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A Thematic Review of Students' Alternative Ideas Studies on Greenhouse Effect

Erhan AKTAŞ, *Graduate School of Natural and Applied Science, Kastamonu University, Turkey, erhanaktas0657@gmail.com*
Mehmet Altan KURNAZ, *Department of Mathematics and Science Education, Kastamonu University, Turkey, altan.kurnaz@gmail.com*

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ABSTRACT
Based on the fact that current research will lead to future research, studies in Turkey on greenhouse effect have been examined in terms of their needs, methods, findings, results and recommendations. Document analysis method was used in the study. Eleven articles, a statement and a dissertation between 2002 and 2010 were studied. As a result of analyzes conducted, the needs, methods, findings, results and suggestions of the researches are presented in the tables in a holistic manner. Based on the findings, some suggestions were made for future research on greenhouse effect.
Keywords: Greenhouse effect, thematic review, alternative ideas

Sera Etkisi Konusundaki Alternatif Fikir Çalışmalarının Tematik İncelenmesi

ÖZET
Mevcut araştırmaların gelecekteki araştırmalara yön vereceği gerçeğinden hareketle, bu çalışmada, sera etkisi konusunda Türkiye'de yapılmış çalışmalar gerekçeleri, yöntemleri, bulguları, sonuçları ve önerileri açısından incelenmişlerdir. Çalışmada doküman incelemesi yöntemi kullanılmıştır. 2002 ile 2010 yılları arasında yapılmış on bir makale, bir bildiri ve bir tez üzerinde çalışılmıştır. Gerçekleştirilen analizler sonucunda incelenen araştırmaların gerekçeleri, yöntemleri, bulguları, sonuçları ve önerileri bütüncül bir şekilde tablolarda sunulmuştur. Ulaşılan bulgulardan hareketle de sera etkisi konusunda gelecekte yapılabilecek araştırmalar için bazı önerilerde bulunulmuştur.
Anahtar Kelimeler: Sera etkisi, tematik inceleme, alternatif fikirler

INTRODUCTION

According to the constructivist learning approach, individuals can generalize new knowledge through experience, mental structure, skill and belief filter in the learning process. For this reason, learning can be realized by associating new knowledge with existing knowledge and building a harmonious structure (Osborne & Wittrock, 1983; Bodner, 1990; Yager, 1991; Mathews 2000; Taber, 2002). On the other hand, if the current knowledge of students does not coincide with the definitions defined in the scientific sense, it is possible that a meaningful learning is not realized in the students (Bodner, 1990; Çalık, 2006; Özsevgeç, 2007). If

teachers do not have a deep knowledge about the non-scientific (and known as alternative ideas) concepts of pupils they will teach, it is quite difficult for students to develop their perceptions in a scientific sense (Çalık, 2006). Therefore, alternative concepts of students should be accepted as the starting point for the realization of learning and possible alternative ideas of the students should be investigated accordingly. In the relevant literature, it can be said that there are many studies on the determination of alternative student ideas, although mostly on the basic concepts of physics, chemistry, biology and mathematics.

In recent years, it can be stated that alternative student ideas about the concepts related to environment started to be examined. In these studies, different findings and results about alternative student ideas have been reached. The topic of 'greenhouse effect', which is one of the important topics of environmental education, is the subject of alternative student ideas. It is clear that teachers' knowledge of possible alternative ideas in educating individuals who are sensitive and aware of the greenhouse effect considered as a global problem can be useful in designing learning environments (Selvi & Yıldız, 2009; Arsal, 2010). In addition, considering the contribution of these studies in relation to greenhouse effect to the literature and the difficulties of reaching teachers and/or researchers at the same time, it is thought that it will be effective to collect these together and present them to the related persons. For this reason, a thematic review should be undertaken by means of a matrix with needs, research methodologies, general knowledge claims and implications on students' alternative conceptions related with the greenhouse effect. In this context, the following questions were asked:

1. What were the needs of the related subject area?
2. Which methodologies (sampling, data collection tools, analysis methods, etc.) were used in the studies?
3. What are the main findings from the studies?
4. What are the main results from the studies?
5. What kind of recommendations are presented in the studies?

