A Study on Primary and Secondary School Students' Misconceptions about Greenhouse Effect (Erzurum Sampling)

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Abstract
The aim of this study is to determine what level of primary and secondary school students' misconceptions related to greenhouse effect is. Study group consists of totally 280 students attended to totally 8 primary and secondary schools (4 primary school, 4 secondary school) which were determined with convenient sampling method from center of Erzurum. To collect data, a scale was used by utilizing from literature. Scale consisted of totally 22 items, 20 items of which were scored on a three-point Likert scale and 2 items left obtained information on demographic variables. The findings indicated that the students had fewer misconceptions than those specified in the literature related to "events depending on increasing of greenhouse effect", events getting bigger greenhouse effect" and "events to reduce greenhouse effect".

Keywords: Primary school, secondary school, greenhouse effect, misconceptions.

Introduction

In recent years, ecological balance have been damaged by especially anthropogenic influences and therefore environmental problems have been increasing rapidly (Orbay et al., 2009). Continued environmental problems consist of global warming, acid rains, thinning of the ozone layer, marine pollution and more local environmental problems (Selvi & Yıldız, 2009).

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Today, global warming and climate change caused by global warming is at the head of the environmental problems. Earth's climate has exposed sometimes warm and sometimes cold periods for centuries and today relatively cold period must be entered. But today, it seems that earth's climate is at a dangerously warm period in contrast to the cold period. The biggest cause of this situation is no doubtly global warming (Orbay et al., 2009).

The most important reason of the global warming and relatively climate changes is "Greenhouse Effect". Greenhouse effect means that short wave radiations from sunshine, after striking to earth's surface, are re-reflected by greenhouse gases to earth's surface at shape of long wave radiations (Orbay et al., 2009).

Because of increasing in greenhouse effect, earth has faced to global warming and as a result of this, the areas covered by glaciers in polar regions have been reduced gradually. In this way, it is likely to remain under water a large part of pieces of land on earth in later years. In addition, it may be showed that some events (a rise in water levels, drought in some areas, coastal erosions, increase in flood etc.) have occured (Bozkurt & Cansüngü, 2002).

Environmental protection against this type of environmental problems and delaying disasters at least can be provided with the training of individuals who impress it most. In addition, tha aim of this training should be giving behaviors with which individuals can deal with environmental problems and reach solution (Köse, 2010).

Environmental issues are taught at different stages of formal education. For example in Turkey, the information towards greenhouse effect is taught in 7^{th} classes for primary school and 8^{th} classes for secondary school.

The periods when students is given the information about environment is important because students develop environmental awareness during these periods. But, it is obvious that the information obtained in this period is not sufficient to interpret the abstract and complex issues such as greenhouse effect (Oluk, 2007). A lot of research have showed that youth and children cannot obtain accurate and consistent information about greenhouse effect, the factors increasing the greenhouse effect, environmental problems created by greenhouse effect and reduction or prevention of the greenhouse effect. These researches have also showed youth and children have constructed their information by obtaining from families, written and visual media generally and thus they can develop erroneous ideas which are inappropriate scientific understanding (Darçın vd 2006; Jeffries et al., 2001; Kahraman et al., 2008).

These erroneous ideas named "misconceptions" are very crucial obstacles for an effective science and environmental education. For

combating with these obstacles and removing them, it should be determined how the students constructed these conceptions in their minds. These determination is prerequisite for preparing an efficient learning environment (Bozkurt & Cansüngü, 2002).

In the light of these information, the aim of this study is to determine what level of primary and secondary school students' misconceptions related to greenhouse effect is.

Method

Research Approach

This sudy is a descriptive study which is aimed what level of primary and secondary school students' misconceptions towards "Greenhouse Effect" subject is.

Study Group

Study group consists of totally 280 students attended to totally 8 primary and secondary schools (4 primary school, 4 secondary school) which were determined convenient sampling method from center of Erzurum. It iwas taken into account that the students previously learned subject of greenhouse effect in their syllabus. Table 1 shows demographic characteristics of students.

Table 1.

