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A Collection of Studies Conducted In Education About "Global Warming" Problem*

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Abstract

The studies global warming problem conducted in education discipline in the world and in Turkey were analysed for this study. The literature was reviewed extensively especially through the articles in the indexed journals of Ebsco Host, Science Direct, Taylor and Francis and Web of Science databases and this study was conducted according to the descriptive method. 62 scientific publications about global warming which were published between the years 1992 and 2009 were included in the research. The articles obtained as a result of this review process were analyzed by taking the aims, results and the education levels into consideration. As a result of the research, some studies which didn't complement one another both in the world and in Turkey were encountered. However, for the most part the studies conducted had similar purposes and they had the same results. Descriptive studies introduced that similar misconceptions related to global warming existed in all levels of education and the media had negative effects during this process. Experimental studies revealed that the education methods where the students are active, visual materials and social activities outside the school were more effective methods in educating more conscious students about global warming.

Key Words

Global warming, Greenhouse Effect, Environment Education

Phenomenon such as the rapid population growth, industrialisation, urbanisation, and exploitation of natural resources implicitly cause a lot of negative effects on natural balance and these problems cause environmental problems to occur (Yıldız, Sipahioğlu, & Yılmaz, 2000). Global warming is the primary environmental issue that is encountered today. Global warming can be defined as the gradual increase in the earth's surface temperature because greenhouse gases, such as CO_2 (carbon dioxide), CH_4 (methane), H_2O (water vapor), and fluorinated gases let the heat from the Sun into the atmosphere but partially prevent the heat escape back into the atmosphere (Lynas, 2008). Global warming, which causes the climate system change as a result of the greenhouse effect is the most important environmental issue which emerged because of the human beings (scientific, political, economic and ethical fields) and it is a much debated question of the 21st century (Schreiner, Henriksen, & Hansen, 2005). Global warming affects not only the countries which cause the release of these gases but also all the regions on the earth. When the recent past is analysed, a lot of devastating natural events have been witnessed in a lot of continents ranging from America to Europe, Asia to Antarctica. The increase in the number and in the strength of hurricanes and typhoons in the States and Japan, the rapid melting of glaciers at the poles, fighting floods in the south of Asia, the unexpected destruction caused by the forest fires in Australia led to the deathes of a lot of people and a considerable amount of material damage (Lynas, 2008).

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There is not only political, economic and technological search for the solutions of environmental problems such as global warming but also the increasing number of the educated individuals who are aware of environmental problems and who know which precautions to be taken to prevent them is extremely important. Therefore, "environmental education investment" made for our children must be perceived as an investment made for the world (Atasoy & Ertürk, 2008; Bozkurt & Cansüngü, 2002; Yılmaz, Morgil, Aktug, & Göbekli, 2002).

When a lot of descriptive and experimental studies conducted in the world and Turkey are taken into consideration, it is considered that the collection of these studies under common terms after being analysed will fill the gap in the literature and pave the way for the other studies to be conducted. The studies which were carried out in the world and in Turkey and which were indexed by the journals of important databases were analysed for this study and it was done so with the purpose of informing students and forming a conscious society. The studies were evaluated by analysing the purposes, results and levels of education in order to compare and contrast and to bring up the relationships between them.

Method

Research Design

Descriptive method was the main method used in this study. This method was used because the studies conducted in the past about global warming were thought to be described and interpreted in detail. The literature was scanned with the studies conducted in the world and in Turkey at different education levels and especially with the articles published in the indexed journals of Ebsco Host, Science Direct, Taylor and Francis and Web of Science databases. Seven key words called as "global warming", "environmental education", "primary education", secondary education", "university", "environmental problems" and " greenhouse effect" were used. As a result of the scanning, 62 scientific publications which were published about global warming between the years 1992 and 2009 were included in the research. The articles which were obtained as a result of literature search were analysed by taking into consideration the purposes, results and education levels.

