

MIDDLE SCHOOL STUDENTS' CONCEPTIONS OF ENVIRONMENTAL ISSUES

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ABSTRACT

Environmental issues especially the greenhouse effect and global warming are some of serious problems that the Earth face today. It is very important to understand possible reasons for these environmental phenomena and their effects on human beings and on the planet. Therefore, the purpose of this study was to identify Turkish middle school students' conceptions of environmental issues. Eighty four grade 8 students from two different middle schools voluntarily participated in the study. Data were collected from the Environmental Issues Questionnaire originally developed by Boyes & Stanisstreet (1993). Results revealed that students lack of scientific understanding of environmental issues.

Keywords: students' conceptions, the greenhouse effect, global warming, ozone layer depletion, eight grade students

INTRODUCTION

Environmental issues especially the greenhouse effect and global warming are some of serious problems that the Earth face today. The greenhouse effect is a natural process and plays a key role in determining the earth's climate (Millar & Spoolman, 2013). Since the beginning of the Industrial Revolution in the mid-1700s, as a result of human actions mostly the burning of fossil fuels and deforestation, the increase in the concentrations of several greenhouse gases in the lower atmosphere has been observed. The Intergovernmental Panel on Climate Change [IPCC] issued a report in 2007 based on 29000 sets of data from more than 130 countries and acknowledged that human-induced changes are beginning to change the earth's climate (Millar & Spoolman, 2013). Any change in the Earth's climate may affect precipitation and weather patterns and the environmental system. Therefore, studies related to environmental issues mainly the greenhouse effect and global warming are getting increased attention by many scholars from different countries in recent years (see Boon, 2009; Boyes, Skamp, & Stanisstreet, 2009; Boyes & Stanisstreet, 1993;1997a;1997b;1998; Bozkurt, & Cansüngü-Koray, 2002; Chhokar, Dua, Taylor, Boyes, & Stanisstreet, 2011; Daniel, Stanisstreet, & Boyes, 2004; Darçın, Bozkurt, Hamalosmanoğlu, & Köse, 2006; Daskolia, Flogaitis, & Papageorgiou, 2006; Dove, 1996; Fisher, 1998; Francis, Boyes, Qualter, & Stanisstreet, 1993; Gambro & Switzky, 1996; Grima, Filho, & Pace, 2010; Groves & Pugh, 1999; Ikonomidis, Papanastasiou, Melas, & Avgoloupis, in press; Khalid, 2003; Kılınç, Boyes, & Stanisstreet, 2011; Kılınç, Stanisstreet, & Boyes, 2008; Kirkeby Hansen, 2010; Koulaidis, & Christidiou, 1999; Lambert, Lindgren, & Bleicher, 2012; Lee, Lester, Ma, Lambert, & Jean-Baptiste, 2007; Meadows & Wiesenmayer, 1999; Michail, Stamou, & Stamou, 2007; Papadimitriou, 2004; Punter, Ochando-Pardo, & Garcia, 2011; Ratinen, 2011; Shepardson, Niyogi, Choi, & Charusombat, 2009; Summers, Kruger, & Childs, 2000).

Research reveals that both students and teachers lack of scientific understanding of environmental issues and have a variety of alternative conceptions about environmental issues. One of the main difficulties for students is to explain the greenhouse effect and global warming (Andersson & Wallin, 2000; Dove, 1996; Jeffries, Stanisstreet, & Boyes, 2001). Another difficulty reported in the literature is to distinguish between the natural greenhouse effect and the anthropogenic effect caused by human combustion of fossil fuel (Ikonomidis, Papanastasiou, Melas, & Avgoloupis, in press;). Some students thought that the heat from car engines causes global warming (Boyes & Stanisstreet, 1997b; Mason & Santi, 1998) and believed that global warming can be reduced through the use of unleaded petrol or a reduced number of atom bombs (Francis, Boyes, Qualter, & Stanisstreet, 1993, Kılınç, Stanisstreet, & Boyes, 2008). One of the most common alternative conceptions widely reported in the literature is the confusion the greenhouse effect with the problem of depletion of the ozone layer (Fisher, 1998; Francis et al., 1993; Ikonomidis et al., in press). Many students claimed that due to the holes in the ozone layer that more energy from the Sun comes to the earth and causes global warming. Although they indicated that CO₂ in the atmosphere causes global warming but they explained the role of CO₂ as breaking down the ozone layer (Boyes & Stanisstreet, 1997b). Some students also thought that chlorofluorocarbons (CFCs) cause the greenhouse effect as they break down the ozone layer (Rye & Rubba, 1998). Research also indicates that both students and teachers incorrectly associated endangered species, street and beach pollution, nuclear bomb stockpiles with the greenhouse effect. They also believed that an augmented greenhouse effect can result in an increased frequency of food

poisoning, heart attacks, and skin cancer (Jeffries, Stanisstreet, & Boyes, 2001). The common belief reported in the literature is that good things (healthy food, clean beaches) can help ameliorate the greenhouse effect while bad things (insecticides) can enhance (Ikonomidis et al., in press).

