THE KNOWLEDGE AND THOUGHTS OF NINTH GRADE STUDENTS ON THE CONCEPTS RELATED TO THE SUBJECT OF ENERGY[1]

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Abstract: In the research, knowledge and thoughts of the secondary school, ninth grade students about the concepts within the subject of energy, were aimed to be described in details. In this respect, the research was figured as a descriptive case study. As for the participants of the research, they were consisting of 85 students who were students at the ninth grade of three different Anatolian High schools in the city of Ankara. The research data was gathered in the spring semester of 2013-2014, and the data was gathered via the form of determining the thoughts of students about energy, at the beginning of the research process, and at the end of the process via energy concept form. The data gained by the research has been resolved by the descriptive analysis method. Besides, in order to support the statements of the students in the research, semi-structured interviews were carried out with %20 of the students from each class. In the conclusion of the research, it was revealed that the students had deficient and wrong information about nuclear energy among the concept of energy, types of energy, energy conversions and energy sources. It was determined that the students think, in terms of energy, as comprehensive, difficult, related with all the subjects of physics, basis for all the subjects, related to daily life, requiring the ability of interpretation, being difficult also in primary schools, and an abstract issue.
Keywords: Energy, energy protection, energy conversion, energy sources, student thoughts.

INTRODUCTION

The branch of science that is dependent on the universal events and progressive in accordance with the developments in technology is called “Physics” (Karakuyu, 2006). Within the branch of Physics, on the other hand, the subject of energy which has an important place in the universe, is handled (Jones & Dugan, 2003; Serway & Beichner, 2008). That is because apart from the science of physics, many events in the universe can be explained by the concept of energy (Ellse, 1988). Also in our country, energy has had a very important place in our lives in terms of many factors like tendencies to different energy sources, energy conversions, benefiting from renewable energy sources, vehicles, stoves etc. working with solar energy, dams, oil sources and natural gas (Ertaş, Şen & Parmaksızoğlu, 2011). Today, due to limited and daily running out energy sources, it is observed that the existing problems about energy sources are on the rise. For these problems, it is considered that the teaching of the subject of energy, based on the structuralist learning approach, would be affective in educating individuals who are sensitive to environment and interested in renewable energy sources, and that the subject will be more important in time (Koçak, 2008). Besides, with this current appearance of the renewable energy on the agenda, it is observed that there is a rise in the number of studies carried out about energy recently (Bilen, Özel & Sürücü, 2013). When the studies about the energy in the recent years are inspected, it is observed that the students have errors about the concepts in terms of energy (Ellse, 1988; Konuk & Kılıç, 1999; Ogborn, 1990; Solomon, 1982; Stylianidou 1997; Stylianidou, Ormerod & Ogborn, 2002; Trumper, 1998; Çoban, Aktamış & Ergin, 2007; Yürümezoğlu, Ayaz & Çökelez, 2009). In the

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researches of Çoban, Aktamış and Ergin (2007), Seçer (2008) and Hırça et al. (2008) which were carried out in order to reveal how the concept of energy was perceived, it was determined that the students structured the concept of energy in their minds with alternative concepts like kinetic energy, the energy present in the living things, that they had difficulties in understanding the concepts, unable to put into practice the theoretical information they had, and had unscientific ideas. In the research, carried out by Küçük, Çepni and Gökdere (2005), Yuenyong and Yuenyong (2007) and Ogborn (1990) while it was determined that the students defined energy as electrical, potential, heat, mechanical energy, it was revealed that they took energy as the same as force and as a type of fuel, and had a conceptual error resulting from relating the concept of energy with force and power, and also it was seen that the reason for this error was the foreknowledge the students had due to the daily language used. Trumper and Gorsky (1993), Watts (1983), Ben Zvi (1999) and Tatar and Oktay (2007) have also determined that the students think that energy is only related with humans, it is consumed and lost, the diminishing of energy is the opposite of energy preservation, and the preservation of energy means the saving of energy. Also in the research, carried out by Kaper and Goedhart (2002a), it was found out that the students related energy with visible events and technological applications before the learning of the subject of energy. As it is seen from the researches carried out so far, the better teaching of the subject of energy, the ability of students to use the information they have learned in various events, and the capability of providing different explanations with combining this information with the daily life is expected (Coştu, Ünal & Ayas, 2007). Thus, students will be able to learn the subject of energy and its concepts. In the teaching of such an abstract concept, in order for the students to learn comprehensively and have enough knowledge on the subject of energy, great burden is on the teachers for they have to teach by relating the daily life events, which affect the students, with the concept of energy (Liarakou, Gavrilakis & Flouri, 2009; Öztürk, 2007). In this respect, it was aimed in this research that the thoughts and information the students had about energy, energy conservation, energy conversion and energy sources be evaluated according to the process. In the research, which was carried out in three different Anatolian High schools, the subject of energy which was being taught in accordance with the new physics teaching program, was considered. As the students in the research varied, comparisons have been made between the students. Moreover, in the areas where the research took place, the teaching program of physics is applied for the first time, and it is believed that the thoughts and information of the students about the energy, energy conservation, energy conversion and energy sources, all in the subject of energy, would be important as they will be evaluated within the scope of qualitative case study.