Importance and Restriction of the Study

Analyzing the studies on alternative student ideas about greenhouse effect, considered among the popular problems, will help to uncover the focus of these studies and summarize the process from the initial studies of the concept to the present. Such a study, on one hand, will provide teachers with a holistic perspective and will contribute to the realization of effective teaching activities. On the other hand, a synthesis of the studies in the relevant literature will facilitate access to information on this subject that attracts teachers, curriculum developers and policy makers. Considering the need for conducting synthetic works (Kurnaz & Çalık, 2009), it is believed that this study is important in terms of the fact that no studies have been encountered reflecting the perspective adopted. The aim of this study is to reach a holistic document on the greenhouse effect and to provide young researchers with the opportunity to see new and different fields of study, based on synthetic reflections. It is also thought that focusing on national literature may contribute to understanding the cultural meaning of 'greenhouse effect'. The effect of culture in the learning process cannot be denied and this situation shows the necessity and importance of the work in a different perspective.

In the research, the articles, papers and theses made in the field of education in Turkey were screened with the keyword 'greenhouse effect'. As a result of the reviewed studies, it was determined that 13 of these studies were about 'greenhouse effect'. This study is limited to the studies conducted and the analyzes performed since the related studies are subjected to thematic analyzes in terms of subject areas, research methodologies, basic findings, basic results and suggestions.

METHOD

In the study, the publications on the 'greenhouse effect' using the document analysis method have been examined in a systematic way. The matrix used in some studies (e.g. Kurnaz & Çalık, 2009; Kurnaz & Sağlam-Arslan, 2011; Ezberci Çevik & Kurnaz, 2016; Kurnaz, Bozdemir, Altunoğlu & Ezberci Çevik, 2016), which the researchers have a common view on what to consider before the studies are classified, is adapted to this study. The (i) needs, (ii) method, (iii) study group, (iv) data collection tool, (v) data analysis methods/techniques, (vi) important findings and (vii) important results and (viii) recommendations of the studies have been examined by thematic analysis and classification. With thematic analysis, it can be demonstrated how a change or diversification is occurring for a situation (e.g. 'greenhouse effect'). In this study, it was preferred to present the findings in tables.

FINDINGS

In accordance with the mentioned questions above, the findings obtained from the studies examined are presented under this heading respectively.

Chronology and Needs of the Studies

The needs for the studies examined are given chronologically in Table 1.

Table 1. *Needs for related studies*

Studies	Needs
Bahar & Aydın, 2002	The aim is to determine the students' preliminary knowledge about greenhouse gases and global warming, determination of learning levels after the lecture, and investigation of the seminar-based discussion technique as a teaching method.
Bozkurt & Cansüngü, 2002	The aim of the study was to determine the students' concept of greenhouse effect.
Bal, 2004	It is aimed to determine the misconceptions of prospective teachers about the greenhouse effect, to eliminate the misconceptions, and to present suggestions for the realization of an effective environmental education.
Cin, 2005	This study was carried out in order to determine prospective teachers' misconceptions about the greenhouse effect.
Darçın vd., 2006	The aim of this study is to determine the level of knowledge and misconceptions of primary school students about greenhouse effect.
E. Oluk & S. Oluk, 2007	To determine the greenhouse effect, global warming and climate change perceptions of higher education students.
Selvi & Yıldız, 2009	The aim of this study was to investigate the perceptions of biology teacher candidates about the greenhouse effect and to determine whether there is a statistically significant difference between the students who take environmental courses and students who do not.
Arsal, 2010	The aim of this study is to determine the misconceptions of primary and secondary school teachers about greenhouse effect.
Yalçın, 2010	To determine the level of knowledge and misunderstandings of primary school students about global warming and greenhouse effect.
Topsakal & Altınöz, 2010	In this study, it has been tried to determine the misconceptions of primary school teacher candidates related to the greenhouse effect, which is one of the important environmental problems, and whether these misconceptions are related to the departments they studied.
Erdoğan & Özsevgeç, 2012	The aim of the course is to eliminate the misconceptions about greenhouse effect and global warming by using concept cartoons.
Çakmak & Akçöltekin, 2013	This research was carried out to determine the misconceptions and knowledge levels of the 8th grade primary school students about the greenhouse effect sources, effects and mitigation and prevention ways within the scope of environmental education of science and technology course.
Bakırcı & Yıldırım, 2017	The aim of this study is to investigate the effect of common knowledge configuration model on seventh grade students' conceptual understanding and retention of greenhouse effect.