METHODOLOGY

Research questions

The purpose of this study was to investigate middle school (the eighth grade) students' conceptions about environmental issues especially global warming and the greenhouse effect by the time they completed their compulsory education in Turkey. The following research questions were generated in the study.

1. What are middle school students' conceptions of environmental issues?
 - a. What are middle school students' conceptions about consequences of the greenhouse effect?
 - b. What are middle school students' conceptions about causes of greenhouse effect?
 - c. What are middle school students' conceptions about cures of greenhouse effect?
2. Where do students' conceptions of environmental issues mainly come from?

Data collection

Eighty four grade 8 students (46 female and 37 male) from two different middle schools voluntarily participated in the study. Data were collected from the Environmental Issues Questionnaire developed by Boyes & Stanisstreet (1993). The questionnaire was translated into Turkish and validated by Kılınc, Stanisstreet, & Boyes (2008). Environmental Issues Questionnaire consisted of 36 items with three main parts containing items about consequences, causes and cures of global warming. An open-ended question of how students have learned their current knowledge was added to the questionnaire. The reliability coefficient of scale was calculated $\alpha = 0.79$.

Data analysis

All data were entered to the SPSS program and analyzed in terms of the frequency of correct responses to each question on the questionnaire. Students' responses were analyzed under three parts including consequences, causes, and cures of global warming.

FINDINGS

Table 1 shows the percentage of students' responses to each question regarding the consequences of global warming. A majority of students (81%) in this study are aware of the fact that the greenhouse effect can result in the changes in the world's weather and 66% of the students stated that the earth will get hotter if the greenhouse effect increases. More than half of the students (66%, 65% respectively) agreed that there will be more deserts and some of the ice at the poles will melt as the increase of the greenhouse effect. Sixty nine percent of the students thought that some tap water will become unsafe to drink while 62% of the participants believed that more people will get skin cancer if the greenhouse effect gets bigger. Forty four percent of the participants thought that more people will get food poisoning and 53% of them thought that more fish will get poisoned in the rivers. Students who think that more people will die of heart attacks are relatively low (39%). Half of the participants did not know if there is a connection between earthquakes and the greenhouse effect but a quarter of the students (25%) believed that there will be more earthquakes if the greenhouse effect increases.

Table 1: Students' responses about the consequences of global warming

If the greenhouse effect gets bigger, ...	It is true		No idea		It is false	
	f	%	f	%	f	%
1. The Earth will get hotter.	55	66*	13	16	16	19
2. More people will get food poisoning.	37	44	32	38	15	18*
3. There will be more flooding.	27	32*	28	33	29	35
4. More fish will get poisoned in the rivers.	45	53	30	36	9	11*
5. More people will get skin cancer.	52	62	26	31	6	7*
6. Some of our tap water will become unsafe to drink.	58	69	21	25	5	6*
7. There will be more bugs and pests on crops.	44	54*	29	36	8	10
8. There will be changes in the world's weather.	68	81*	14	17	2	2
9. More people will die of heart attacks.	32	39	32	39	18	22*

10. There will be more deserts in the world.	55	66*	21	25	7	9
11. Some of the ice at the North and South Poles will melt.	54	65*	18	22	11	13
12. There will be more earthquakes.	21	25	39	47	23	28*

Table 2 indicates the percentage of students' responses to each question about the causes of global warming. Findings of the study indicate that students have some alternative conceptions about the causes of global warming. The most common students' alternative conception was that radioactive waste from nuclear power stations makes the greenhouse effect worse (68%). More than half of the students agreed that the greenhouse effect is made worse by rubbish dumped in rivers and streams (55%) and by getting too many Sun's rays to the earth (60%). Half of the students thought that holes in the ozone layer makes the greenhouse effect worse. Forty three percent of the students agreed that the greenhouse effect is made worse by acid in the rain.