THE STUDY

In this study, the thoughts and knowledge of the secondary school, ninth class students on the energy, before the study, and on energy, energy conservation, energy conversion and energy sources after study, were aimed to be portrayed via the help of case study pattern. Case study is defined as; a kind of study among the methods of qualitative research, which is a pattern that enables a detailed analysis of an event or a case (Creswell, 2013; Glesne, 2012; Yin, 2009). Besides, existing within the pattern of case study as a type, the total multiple case pattern has also been used in the research. The total multiple case pattern is defined as a type which enables the comparison of multiple cases that are handled in itself as a total like a class (Yıldırım & Şimşek, 2013). With this set out, three different classes, in which the teaching of the subject of energy was carried out in the ninth classes of secondary schools, of three different Anatolian High schools were considered, and comparisons were made between these classes in the research.

Study Group

The study group of the research consists of 85 ninth class students who are studying the subject of energy in three different Anatolian High schools in the city of Ankara. 31 of the 85 students are studying in the first Anatolian High school (BAL), 24 of them are in the second Anatolian High school (İAL) and 30 of them are in the third Anatolian High school (ÜAL). The participants in the study were determined in accordance with the criterion sampling which is one of the methods of purposeful sampling among qualitative research methods (Yıldırım & Şimşek, 2013). The fact that the class level of the students was determined as the ninth class and that their schools were Anatolian High schools as a criterion, enabled obtaining detailed information in the research (Patton, 2002).

Data Collection Tools

In the research, documents which are in parallel with the goal of the research have been used as tools for data collection. With the data collection tools used in the research, the total and detailed description of the data was aimed. Therefore, data was collected via the form of determining the thoughts of students about energy and the form of the energy concept. Prior to the application, with the aim of determining the knowledge and thoughts of students about energy, they were given a form of determining the thoughts of students about energy which consisted of three questions. While literature was used in two of the questions in the form, one of them was developed by the researcher and the form took its final shape after taking the advices of the experts about the questions in the form (Hırça, Çalık & Seven, 2011; Yürümezoğlu, Ayaz & Çökelez, 2009). As for the reason that the questions in literature were used, they were affective in revealing the thoughts of students about energy. Following the application, in order to receive students' thoughts about energy, energy conservation and conversion, energy transfer, energy sources and associating them with the daily life, the concept of energy form, which was prepared by making use of various researches, consisting of 12 questions, were given to the students to fill (Çoban, Aktamış & Ergin, 2007; Kırtak, 2010; Pastırmacı, 2011; Tekbıyık, 2010; Ünal, 2011). While the concept of energy form was being prepared, initially the literature about energy was scanned, and then questions were determined in accordance with the acquisitions stated in the teaching program. The advice of five experts was taken for the content validity of the concept of energy form, which was prepared in accordance with the acquisitions, and the form has been finalized according to these advices. Most of the questions that are prepared by using the literature were directly taken, while some of the questions were altered in accordance with the opinions of the experts. Besides, in order to support the data collected by the forms in the research, semi-structured interviews were done with the students. Most of the question in the semi-structured interview forms were prepared by using literature in accordance with the experts' opinions (Hırça, Çalık & Seven, 2011; Köse, Bağ, Sürücü & Uçak, 2006; Tekbıyık, 2010; Kırtak, 2010; Töman & Çimer, 2012).