When Table 1 is examined, it is understood that the greenhouse effect studies have started to be carried out in the last fifteen years. In addition to the greenhouse effect, some studies also focus on global warming, greenhouse gases and climate change. From a

pedagogical point of view, it is observed that learning levels and perceptions of students' misconceptions about greenhouse effect are investigated in these studies.

Methodologies of the studies

Related with the studies on the greenhouse effect, Table 2 presents the research methodologies, and study groups and numbers of groups.

Table 2. *Methodologies and study groups of related studies*

Studies	Research Method				Study Groups		
	E	D	S	U	P	El	f
Bozkurt & Cansüngü, 2002			✓			✓	350
Bahar & Aydın, 2002				✓	✓		90
Bal (2004)			✓		✓		140
Cin (2005)			✓		✓		160
Darçın vd., (2006)			✓			✓	319
Oluk & Oluk (2007)		✓			✓		24
Selvi &Yıldız (2009)		✓			✓		152
Arsal (2010)		✓			✓		171
Topsakal & Altınöz (2010)			✓		✓		286
Yalçın (2010)			✓			✓	200
Erdoğan & Özsevgeç (2012)	✓					✓	17
Çakmak & Akçöltekin (2013)			✓			✓	148
Bakırcı & Yıldırım (2017)	✓					✓	25

E: Experimental; D: Descriptive; S: Survey; U: Unspecified; P: Prospective teachers; El: Elementary students

In Table 2, it is seen that experimental, descriptive and scanning research methods are used. It is noted that the research methods related to the subject are limited to certain methods and mostly survey methods are used. In the researches, it is revealed that the study group is working with prospective teachers (undergraduate students) and elementary school students. Although the greenhouse effect is a current issue / problem concerning the whole society, it is noteworthy that the research has been carried out with a small number of people without reaching specific groups and the masses.

Data gathering tools and analysis methods of the studies

The data collection tools and methods of analysis of the relevant studies are presented in Table 3.

Table 3. *Data collection tools and analysis methods of related studies*

Studies	Data collection tools					Analysis methods				
	L	A	O	I	F	T	An	C	Co	U
Bozkurt & Cansüngü, 2002	✓				✓					
Bahar & Aydın, 2002		✓	✓							✓
Bal (2004)	✓		✓		✓					
Cin (2005)	✓				✓					
Darçın vd., (2006)	✓				✓					
Oluk & Oluk (2007)				✓					✓	
Selvi &Yıldız (2009)	✓			✓				✓		
Arsal (2010)	✓					✓				
Topsakal & Altınöz (2010)	✓							✓		
Yalçın (2010)	✓					✓	✓			
Erdoğan & Özsevgeç (2012)		✓			✓	✓				
Çakmak & Akçöltekin (2013)	✓				✓					
Bakırcı & Yıldırım (2017)		✓					✓			

L: Likert type survey; A: Achievement test; O: Open-ended survey; I: Interview; F: Frequency; T: T-test; An:Anova; C: Chi Square; Co: Content analysis; U: Unspecified

When Table 3 is examined, achievement tests, interviews and likert-type and open-ended surveys are preferred as data collection tools. Statistical analysis as data analysis methods were more preferred and frequency, t-test, anova, chi-square methods were used. Content analysis method was used as inferential analysis.

Findings of the studies

The most important findings of the relevant studies are given in Table 4, with the common findings being together.