Results

Descriptive studies carried out at primary education level, revealed that the students had limited information and different conceptual misconceptions about the problem of global warming (Andersson & Wallin, 2000; Boyes & Stanisstreet, 1993; Gambro & Switzky, 1996; Rye, Rubba, & Wiesenmayer, 1997). In another study conducted it was found that the high school students had some scientific knowledge about greenhouse effect but they also had a lot of wrong information and conceptual misconceptions (Boyes & Stanisstreet, 2001). It was determined in the descriptive studies conducted at the university level that the students had different conceptual misconceptions (Boyes & Stanisstreet, 1992; Read, Bostrom, Morgan, Fischhoff, & Smuts, 1994). Boyes, Chambers and Stanisstreet (1995) determined in their study that the trainee teachers had some conceptual misconceptions which they brought from their high schools and they still carried on. It was seen in other studies that the preservice teachers had some misconceptions related to greenhouse effect, the thinning of ozone layer and acid rains (Dove, 1996; Groves & Pugh, 1999). Moreover, the studies conducted with the teachers revealed that the teachers had missed some concepts and conceptual misconceptions related to the biological diversity, carbon cycle, the thinning of ozone layer and global warming (Summers, Kruger, Childs, & Mant, 2000, 2001). Khalid who conducted two different studies in the USA in 2001 and 2003 found out that both the teachers and the preservice teachers had a lot of misconceptions about global warming, greenhouse effect, ozone and acid rain. He stated that the reason for these misconceptions resulted from the teachers' having superficial knowledge about these subjects and not completing their lack of knowledge both from visual and print media. The two different studies conducted in Greece introduced that not only the teachers but also the preservice teachers had inadequate information about climate change, greenhouse effect, acid rain and the thinning of ozone layer (Michail, Stamou, & Stamou, 2007; Papadimitriou, 2004).

One of the first descriptive studies at primary education level was conducted by Bozkurt and Cansüngü (2002) and it showed that because the students were not well-informed about greenhouse effect, they had a lot of conceptual misconceptions about it. The other studies conducted at primary school education level also revealed that the students had considerably low level of knowl-

edge about greenhouse effect, ozone layer, and acid rains (Bozkurt, Aydın, Yaman, Uşak, & Gezer, 2005; Bozkurt & Aydoğdu, 2004; Darçın, Bozkurt, Hamalosmanoğlu, & Köse, 2006; Yılmaz, Boone, & Andersen, 2004). Another study showed that although the 2nd grade high school students had a good knowledge about the results of global warming and the precautions to be taken to slow down global warming, they had different conceptual misconceptions (Kılınç, Stanisstreet, & Boyes, 2008). In the studies conducted at university level, the preservice teachers had various misconceptions about ozone layer, biosphere, greenhouse effect, acid rains (Bahar & Aydın, 2002; Erol, 2005; Pekel, 2005; Öztaş & Kalıpçı 2009; Soran, Morgil, Yücel, Atav, & Işık, 2000;), and the environmental education was inadequate (Yılmaz, Morgil, Aktug, & Göbekli, 2002).

As it is understood, there are a lot of conceptual misconceptions which emerged in the studies conducted. The most frequently encountered conceptual misconception in the studies which were conducted not only in Turkey but also abroad was to think that there was a "direct relationship between global warming and the ozone layer". What is interesting is that this misconception was the most frequently encountered conceptual misunderstanding with the primary school students (Boyes & Stanisstreet, 1993; Bozkurt & Aydoğdu, 2004; Bozkurt & Cansüngü 2002; Bozkurt et al., 2005; Darçın et al., 2006; Hansen, 2009; Koulidis & Christidou, 1999; Rye et al., 1997), secondary school students (Boyes & Stanisstreet, 2001; Boyes, Stanisstreet, & Papantoniou, 1999; Kılınç et al., 2008; Pekel, 2005) and the preservice teachers / teachers (Bahar & Aydın, 2002; Boyes et al., 1995; Boyes ve Stanisstreet, 1992; Bozdoğan 2009; Dove, 1996; Groves & Pugh, 1999; Khalid, 2001, 2003; Michail et al., 2007; Matkins & Bell, 2007; Papadimitrio, 2004; Pekel, 2005; Read et al., 1994; Soran et al., 2000; Summers et al., 2000, 2001) in short, with students at every level and age. The participants taking part in the researches usually think that global warming will increase because of the thinning of ozone layer. But, one of the most frequently encountered misconceptions is to think that "the increase in the temperature due to greenhouse effect / global warming will lead to skin cancer". This misconception exists in the studies which were carried out in primary (Boyes & Stanisstreet, 1998; Darçın et al., 2006), secondary (Boyes & Stanisstreet, 2001; Kılınç et al., 2008), and university levels (Groves & Pugh, 1999; Khalid, 2001). Besides this conceptual misconceptions, a lot of conceptual misconceptions such as "the increase in global warming will cause heart attack (Boyes & Stanisstreet, 1993, 2001; Kılınç et al., 2008), "green house effect will increase because CO_2 cycle isn't formed" (Bahar & Aydın, 2002), "global warming will cause earthquakes" (Boyes & Stanisstreet, 2001; Groves ve Pugh, 1999; Kılınç et al., 2008), "the use of unleaded gas will decrease global warming" (Boyes & Stanisstreet, 1992, 1993; Kılınç et al., 2008) and " food poisoning will be experienced as a result of greenhouse effect" (Bozkurt & Cansüngü, 2002; Kılınç et al., 2008) were encountered in the studies conducted.