The demographic characteristics of students in study group

	Primary school	Secondary school	Total
Female	72	98	170
Male	48	62	110
Total	120	160	280

Research Instruments and Analysis Techniques

In this study, an 16-item' Likert type scale which previously Bozkurt & Cansüngü (2002) prepared by adopting Boyes & Stanisstreet (1993)' study was utilized to collect data. And then, this scale was reorganized by researchers by adding 4 Likert type items and 2 items towards demographic characteristics. According to this, finally scale consisted of totally 22 items. 20 items were scored on a three-point Likert scale: "agree", "disagree", "undecided". 2 items obtained information on demographic variables such as gender, education level.

The scale was applied in the fall term of 2008-2009 academic year. SPSS statistical packet program was used to analyze the data. In this study, the data were analyzed by frequency analysis.

Findings

The findings of this study are given at Table 2, 3 and 4.

The findings related to events depending on increasing of greenhouse effect

Table 2.

The findings related to events depending on increasing of greenhouse effect

Expressions	Group	Agree		Disagree		Undecided	
		f	%	*f*	%	*f*	%
1. If the greenhouse effect gets bigger, people will be poisoned from foods.	P.S.	24	20.0	20	**16.7***	76	63.3
	S.S.	62	38.8	14	**8.8***	84	52.5
2. If the greenhouse effect gets bigger, there will be more flooding.	P.S.	42	**35.0***	30	25.0	48	40.0
	S.S.	70	**43.8***	24	15.0	66	41.2
3. If the greenhouse effect gets bigger, there will be more desertification.	P.S.	68	**56.7***	16	13.3	36	30.0
	S.S.	92	**57.5***	12	7.5	56	35.0
4. If the greenhouse effect gets bigger, the polar ice mountains will dissolve.	P.S.	64	**53.3***	10	8.3	46	38.3
	S.S.	88	**55.0***	12	7.5	60	37.5

"*****" It means correct answer for expression, " P.S."primary school students, "S.S." Secondary school students

It is presented in Table 2 that 20% of the primary school students (P.S.) and 38.8% of the secondary school students (S.S.) have misconcceptions for expression "**if the greenhouse effect gets bigger, people will be poisoned from foods**". In the second expression "**if the greenhouse effect gets bigger, there will be more flooding**", it is seen that 25% of P.S. and 15% of S.S. have misconcceptions. In addition, 13.3% of P.S. and 7.5% of S.S. for expression "**if the greenhouse effect gets bigger, there will be more desertification**" and 8.3% of P.S. and 7.5% of S.S. for expression "**if the greenhouse effect gets bigger, the polar ice mountains will dissolve**" have misconcceptions. According to these findings, P.S. have given more wrong answer than S.S. for expression 2, 3 and 4.

The findings related to events getting bigger greenhouse effect (Table 3)

Table 3.

The findings related to events getting bigger greenhouse effect

Expressions	Group	Agree		Disagree		Undecided	
		f	%	f	%	f	%
5. The waste evacuated into streams and rivers increases greenhouse effect.	İ.Ö.	40	**33.3***	26	21.7	54	45.0
	O.Ö.	68	**42.5***	24	15.0	68	42.5
6. If the waste evacuated into the sea increases, the greenhouse effect will get bigger.	İ.Ö.	36	**30.0***	22	18.3	62	51.7
	O.Ö.	62	**38.8***	22	13.8	76	47.5
7.Increasing of CO_2 in atmosphere increases the greenhouse effect.	İ.Ö.	66	**55.0***	8	6.7	46	38.3
	O.Ö.	94	**58.8***	10	6.2	56	35.0
8. Increasing of CH_4 (methane) in atmosphere increases the greenhouse effect.	İ.Ö.	44	**36.7***	16	13.3	60	50.0
	O.Ö.	82	**51.2***	12	7.5	66	41.2
9. Hole in the ozone layer and greenhouse effect is the same phenomenon.	İ.Ö.	28	23.3	52	**43.3***	40	33.3
	O.Ö.	38	23.8	44	**27.5***	78	48.8
10. If the amount of garbage produced by humans increase, the greenhouse effect will get bigger.	İ.Ö.	44	**36.7***	30	25.0	46	38.3
	O.Ö.	74	**46.2***	30	18.8	56	35.0
11. Unconsciously, the destruction of vegetation increases the greenhouse effect.	İ.Ö.	58	48.3	16	**13.3**	46	38.3
	O.Ö.	84	52.5	4	**2.5**	72	45.0
12. Gases from spoilt waste increases the greenhouse effect.	İ.Ö.	66	**55.0***	16	13.3	38	31.7
	O.Ö.	96	**60.0***	8	5.0	56	35.0
13. Gases from nucleer power stations increases the greenhouse effect.	İ.Ö.	56	46.7	8	**6.7***	56	46.7
	O.Ö.	62	38.8	82	**51.2***	16	10.0
14. If the amount of acid in rain increase, , the greenhouse effect will get bigger.	İ.Ö.	40	33.3	22	**18.3***	58	48.3
	O.Ö.	52	32.5	8	**5.0***	100	62.5
15.CFC (chlorofluorocarbon) from spray products increases the greenhouse effect.	İ.Ö.	62	**51.7***	8	6.7	50	41.7
	O.Ö.	68	**42.5***	12	7.5	80	50.0

