming as follows:

⊙ With the increase in temperature, changes will be observed in the oceans, which are important carbon stores. Organic matter, especially stored in the cold regions of the ocean, contains more carbon than all coal reserves in the world. With warming, these organic carbons can begin to dissolve and form methane and rise to the surface as bubbles.

⊙ The moisture content of the soil will decrease and the underground water reserves will decrease.

⊙ With the warming of the oceans, the wind speed will increase, so more severe hurricanes will occur.

⊙ With increasing temperatures, evaporation in the oceans and seas will increase, which will cause an increase in the humidity level and therefore a further increase in temperature.

⊙ With the increase in temperature, the glaciers on the poles and high mountains will melt, causing the water level of the seas and oceans to rise. This situation will negatively affect the lives of people living on the coastline and cause migration.

⊙ Ecological diversity will be adversely affected by global warming. Living things that cannot keep up with sudden changes will migrate to colder places, and those left behind will perish. It is seen that various corals and plankton in the oceans are adversely affected by this situation, and their species are in danger.

Researchers are concerned that even more methane gas may be produced by the release of different organic materials and their decomposition, especially from the soil under the ice sheet (McKinney & Shoch, 2003). Figure 3 shows the area of the glaciers in the northern polar circle between 1979 and 2018.

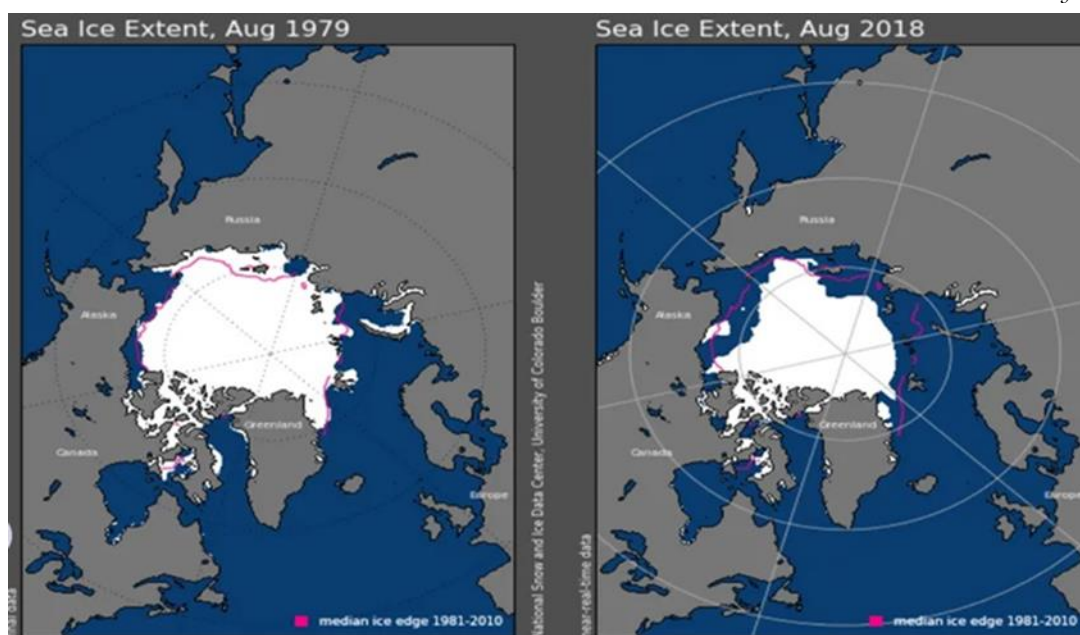


Figure 3. Appearance of Northern Polar Circle Glaciers Between 1979-2018

Source: <https://www.franceculture.fr/geopolitique/le-rechauffement-climatique-aiguise-les-appetits-dans-larctique>

When the map in Figure 3 is examined, it is seen that the amount of glacier that existed in the northern polar circle in 1979, melted to a large extent in 2018. Global warming can be shown as the most important reason for the melting of glaciers. The behaviors that should be implemented in order to slow down and prevent global warming can be listed as follows:

- ⊙ Focusing on the use of renewable energy sources (wind, sun, wave) by reducing the consumption of fossil energy sources (coal, oil and natural gas).
- ⊙ Protecting forests and increasing afforestation areas.
- ⊙ Giving importance to recycling activities.
- ⊙ Use of economical electronic equipment that consumes less electrical energy.
- ⊙ Providing an effective environmental education at every education level.