It was stated in a study conducted in Norway that the media which is an informal education source may have a negative effect on the students' development of knowledge level which is related to greenhouse effect and ozone layer (Hansen, 2009). The studies carried out in the past are likely to support this result. The researches introduce that both the students and the teachers mostly learn the information about environmental issues via visual and print media, especially television (Andersson & Wallin, 2000; Boyes & Stanisstreet, 2001; Groves & Pugh, 1999; Khalid, 2001; Kılınç et al., 2008; Öztaş & Kalıpçı, 2009; Spellman, Field, & Sinclair, 2003; Yılmaz et al., 2002).

Various experimental studies about global warming problem were conducted. It was stated in a study that in-class discussion techniques were effective in correcting the conceptual misconceptions of the primary school students about greenhouse effect and global warming (Mason & Santi, 1998). Oluk and Özalp (2007) stated in the study which they conducted in Turkey that, cartoons and animations made learning easier while teaching global environmental issues such as global warming, the thinning of ozone layer and acid rains, they increased /caught the attention of the students about the subject and made the classes more interesting. Devine-Wright, Devine-Wright and Fleming (2004) determined that collaborative learning environment had a positive and meaningful effect on the individual differences and perceptions of the students about global warming. It was stated in another study that doing social activities will increase the attention of the students about the social problems (Lester, Maa, Lee, & Lambert, 2006). Another study stated that computer assisted education has a positive effects on understanding of environmental problems but this education must be given by the teachers who are equipped with pedagogical knowledge (Aivazidis, Lazaridou, &

Hellden, 2006). It was stated in the previous studies that computer assisted education would be successful in correcting the conceptual misunderstandings (Boyes & Stanisstreet, 2001). Another study introduced that visual education resources /instruments considerably developed the students' level of knowledge about global warming and climate change (Taber & Taylor, 2009).

These studies also mentioned that environment education curriculum should be developed in the institutions where the teachers are educated (Mckeown-Ice, 2000), and it was observed that designing of workshops in the education institutions which were related to the education of environmental problems had positive effects on the teachers (Paul & Volk, 2002). It was said that by providing individual development programs for the preservice teachers, they were given an opportunity to conduct a more effective environmental education (Pruneau et al., 2006) and interactive activities provided an opportunity for permanent learning (Matkins & Bell, 2007). In another study conducted in Turkey, the successful education methods in environmental education were listed as field excursions, laboratory studies and activities to form models (Kostova & Atasoy, 2008). Doğru (2008) found in his study that using problem solving method for the solutions of environmental problems were more effective than traditional methods.

In addition to the studies conducted about global warming problem, there are studies where the knowledge levels of the students were compared in terms of different variables. A study revealed that the students whose parents have high levels of education, the students who are good at science, and the male students have higher level of knowledge (Gambro & Switzky, 1999). Moreover, Spellman et al. (2003) found in their study that the students who are successful in science had sufficient level of knowledge than the other students who are not. Another study which was conducted with the high school students demonstrated that the more the students are ambitious about the solution of environmental problems, the stronger they are to turn them into behaviours (Boyes, Skamp, & Stanisstreet, 2008). It was introduced statistically by Erol and Gezer (2006) in another study which was an extension of the same study that the girls with regard to boys, the older students with regard to younger ones, the students who have working mothers to the ones whose mothers are housewives, the students who don't have any brothers or sisters with regard to the ones who have brothers / sisters have more positive attitude towards environmental problems. A similar study which was conducted at primary education level found that the students who were successful in science developed more positive attitudes towards environmental problems. Moreover, it was found that the female students were more sensitive about the environmental problems than the male students (Yılmaz et al., 2004). Şama determined in his study which was published in 1997 that, the female students had more positive attitudes towards environment than the male students and the students living in big cities had more positive attitudes than the students living in small cities. Demirkaya (2008) claimed that there is no relation between the learning styles of the preservice teachers and the issue of global warming.