Table 2: Students' responses about the causes of global warming

The greenhouse effect is made worse by ...	It is true		No idea		It is false	
	f	%	f	%	f	%
13. Rubbish dumped in rivers and streams.	46	55	24	28	14	17*
14. Because too many of the Sun's rays get to the Earth.	49	60	27	33	6	7*
15. Too much carbon dioxide in the air.	33	39*	36	43	15	18
16. Too much ozone near the ground.	44	53*	29	35	10	12
17. Too much litter in the streets.	40	48	24	29	19	23*
18. Gas from rotting waste.	57	68*	15	18	12	14
19. Radioactive waste from nuclear power stations.	57	68	25	30	2	2*
20. Acid in the rain.	36	43	36	43	12	14*
21. CFC gas from spray cans.	45	56*	31	38	5	6
22. Gas coming from artificial fertilizers.	50	61*	22	27	10	12
23. Holes in the ozone layer.	41	50	27	33	14	17*
24. Because the Sun's rays cannot escape from the Earth.	42	50*	32	38	10	12

Table 3 shows the percentage of students' responses to each question regarding the cures of global warming. Sixty six percent of the students agreed that planting more trees can reduce the greenhouse effect and 60% of the students were aware of the fact that not using cars so much can make the greenhouse effect smaller. Almost half of the students (47%) agreed that not wasting electricity can reduce the greenhouse effect. Fifty three percent of the students were aware of the fact that making electricity from alternative energy sources (wind, waves, and tides) can decrease the greenhouse effect. On the other hand, half of the students incorrectly associated eating healthy food, keeping beaches clean, and using unleaded petrol with the greenhouse effect. Fifty nine percent of the students thought that protecting rare plants and animals can diminish the greenhouse effect.

Table 3: Students' responses about the cures of global warming

The greenhouse effect can be made smaller by ...	It is true		No idea		It is false	
	f	%	f	%	f	%
25. Having more nuclear power stations instead of coal power stations.	32	39*	36	43	15	18
26. Eating healthy food.	43	51	24	29	17	20*
27. Keeping beaches clean.	43	51	31	37	10	12*
28. Using unleaded petrol.	41	49	34	40	9	11*
29. Reducing the number of nuclear bombs in the world.	37	46	29	36	14	18*
30. Planting more trees in the world.	55	66*	22	26	7	8
31. Making our electricity from wind, waves and tides.	44	53*	29	35	10	12
32. Using recycled paper more.	38	46*	31	37	14	17
33. Protecting rare plants and animals.	49	59	18	22	16	19*
34. Not wasting electricity.	39	47*	34	41	10	12
35. Reducing starvation in the world.	19	23	31	37	33	40*
36. Not using cars so much.	50	60*	25	30	8	10

Table 4 shows students' responses regarding where their knowledge mainly come from. As seen in Table 4, the school was the most common response given by a majority of the students (61%). The second common source of students' knowledge come from was the television (40%). Internet was the third common response

given by 29% of the participants. Books and science magazines were said by 27% of the students. Twenty three percent of the students (19) said that they learn their knowledge about environmental issues from their parents while 24% of the students did not respond this question.

Table 4: Sources of students' knowledge about environmental issues

	f	%
School	51	61
Television	34	40
Internet	24	29
Books and magazines	23	27
Family	19	23
No response	20	24

DISCUSSION AND CONCLUSION

The findings of the current study indicated that Turkish middle school students have similar alternative conceptions of environmental issues with those reported in the literature. This study shows that students were aware of the main consequences of the greenhouse effect such as the change in the world's weather and melting some part of the ices at the poles. On the other hand, they lack of understanding of other possible consequences of the greenhouse effect and incorrectly associate skin cancer, heart attacks, and earthquakes with the greenhouse effect (Kılınç, Stanisstreet, & Boyes, 2008). As reported in many studies (Boyes, & Stanisstreet, 1993:), students in the current study also confused the greenhouse effect with the problem of ozone layer depletion (Fisher, 1998; Francis et al., 1993; Ikonomidis et al., in press; Khalid, 2003). As indicated in other studies (Kılınç, Stanisstreet, & Boyes, 2008), the most common students' alternative conception in the current study was that radioactive waste from nuclear power stations makes the greenhouse effect worse. In the current study, almost half of the students (47%) agreed that not wasting electricity can reduce the greenhouse effect. However, in Kılınç, Stanisstreet, & Boyes's (2008) study, only a fifth of the students realized that saving electricity could help to reduce the greenhouse effect. The findings of the study offer important insights related to the literature about students' conceptions of environmental issues.

- a. As a source of students' conceptions of environmental issues, school was the common source where students' conceptions coming from (Ikonomidis et al., in press; Kılınç et al., 2008). In the current study, TV was the second common response similar to Kılınç et al.'s (2008) study. Therefore, teachers' conceptions of environmental issues should be considered and workshops can be designed for in-service teachers so that not only teachers review their knowledge about environmental issues but also they learn new teaching activities about how to teach environmental issues to students. Moreover, teacher education programs should be revised in order to prepare well-informed pre-service teachers about environmental issues. Teaching materials including textbooks, magazines, and CD/DVDs should be reviewed and designed based on students' alternative conceptions in order to help students learn environmental issues.
- b. As further research, educators may develop new teaching methods and materials and test their effects on students' conceptions and attitudes toward environmental issues. Researchers also may investigate effects of professional development programs.

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