Paying attention to these listed behaviors by all individuals will ensure that global warming is largely controlled. It has been determined that the number of studies conducted with primary school teacher candidates on this subject is low. In this respect, it is thought that this research will contribute to filling the gap in the field. From this point of view, the aim of this study is to determine the knowledge level of primary school teacher candidates about global warming. In order to achieve this aim, answers to the following sub-problems were sought:

1. What are the classroom teacher candidates' knowledge level scores on global warming?
2. Do the classroom teacher candidates' average scores on the global warming determination scale differ significantly according to the gender variable?
3. Do the mean scores of the classroom teacher candidates' knowledge level determination scale on global warming show a significant difference according to the grade level variable?

Method

Research Model

Survey model was used in this study. The survey study is called as the studies are the investigations of setting the participants skills, interests and attitudes, besides searching the more extensive sampling compared to the other types of the study (Fraenkel & Wallen, 2006). This method was used in order to reveal the existing situation in a large group.

Sample

The sample of the study consists of 324 teacher candidates studying at Kastamonu University Faculty of Education Classroom Education undergraduate program in the fall semester of 2019-2020 academic year. In the selection of the sample, an easily accessible sampling model was preferred. The descriptive statistics of the study group of the research are given in Table 1.

Table 1. Descriptive statistics of the sample

Grade Level	N		Total	%
	Female	Male		
First	57	20	77	23,8
Second	65	15	80	24,7
Third	62	22	84	25,9
Fourth	69	14	83	25,6
Total	253	71	324	100

When Table 1 is examined, it is seen that 23,8% of the classroom teacher candidates forming the sample are in the first grade, 24,7% are in the second grade, 25,9% are in the third grade and 25,6% are in the fourth grade. According to these values, it can be said that the participants showed a balanced distribution in terms of numbers.

Data Gathering Tools

The “Global Warming Knowledge Scale” developed by Eroğlu (2009) which was consisted of 26 items was used as a data gathering tool in this research. The Cronbach's alpha reliability coefficient value for the original scale was determined as .84. For this study, the reliability coefficient of the scale was recalculated and a value of .73 was obtained. According to Büyüköztürk (2007), the reliability coefficient calculated for a psychological test is .70 and higher, which is considered sufficient for the reliability of the test scores. Accordingly, it can be said that the alpha value of .73 determined for this study is appropriate in terms of the applicability of the scale.

Data Analysis

SPSS statistical package program was used in the analysis of the data. In the analysis of the data, t-test was performed for independent groups in order to determine whether there was a statistically significant difference according to the gender variable. One-way analysis of variance (ANOVA) and Bonferroni test were used to determine the statistical significance of the difference between the mean scores according to the grade level variable. Statistical analyzes were evaluated according to the $p < .05$ significance level. The expressions in the 5-point Likert-type scale consist of "Absolutely Wrong", "Wrong", "I Have No Idea", "True" and "Absolutely True". While coding the SPSS application, the expression "I Have No Idea" was coded with zero (0) points, while the other expressions were coded by giving 1,2,3 and 4 points from negative to positive. In this case, the highest score that can be obtained from the scale consisting of 26 items was determined as 104, and the lowest possible score was determined as 0 (zero).

Findings

In this section, the findings obtained as a result of the research are given. Findings are presented in order of sub-problems.

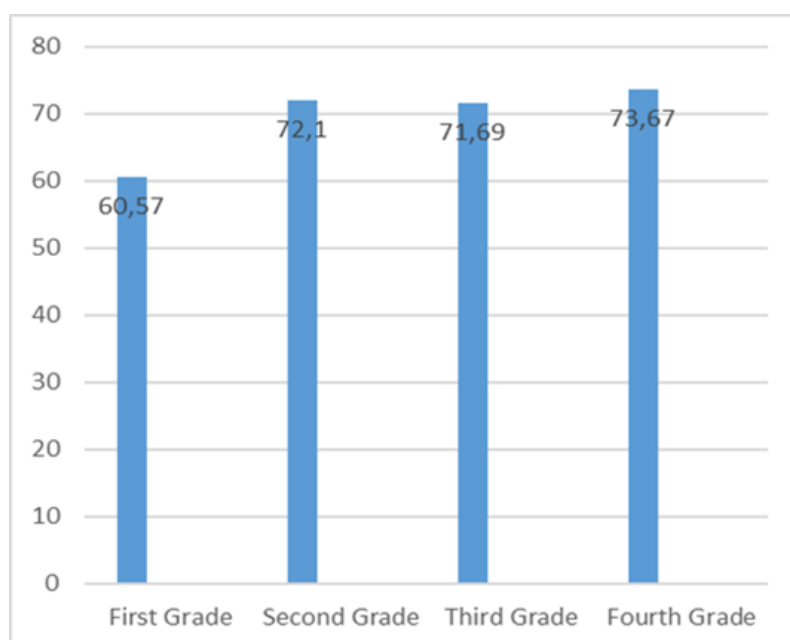
Findings of the First Sub-problem

Within the scope of the first sub-problem, a total of 324 classroom teacher candidates who participated in the study were examined in terms of global warming knowledge level determination scale scores. The scores obtained from the scale according to the grade levels are given in Table 2.