Discussion

When the studies conducted were evaluated in a framework, it was seen that some studies complemented each other both in Turkey and in the world and studies which had the same purposes, they reached similar results. The studies conducted at the levels of primary and secondary education introduced that the students had a lot of conceptual misconceptions about the reasons of global warming. It was observed that this condition resulted from the teachers who had different conceptual misconceptions and whose in-class activities and the visual and print media where the students acquired information to a great extent were inadequate. The best example of this was put forth by the study carried out in 2001. Although methane is a more dangerous greenhouse gas than carbon dioxide, because the release of carbon dioxide was mentioned more frequently in the media, the study conducted found that the students paid more attention to carbon dioxide. (Khalid, 2001). Another study demonstrated that the visual and print media had a great effect on the attitudes and behaviours of the public towards environmental problems such as climate change (Fortner et al., 2000). An interesting result found in the study was that although the students had a lot of conceptual misconceptions about the reasons of global warming, they had a good level of knowledge about the effects of global warming and the precautions to be taken against it. The researchers think that the guidance of media is effective during the process, too. Within this context, it is found out that the visual and print media both have negative and positive effects on

the students about different environmental problems, especially on global warming, so their publications and broadcasts should be more correct and responsible.

Another dimension of the studies puts forth that the amount of education given in the schools is required to be increased (Negev, Sagy, Garb, Salzberg, & Tal, 2008; Rye et al., 1997). Educating students at younger ages will give opportunities for the society to change positively and to acquire positive attitudes and behaviours in the long term (Boyes & Stanisstreet, 1993, 1998). Because of that, it was determined that while teaching abstract concepts such as the greenhouse effect, the activities (in-class discussion methods, group works, project works, collaborative learning, computer and Internet assisted learning etc.) which make the students active are needed. Moreover, it was stated that the information should be passed on the students by raising the curiosity and interest of the students and the lessons should be enriched by using different media such as overhead projectors, P.point slides, visual materials and so on (Darçın et al., 2006; Lenzen & Murray, 2001; Meadows & Wiesenmayer, 1999; Yılmaz et al., 2004;). It was also stated that off-campus social activities (Ajiboye & Silo, 2008) are effective for raising the awareness of the students about such environmental problems and they influence the students to be more sensitive about them than the adults.

Another important result is that conceptual misconceptions about global warming which are met at primary education level are also observed at secondary and university education levels. This result puts forth the importance of primary education and even pre-school education for the correction of conceptual misconceptions and the acquisition of new concepts. Within this context, different curricula planning, which was parallel with the studies in the world, were also designed about environment education in Turkey. Environmental education has been given since 1991 in formal education (Erol & Gezer, 2006), environmental education was adapted for the science curriculum in 1993 (Demiröven, 1999) and the environmental concepts were brought to the focus with the new science and technology programs which were accepted in 2004 (Yılmaz et al., 2002). Furthermore, Ministry of Education published a printed notice about global warming for the first time in 2007-2008 academic year (Milli Eğitim Bakanlığı [MEB], 2007).

The studies conducted at primary and secondary education levels put forth what is to be done for the formation of aware students about environmental problems such as global warming. However, the teachers who are going to organize such activities are required to be well-equipped and qualified because the studies conducted revealed that the preservice teachers didn't have knowledge about the teaching strategies which they are supposed to use in environmental education courses (Lane, Wilke, Champeau, & Sivek, 1994) and they needed a lot more support about the education techniques and practices related to environment education (Moseley & Utley, 2008). The reason for these needs of the preservice teachers result from the fact that they don't have a good level of field knowledge which means that they don't master a subject because the study conducted found that the preservice teachers who had a very good knowledge of their field had also well-equipped pedagogical knowledge for teaching the subject (Kaya, 2009). So within this context, the trainee teachers can be informed about other environmental problems, especially about global warming, with the help of the other well-equipped /qualified teachers and the presentations done especially by using visuals can be more effective. Moreover, doing in-class activities such as problem solving, collaborative learning where the preservice teachers are active and are organizing different social activities like establishing student clubs, stands, preparing brochures and leaflets and so on can have positive effects.

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