It is presented in Table 3 that 21.7% of the primary school students (P.S.) and 15% of the secondary school students (S.S.) for expression "**the waste evacuated into streams and rivers increases greenhouse effect**" and 18.3% of P.S. and 13.8% of S.S. for expression "**if the waste evacuated into the sea increases, the greenhouse effect will get bigger**" have misconcceptions. Besides, 6.7% of P.S. and 6.2% of S.S. for expression "**increasing of CO_2 in atmosphere increases the greenhouse effect**" and 13.3% of P.S. and 7.5% of S.S. for expression "**increasing of CH_4 (methane) in atmosphere increases the greenhouse effect**" have misconcceptions. In addition, 23.3% of P.S. and 23.8% of S.S. for expression "**hole in the ozone layer and greenhouse effect is the same phenomenon**", 25% of P.S. and 18.8% of S.S. for expression "**if the amount of garbage produced by humans increase, the greenhouse effect will get bigger**", 43.3% of P.S. and 52.5% of S.S. for expression "**unconsciously, the destruction of vegetation increases the greenhouse effect**" and 13.3% of P.S. and 5% of S.S. for expression "**gases from spoilt waste increases the greenhouse effect**" have

misconcceptions. Finally, 46.7% of P.S. and 38.8% of S.S. for expression "**gases from nucleer power stations increases the greenhouse effect**", 33.3% of P.S. and 32.5% of S.S. for expression "**if the amount of acid in rain increase, , the greenhouse effect will get bigger**" and 6.7% of P.S. and 7.5% of S.S. for expression "**CFC (chlorofluorocarbon) from spray products increases the greenhouse effect**" have misconcceptions. According to these findings, P.S. have given the wrong answer than S.S. for expression 5, 6, 7, 8, 10, 12, 13 and 14.

The findings related to events to reduce greenhouse effect (Table 4)

Table 4.

The findings related to events to reduce greenhouse effect

İfadeler	Group	Agree		Disagree		Undecided	
		f	%	f	%	f	%
16. The establishment of nuclear power plants instead of thermal power plants reduces the greenhouse effect.	İ.Ö.	30	**25.0***	32	26.7	58	48.3
	O.Ö.	26	**16.2***	22	13.8	112	70.0
17. Prevent the use of nuclear bombs reduces the greenhouse effect.	İ.Ö.	60	50.0	12	**10.0***	48	40.0
	O.Ö.	62	38.8	24	**15.0***	74	46.2
18. To keep clean coast reduces the greenhouse effect.	İ.Ö.	40	33.3	30	**25.0***	50	41.7
	O.Ö.	60	37.5	24	**15.0***	76	47.5
19. Being protected of reduced plant and animal species reduces the greenhouse effect.	İ.Ö.	36	30.0	28	**23.3***	56	46.7
	O.Ö.	56	37.5	30	**18.8***	74	46.2
20. Unnecessary use of motor vehicles reduces the greenhouse effect.	İ.Ö.	52	**43.3***	44	36.7	24	20.0
	O.Ö.	48	**30.0***	58	36.2	54	33.8

It is presented in Table 4 that 26.7% of the primary school students (P.S.) and 13.8% of the secondary school students (S.S.) have misconcceptions for expression "**the establishment of nuclear power plants instead of thermal power plants reduces the greenhouse effect**". For expression "**prevent the use of nuclear bombs reduces the greenhouse effect**", it is seen that 50% of P.S. and 38.8% of S.S. have misconcceptions. In addition, 33.3% of P.S. and 37.5% of S.S. for expression "**to keep clean coast reduces the greenhouse effect**", 30% of P.S. and 37.5% of S.S. for expression "**being protected of reduced plant and animal species reduces the greenhouse effect**" and 36.7% of P.S. and 36.2% of S.S. for expression "**unnecessary use of motor vehicles reduces the greenhouse effect**" have misconcceptions. According to these findings, P.S. have given the more wrong answer than S.S. for expression 12, 13 and 16.