Table 2. The knowledge scale average scores of primary school teacher candidates about global warming

Grade Level	N	X	Sd
First	77	60,57	7,74
Second	80	72,1	6,09
Third	84	71,69	6,26
Fourth	83	73,67	6,05
Total	324	69,65	8,31

When Table 2 is examined, it is seen that the average score of the first grade classroom teacher candidates is $X=60,57$. The score of the second grade classroom teacher candidates is $X=72,1$. The third grade classroom teacher candidates' score is $X=71,69$ and the fourth-grade classroom teacher candidates' score is $X=73,67$.

**Graph 1.** Appearance the Scale Scores of Teacher Candidates at Different Grade Levels

Graph 1 shows that the average scores of the classroom teacher candidates' studying at different grade levels from the knowledge scale on global warming. Accordingly, it can be said that the knowledge levels of the second, third and fourth grade teacher candidates about global warming are similar. It can be stated that the knowledge level of the first-year teacher candidates about global warming is lower than that of the teacher candidates at other grade levels.

Findings of the Second Sub-problem

In order to determine whether there is a statistically significant difference between the mean scores of the global warming knowledge level determination scale of 324 classroom teacher candidates participating in the research, according to the gender variable, t-test was applied for independent groups. Findings related to this are shown in Table 3.

Table 3. Independent t-test results of classroom teacher candidates' knowledge scale scores on global warming according to gender variable

Gender	N	X	Sd	df	t	p
Female	253	69,58	8,86	322	-,296	,767
Male	71	69,91	5,95			

*p<,05

Looking at Table 3, it is seen that the average score obtained by the female classroom teacher candidates participating in the research from the scale of determining the level of knowledge about global warming is $X=69,58$ and it is understood that the average score of male classroom teacher candidates is $X=69,91$. When the average scores obtained from the scale were compared, it was concluded that the difference between the scores of female and male classroom teacher candidates on the global warming knowledge level assessment scale was not statistically significant ($t_{(322)} = -.296, p > .05$).

When the results of the independent t-test applied separately for each grade level in terms of gender variable were examined, it was determined that the difference between the scores of the fourth grade teacher candidates was statistically significant. Findings related to this are shown in Table 4.

Table 4. Independent t-test results of fourth grade teacher candidates' knowledge scale scores on global warming according to gender variable

Gender	N	X	Sd	df	t	p
Female	69	74,27	6,39	81	2,044	,044*
Male	14	70,71	2,52			

*p<,05

When Table 4 is examined, it is seen that the average score obtained from the scale by female classroom teacher candidates studying in the fourth grade is $X=74,27$. The average score of male teacher candidates was calculated as $X=70,71$. As a result of the t-test applied to compare the average scores of them, it was determined that there was a statistically significant difference in favor of female teacher candidates between the average scores of fourth grade female and male classroom teacher candidates from the scale ($t_{(81)} = 2,044$,

* $p < .05$). Based on this finding, it can be said that female teacher candidates in the fourth grade have a higher level of knowledge about global warming than male teacher candidates.

Findings of the Third Sub-problem

One-way analysis of variance (ANOVA) was conducted in order to determine whether the mean scores of the classroom teacher candidates' knowledge level on global warming showed a significant difference according to the grade level variable. Findings related to this are given in Table 5.

Table 5. ANOVA results of classroom teacher candidates' knowledge scale scores on global warming according to grade level variable

Source of Variance	Sum of Squares	df	Mean Squares	F	p	Significant Difference
Between Groups	8520,746	3	2840,249	66,061	,000*	4-1, 3-1, 2-1
Within Groups	13758,226	320	42,994			
Total	22278,972	323				

* $p < .05$

1=First Grade, 2=Second Grade, 3=Third Grade, 4=Fourth Grade

According to Table 5, it is seen that there is a statistically significant difference between the average scores of the knowledge scale about global warming of the classroom teacher candidates studying at different grade levels. $F(3, 320)=66,061$, * $p < .05$. Bonferroni test, which is one of the multiple comparison tests, was applied to determine between which groups the difference between grade levels. According to the Bonferroni test results, it was determined that there was a significant difference between the scale scores of the first-year teacher candidates and the scale scores of the second, third and fourth-grade teacher candidates in favor of the second, third and fourth grade teacher candidates. According to this finding, it can be said that the level of knowledge about global warming of the primary school teacher candidates studying in the first grade is lower than that of the teacher candidates at other levels.