Table 4. *Important findings of the studies*

Studies	Findings
Bozkurt & Cansüngü, 2002; Darçın vd., 2006; Arsal, 2010; Yalçın, 2010; Çakmak & Akçöltekin, 2013	Preventing, reducing or eliminating the use of nuclear bombs will reduce the greenhouse effect.
Bahar & Aydın, 2002; Oluk & Oluk, 2007; Erdoğan & Özsevgeç, 2012; Bakırcı & Yıldırım, 2017	Greenhouse gas wraps the earth and prevents the sun rays from leaving the world and the world overheating causes global warming.
Bal, 2004; Selvi &Yıldız, 2009; Topsakal & Altınöz, 2010	Waste from nuclear power stations increases the greenhouse effect.
Cin, 2005; Selvi &Yıldız, 2009; Çakmak & Akçöltekin, 2013	Holes in the ozone layer increase the greenhouse effect.
Darçın vd., 2006; Topsakal & Altınöz, 2010; Arsal, 2010	With the increase of greenhouse effect, more people get skin cancer.
Selvi &Yıldız, 2009; Topsakal & Altınöz, 2010	The greenhouse effect is entirely due to human activities.
Bahar & Aydın, 2002	CO_2 keeps the temperature, the heated atmosphere is used in greenhouse cultivation.
Bozkurt & Cansüngü, 2002	Increasing the amount of acid in the rain increases the greenhouse effect.
Bal, 2004	When the greenhouse effect increases, people will be poisoned from food.
Cin, 2005	- Solid wastes increase the greenhouse effect. - Recycling used paper does not reduce the greenhouse effect.
Yalçın, 2010	When the greenhouse effect increases, more floods will be seen.
Erdoğan & Özsevgeç, 2012	To grow vegetables, fruit and flowers in places covered with glass or nylon sheets from cold and other adverse weather conditions are called greenhouse effect.
Çakmak & Akçöltekin, 2013	Throw garbage into rivers, it will further increase the greenhouse effect.
Bakırcı & Yıldırım, 2017	Methane gas from the dumps damages the atmosphere, prevents heat from returning to space and increases the greenhouse effect.

When Table 4 is examined, it is noteworthy that the important findings in the studies are based on the learning difficulties and alternative ideas of the participants and they vary in terms of the meaning, causes, results and solutions of the greenhouse effect. The common findings of "nuclear bomb use-greenhouse effect" relationship (Bozkurt & Cansüngü, 2002; Darçın vd., 2006; Arsal, 2010; Yalçın, 2010; Çakmak & Akçöltekin, 2013), greenhouse gas global warming relationship (Bahar & Aydın, 2002; Oluk & Oluk, 2007; Erdoğan & Özsevgeç, 2012; Bakırcı & Yıldırım, 2017), greenhouse effect relation of nuclear wastes (Bal, 2004; Selvi &Yıldız, 2009; Topsakal & Altınöz, 2010), Greenhouse effect relationship with the holes in the ozone layer (Cin, 2005; Selvi &Yıldız, 2009; Çakmak & Akçöltekin, 2013) and the relationship between human health and greenhouse effect (Darçın vd., 2006; Topsakal & Altınöz, 2010; Arsal, 2010) appears to be related.

Results of the studies

The results of the related studies are given in Table 5, with the common results being combined.

Table 5. *Important results of the studies*

Studies	Results
Bozkurt & Cansüngü, 2002; Bal, 2004; Cin, 2005; Darçın vd., 2006; Oluk & Oluk, 2007; Selvi &Yıldız, 2009; Topsakal & Altınöz, 2010; Yalçın, 2010; Çakmak & Akçöltekin, 2013	Participants are not sufficiently informed or knowledgeable about the greenhouse effect.
Bahar & Aydın, 2002; Bozkurt & Cansüngü, 2002; Bal, 2004; Cin, 2005; Darçın vd., 2006; Topsakal & Altınöz, 2010; Arsal, 2010; Erdoğan & Özsevgeç, 2012; Çakmak & Akçöltekin, 2013	Participants have some misconceptions about the greenhouse effect.
Bahar & Aydın, 2002	The participants have insufficient knowledge of greenhouse gases and global warming.
Oluk & Oluk, 2007	The participants define the sources of greenhouse gases by generalizing them.
Erdoğan & Özsevgeç, 2012	There is a positive effect of teaching with the concept cartoons on greenhouse effect.
Bakırcı & Yıldırım, 2017	The Common Information Configuration Model has a positive effect on students' conceptual understanding of greenhouse effect and the permanence of knowledge.