Conclusion and Recommendations

This study is important to be able to determine level of primary and secondary school students' misconceptions towards "Greenhouse Effect" subject and to guide future works towars removing these misconceptions.

Global environmental problems such as greenhouse effect is based on "abstract" concepts which are difficult to revive in mind. Therefore, learning this type of issues or concepts in a meaningful way depends on students' learning by doing and living (Darçın et al., 2006). The findings from this study have indicated that primary and secondary school students have insufficient knowledge and a lot of misconceptions about greenhouse effect. Smilarly, Bahar (2000)'s study indicated that the students at the university have not knowledge about this subject and they also have the inaccurate information.

An important finding for the mojority of expressions directed to students about greenhouse effect is that primary school students (P.S.) have more misconceptions than secondary school students (S.S.). As mentioned earlier, the subjects related to greenhouse effect is taught in 7^{th} classes for primary school and 8^{th} classes for secondary school. This study was carried out with 8^{th} class of primary school and 9^{th} class of secondary school. Therefore, the reason why the primary school students have more misconceptions than secondary school students is likely that they may have forgotten the subject more in the 1-year period. But, unlike similar studies in previous years (Bozkurt & Cansüngü, 2002; Kışoğlu et al., 2010; Koulaides & Christidou, 1999; Mohapatra & Bhadauria, 2009; Şahin et al., 2004; Yardımcı & Kılıç, 2010), it is quite pleasing that the percentage of students with misconceptions is a lower rate in this study. This finding can be thought as an indicator which they can be associated with expressions about greenhouse effect correctly.

As stated by Cin (2005), some of the students'misconceptions may be occured as a result of student's mixing any environmental problem with another environmental problem. For examle, similarly to Cin (2005)'s study, the students in this study perceived as if greenhouse effect and hole in the ozone layer was a single problem in many ways. According to Cin (2005), the reason for this stuation may be students to highlight the common characteristics of these two concepts rather than the distinctive features of them.

One of the reasons for students'misconceptions may be observations and experiences spent out at school (Halloun & Hestenes, 1985). For example, a study by Arsal (2010) has showed despite the fact that the earhquakes don't connected to weather and climate events which occured as greenhouse effect and consequence, teacher candidates connected to the earhquakes with greenhouse effect by mistake. As regarding this subject, especially Jeffries et al. (2001) and Kahraman et al. (2008) have emphasized that students' daily life and media (television, radio, internet etc.) was the probable reasons for students'misconceptions. Taking into account all of these studies, in future studies, it may be useful to do applications towards determining from which sources the students obtain their knowledge in daily life.

Some of the students'misconceptions may be caused that greenhouse effect is an abstract concept. Therefore, as stated by Selvi & Yıldız (2009), concrete models can be used in teaching these concepts. Especially, in teaching issues of this type, it may be useful to carry out the lessons with student-centered methods and activities (Darçın et al., 2006).

Some of the students'misconceptions may also be caused by the teachers. As regarding this subject, Groves & Pugh (1999) stated that misconceptions seen in teachers may be likely to have students. Therefore, it is important to correct the teachers'misconceptions and increase their knowledge levels with in-service training both before starting to work (Cin, 2005) and during working. At this point, as stated by Pekel et al. (2007), for increasing the teachers' knowledge levels by eliminating their misconceptions about the greenhouse effect, it may be very useful to organize seminars or renovation courses in all cities.

For reaching to the desired level, the future generations' literacy level about greenhouse effect, the presence and level of the misconceptions is important to determine exactly. Therefore, , it is to be useful to do studies towards determining both students and teachers' knowledge levels about current environmental issues in the each education level. However, in the future studies, if the questions towards uncovering awareness of society about the greenhouse effect can be prepared, much more useful results will be obtained.

Biographical statement

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