Performing the Application

The application Tas performed by giving the students forms in the beginning and at the end of the teaching of the subject of energy in the classes that participated in the research. In the forms, which were prepared for revealing the knowledge and thoughts of students about the concept of energy and the subject of energy, open-ended questions were used. In the form of determining students' thoughts about energy, which was given to the students in the beginning of the research process, the aim was to determine foreknowledge and thoughts of the students about energy, and at the end of the research, adequate data was collected. As a result of the concept of energy form, which was applied when the teaching of the subject of

energy was finished, the thoughts and knowledge of the students, whose learning were finalized with different teaching methods, were revealed. The application of the forms were performed in class hours, a period of 15-20 minutes were spared for each form. Besides, at the end of research, six students from different levels, who were equally chosen from the students with conceptual errors, having right and deficient knowledge, were interviewed once, and with these semi-structured interviews the data which was collected from the concept of energy form and the form of determining the thoughts of students was supported. In order to describe the situation in the classroom, the thoughts of different students were used. The semi-structured interviews that were conducted with the students were done face to face and recorded with a voice recording tool. Apart from these, before starting the application, in order to test the validity of the data collecting tools, a pilot application was carried out in the ninth class of an Anatolian High school, in which 32 students were studying, in the city of Ankara. As a result of the pilot study, it was agreed, with the opinions of the experts, that in revealing the thoughts and knowledge of the students on the energy, before the study, and on energy, energy conservation, energy conversion and energy sources after study, the tools of data collection were sufficient.

Analysis and Evaluation of Data

The data in the research has been resolved with the descriptive analysis method both in the data collection process and at the end of the data collection process. First of all, the data that was collected from the forms and interviews was transferred to electronic environment by the researcher without any change. The data that was transferred to electronic environment was analyzed by the expert and the answers that came within the framework of each question were summarized with themes by the researcher and the expert. Once the themes were made, data entry was made under the themes that were determined by the researcher and the expert, and the data entries were re-analyzed by the experts. The results were interpreted clearly, by interconnecting and giving meaning to the data by the researcher. Besides, in order to reflect the point of views of the students, direct quotations were used frequently.

FINDINGS

In accordance with the data gained from the form through which it was aimed to determine the thoughts of students about energy before the teaching of the subject of energy took place, as the first question in the form; "*What did you think when the teacher told you that the next topic would be energy? What did you think about the difficulty level of the subject for you before the starting of the subject?*" was directed to students who participated in the research. When the teacher told that the next topic will be energy, while 16 of the students (51,16%) from BAL made negative comments by stating that the subject is difficult, long, comprehensive, abstract and requires the ability of interpreting, 14 of them (45,16%) made positive comments, by stating that the subject is nice, interesting, easy, connected with the information in the primary school and entertaining. Besides, one student (3,22%) stated that he has no idea about the subject. Following are quotations taken from the statements in the form (S: Student; #: Student Number):

> ***S24:*** *I remembered potential and kinetic energy which I learned at the 7th class, I think the subject is difficult.*
>
> ***S5:*** *Energy is very difficult and challenging subject. The subject of energy will be difficult as it is quite different from other subjects, related to daily life and requires logic.*

> ***S1:*** *We studied this subject in the previous years too. I quickly checked the things I learned in the past years and I remembered the subject, and I think that it will be enjoyable. It is my favorite subject in physics.*
>
> ***S2:*** *I think energy is quite an interesting and nice subject. Because energy is related to daily life, therefore it is everywhere.*

10 (41,66%) of İAL students have stated that as all subjects of physics are difficult, this subject will also be difficult and they will experience difficulties as they don't like the subject of energy. Besides, one student has made a statement as; "I had it in the primary school, it was easy but as we are in high school now, it will be difficult." Also, another student who remembered the teaching of the subject of energy at the primary school level, has stated that he had difficulties on this subject with the phrase "When I remembered the formulas of work, energy, I thought it would absolutely be difficult", and he thought that this difficulty would continue in high school. While another 10 (41,66%) of the students stated that they think the subject will be easy as they like it, 4 students (16,66%) have stated that they do not have any opinions in the form of determining the thoughts of students about energy.

13 (43,33%) of ÜAL students, on the other hand, stated that they think that the subject of energy would be difficult as they had difficulties with it at primary school, physics issues are difficult in general, and that energy is an abstract concept. It has also been determined that 17 (56,66%) students thought that the subject of energy would be easy due to the introductory picture in the book, also that the subject would be enjoyable, interesting and entertaining because of the previous knowledge on the subject.

In relation with the answers which the students of ÜAL gave, and in order to support the information obtained, the question; *"What crosses your mind about energy at the first glance when you look at the picture below, what does it remind you"* was asked to the students about the introductory picture in the course book in the semi-structured interviews (Figure 1).