When Table 5 is examined, the obvious result of the studies is that the participants do not have enough information about the greenhouse effect. As a common result of studies, the participants have misconceptions about the greenhouse effect, its causes, effects and ways of preventing the greenhouse effect.

Recommendations of the studies

The recommendations mentioned in the relevant studies are given in Table 6, with the common recommendations being combined.

Table 6. *Important recommendations of the studies*

Studies	Recommendations
Bozkurt & Cansüngü, 2002; Darçın vd., 2006; Oluk & Oluk, 2007; Selvi &Yıldız, 2009; Topsakal & Altınöz, 2010; Yalçın, 2010; Çakmak & Akçöltekin, 2013	Different teaching strategies should be developed by considering the insufficient points of the students.
Selvi &Yıldız, 2009; Arsal, 2010; Topsakal & Altınöz, 2010; Erdoğan & Özsevgeç, 2012	Perceptions of different participants on environmental issues should be determined and the results should be compared.
Bahar & Aydın, 2002; Yalçın, 2010	More attention should be given to environmental education.
Bal, 2004; Darçın vd., 2006	Emphasis should be placed on experimental studies and material use should be enriched.
Bal, 2004; Cin, 2005	Students should be given courses such as ecology and environmental education.
Darçın vd., 2006; Yalçın, 2010	For motivation and meaningful learning, subjects should be given in a way that is intriguing and interesting to the student.
Bozkurt & Cansüngü, 2002	By providing students to take a more active role in environmental education, students' learning should be realized more permanently and effectively.
Oluk & Oluk, 2007	Issues related to environmental problems should be extended to other branches.
Topsakal & Altınöz, 2010	Scientific activities such as conferences, symposiums and panels should be organized on the greenhouse effect.
Erdoğan & Özsevgeç, 2012	- It is recommended that the materials developed in science subjects be introduced to teachers through in-service courses. - Activities that can actively involve pupils in the process should be used.

When the Table 6 is examined, it is noteworthy that the results of the studies are the most basic suggestions for the students by taking into account the lack of sufficient knowledge about the greenhouse effect. It is emphasized in some studies that studies with different participants are needed. In addition, it is suggested to give more attention to environmental education, to teach courses such as ecology, environmental education, to increase the use of materials by giving weight to experimental studies, to provide motivation and meaningful learning and to provide learning environments that attract student interest.

RECOMMENDATIONS FOR THE FUTURE STUDIES

In this study, some of the articles, conference papers or theses published in Turkey related with the greenhouse effect which were reached by researchers have been analyzed in terms of their needs, methodology, study group, data collection tools and analysis methods, findings, conclusions and recommendations. When all the studies dealt with a holistic perspective, about the greenhouse effect, still can be noted that there is not enough research, and researches are needed in different contexts. Moreover, although in recent years gained intensity of working towards environmental problems all over the world, it is noticeable that the training in Turkey decreased after 2010. Also, it can be said that the studies do not focus on all segments of society. From there, it is advisable for educational researchers to conduct research in the field, especially to young researchers looking for a study topic. In another case that attracts attention in the research reports examined, the researches were carried out mostly through survey research method. Different research methods in which in-depth data are gathered and analyzed, especially in the context of qualitative research, are needed. It can also be stated that different working groups should be differentiated and studies with larger groups should be carried out. In future studies, arrangements can also be made according to the sub-titles of the greenhouse effect, causes, results and solutions to the greenhouse effect during the development of data collection tools. Thus, the findings from the related researches examined in this study can be discussed in a wider and deeper perspective.

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