As a result of the analysis, it was concluded that there was no statistically significant difference between the average scores of the second, third and fourth grade classroom teacher candidates obtained from the scale. According to this finding, it can be said that the knowledge levels of classroom teacher candidates studying at the second, third and fourth grade levels on global warming show similar characteristics.

Discussion and Conclusion

In this study, in which the knowledge levels of classroom teacher candidates at different grade levels were examined, it was concluded that there was no significant difference between the average scores of 324 teacher candidates participating in the research according to the gender variable ($t_{(322)} = -.296, p > .05$). According to this result, it can be said that the knowledge levels of female and male teacher candidates about global warming are similar. This result is similar to the research results of Aksan and Çelikler (2015), Ay and Yalçın-Erik (2020), Eroğlu and Aydoğdu (2016), Gürer and Sakız (2018), Bilgi (2021) in the related literature.

When the scores of the teacher candidates at different grade levels were compared among themselves according to the gender variable, it was determined that there was a statistically significant difference between the scores of only the fourth grade teacher candidates. It was concluded that this significant difference was in favor of female teacher candidates ($t_{(81)} = 2,044, *p < .05$). According to this result, it can be said that the knowledge level of female teacher candidates in the fourth grade about global warming increased in direct proportion to the result of the increase in interest, curiosity and class levels on this subject. It was determined that similar findings were obtained in the studies conducted by Ergin, Akbay, Özdemir and Uzun (2017), Şenyurt, Temel and Özkahraman (2011), Gülsoy (2018), Gülsoy and Korkmaz (2020), Tetik and Acun (2015) in the related literature. On the other hand, in the study conducted by Boyes and Stanisstreet (1992), contrary to the result obtained in this study, it was concluded that the knowledge level of female students about global warming was lower than that of male students.

In this study, the global warming knowledge scale scores of the classroom teacher candidates studying at different grade levels were compared. Accordingly, it has been determined that there is a statistically significant difference between the scores of the teacher candidates studying in the first grade and the teacher candidates in second, third and fourth grades. $F(3, 320) = 66,061, *p < .05$.

According to the results of the Bonferroni test, it was concluded that the significant difference was in favor of the second, third and fourth grade teacher candidates. It can be said that this result is due to the fact that the environmental education course taken in the spring semester of the first year of the classroom education undergraduate program was taken by the second, third and fourth grade teacher candidates, but has not been taken by the

first grade teacher candidates yet. In the relevant literature, Küçük-Biçer and Acar-Vaizoğlu (2015) also obtained similar findings in their research. On the contrary, Bilgi (2021) concluded in her study that the class level variable does not have a significant effect on the level of knowledge about global warming.

When the results obtained after the research are examined in general, it can be said that the knowledge of classroom teacher candidates about global warming is at a moderate level. On the other hand, it can be said that the knowledge of the classroom teacher candidates who have not yet taken an environmental education course in the first year is less than those who have taken this course. It is thought that the meaning of global warming, which is one of the most important environmental problems of the 21st century, what should be done to solve this problem and what the responsibilities of individuals are in this regard, can be provided with environmental education courses and activities to be given at all education levels from pre-school to higher education. It is extremely important for a more livable world that the new generations are sensitive to the environment and have a high level of knowledge about the natural events happening around them. In order for these generations to develop at the desired level, first of all, teachers who are in the position of models for them should have sufficient knowledge and sensitivity. Teachers who are conscious of the environment and sensitive to these issues will be willing to convey this sensitivity to their students. In this sense, it is thought that it is very important that environmental education courses given at the university should be included in all teacher-training undergraduate programs (Uyanık, 2016; Ürey, Çolak & Okur, 2009).

Recommendations

The excessive increase in the human population around the world and the rapid developments in technology have made global warming inevitable and this situation has begun to threaten all living things. Conservation and efficient use of natural resources is of vital importance for the continuity of future generations. For this reason, it is necessary to increase the level of knowledge and awareness of individuals about global warming. For this, it is recommended to carry out various educational practices, different project studies, and activities that can create permanent behavioral changes. Global warming is one of the most important environmental problems of our age. In this context, seminars and conferences can be organized in order to raise awareness and inform about this issue. This research was carried out with primary school teacher candidates. It is recommended that the

studies in this field be applied on different undergraduate programs as well. It is thought that investigating the knowledge levels of teacher candidates in all branches about global warming, which is one of the most current environmental problems, will contribute to the literature.

Acknowledgement

Since the data of this study were collected before 2020, there is no ethics committee approval.

Author Contribution Statement

Gökhan UYANIK: *Literature review, methodology, data collection, processing, analysis, interpretation, general supervision, review-writing and editing*

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