Figure 1. The introductory picture about energy in the course book (Bolat, Aydoğdu & Evgi, 2013)

When the students look at the first picture about the subject of energy in their course books, 9 of them (50%) stated that they thought that the content of the subject is about energy sources, 5 of them (27,77%) thought that the content was about the place of energy in daily life, and four of them (22,22%) thought it was about the types of energy. It was determined that, before the teaching of the subject of energy started, students linked the subject mostly with energy sources. Besides, the students stated that when they looked at the picture for the first time the picture motivated them, and they thought that the subject would start with the teaching of energy sources.

As the second question the form; *"Do you think energy can be seen with a powerful microscope? Explain"* was asked to the students. About if energy can be seen with a powerful microscope or not, the students gave answers as can be seen, cannot be seen or have no idea (don't know) (Table 1). While the students in BAL and ÜAL mostly stated that energy cannot

be seen with a powerful microscope, the students in İAL mostly stated that they thought energy can be seen with a powerful microscope.

Table 1.: Student Views about Whether Energy can be Seen with a Powerful Microscope or Not

Anatolian High Schools	*Student Answers*		
	Can be Seen	*Cannot be Seen*	*Don't Know*
BAL	10 (32,25%)	17 (54,83%)	4 (12,90%)
İAL	14 (58,33%)	9 (37,5%)	1(4,16%)
ÜAL	7 (23,33%)	22 (73,33%)	1 (3,33%)
Total	31 (36,47%)	48 (56,47%)	6 (7,05%)

As it is seen in Table 1, 10 of the students in BAL (32,25%), 14 of the students in İAL (58,33%) and seven of the students in ÜAL (23,33%), with their statements like "If we can see atoms, we can see energy too. I think of energy as the energy of movement and electrical energy and energy can be seen as electrical and heat energy. It can be seen as microscopes are used to see particles that cannot be seen with the eye. Energy can be observed as vibration and movement. Protons, neutrons and electrons can be seen, so the energy. Lightning is outlet of energy. If lightning can be seen, energy can also be seen. As energy is calculable, it can be seen." said that energy can be seen, 17 of the students in BAL (54,83%), nine of the students in İAL (37,5%) and 22 of the students in ÜAL (73,33%), with their statements like "As it is not matter, it cannot be seen. Energy cannot be seen, only its impact can be felt. As energy is not a solid being, it cannot be seen. Energy cannot be seen as it moves with the speed of light", revealed that they do not think that energy can be seen. Also at the end of the research, it was determined that some of the students thought that energy can be seen, it is a bigger matter than atom, proton, neutron and electron, and calculable.

As the last question in the form, the students were asked the question; "*How would you picture energy if you were to draw it in any way or present it with a view?"*. The fact that while BAL students mostly presented energy with the sun, running man and car, İAL students presented it with lightning, explosion and strong man, and ÜAL students with the sun and lightning, was determined from the form of determining the thoughts of students about energy (Table 2).

Table 2. Students' Thoughts Regarding the Picture or View of Energy

Student Answers	*Anatolian High Schools*		
	BAL	*İAL*	*ÜAL*
The Sun	10 (32,25%)	5 (20,83%)	6 (20%)
Lightning	1 (3,22%)	8 (33,33%)	10 (33,33%)
Running man	3 (9,67%)	-	2 (6,66%)
Car	6 (19,35%)	-	-
Galaxy	4 (12,90%)	2 (8,33%)	5 (16,66%)
Electron	2 (6,45%)	2 (8,33%)	4 (13,33%)
Lamp	4 (12,90%)	-	2 (6,66%)
Cannot be drawn	2 (6,45%)	1 (4,16%)	-
Windmill	1 (3,22%)	1 (4,16%)	-
Chocolate	3 (9,67%)	-	1 (3,33%)
Dam	1 (3,22%)	-	-
Explosion	1 (3,22%)	3 (12,5%)	1 (3,33%)
Strong man	1 (3,22%)	4 (16,66%)	2 (6,66%)
Eye	-	-	2 (6,66%)
Other	5 (16,12%)	8 (33,33%)	1 (3,33%)

As stated in Table 2, it was determined that students in general present energy mostly with the sun and lightning. Besides, the drawings of the students revealed that energy was pictured with objects which are thought to be energy sources, the forms of energy and those that are believed to have energy by the students. In order to support the result of the research question, when the same question was asked to the students after the learning process, in the semi-structured interviews, the following answers were received from the students:

> ***S14:*** *The word, energy, reminds me light and heat, that's why I can present energy with the sun or lamp.*
>
> ***S22:*** *Following the learning of the subject of energy, as only energy sources crossed my mind, I can picture energy with a dam or a windmill.*
>
> ***S12:*** *The word, energy, always reminds me energetic people. Therefore I can present it with a running man.*
>
> ***S17:*** *Power means energy. So, I think that a powerful man will have energy.*
>
> ***S2:*** *As energy can appear all of a sudden, I pictured it with an explosion.*
>
> ***S5:*** *Energy cannot be seen with naked eyes, so I cannot draw it.*

With the energy concept form that was applied to the students after the teaching of the subject of energy, the question; *"Do everything in nature have energy? Do you think you have energy, and if you have, where is it and how is it supplied?"* was directed to students as the first question. All of the students from BAL and ÜAL stated that everything in nature and themselves have energy. While students from BAL brought up explanations to the claim that everything in nature and themselves have energy with "living things have energy. Every moving thing has energy. The passing of a matter to the fourth dimension when a matter reaches infinite mass or the idea that light is made up of waves and particles as proven by Young experiment, gives clues about this subject. Therefore, every matter has energy", ÜAL students made statements like "Non-living things have potential energy, living things have biological energy. All things, living or non-living have a reaction against gravity, and for that everything must have energy". ÜAL students stated that energy is supplied from foods, ATP and movement. The answers of the BAL students to the question of from where and how they supplied energy are given in the following words:

S17: *Energy is supplied from the energy sources in nature.*

S26: *Energy is supplied from the cells through respiration.*

S22: *Energy is supplied from foods.*

S11: *Nature is provided with energy by using energy while walking, talking and thinking.*

From the views of the students, it was determined that they thought that energy is supplied from the energy sources in nature, oxygen, human activities and food.

While 22 (91,66%) of the İAL students stated that everything in nature and themselves had energy, 2 (8,33%) of them stated that only living things had energy. As for the source of the supply of energy, the students made explanations as; "Humans' energy is supplied with ATP. If force is applied to any place, that object will have energy. Energy is obtained by movement. Living things give energy ton on-living things. Energy is gained from foods and oxygen". Students stated that energy is supplied from living things, body functions, foods, oxygen and force.

In the semi-structured interview above, which was done to support the obtained findings, when the question of *"Apple, yoghurt, ice-cream, water, phosphor, oxygen, carbon dioxide. From which of these we cannot supply energy, why?"* was asked to the students, they stated, with their reasons that from apple, yoghurt and ice-cream, we can supply energy, but from water, phosphor, carbon dioxide and oxygen we cannot (Table 3). It was seen that there was not consistency between the answers the students gave to the questions in the form and the data obtained. That's because, in the form, students stated that energy can be supplied from foods, as well as from oxygen. As a result, it was determined that the students lacked adequate knowledge about whether it is possible to supply energy from oxygen or not. Besides, the fact that students mostly think that energy cannot be supplied from carbon dioxide, is another finding obtained from the results of the research.

Table 3: Students' Views Regarding the Unavailability of Supplying Energy from Water, Phosphor, Carbon dioxide and Oxygen

Student Answers		***Number of Students (%)***
Water	*Regulator*	6 (33,33%)
	Inorganic	3 (1,66%)
	Liquid	2 (11,11%)
Phosphor	*Joins Structure in the Body*	6 (33,33%)
	Mineral	3 (16,66%)
	Organic	1 (5,5%)
Carbon dioxide	*Ejected out*	12 (66,66%)
	Constituent	1 (5,55%)
Oxygen	*Constituent*	8 (44,44%)

It was determined that students stated that carbon dioxide does not supply energy because they thought that it was ejected out and it was a constituent, water a regulator, inorganic and liquid, phosphor as joining the structure in the body, mineral and organic, and oxygen as another constituent. As for the reason that students thought energy can be supplied from apple, yoghurt and ice-cream, as they stated before, it was because they are food.

As the second question; *"Use the word energy in two different sentences, and explain the meaning of sentences"* was asked to the students. When students of BAL was asked to use the word energy in two sentences, it was determined that they used energy mostly as power 27 (87,09%), movement 26 (83,87%), energy conversion 22 (70,96%), kinetic energy 21 (67,74%), potential energy 21 (67, 74%) and renewable energy 19 (61,29%). A few examples from the sentences that the students made are given below:

S15: *Stoves turn electrical energy into heat.*

S6: *This footballer has much energy.*

S1: *I feel myself very energetic today.*

İAL students, on the other hand, used energy as power 22 (91,66%), mechanical power 19 (79,16%), kinetic energy 18 (75%), energy sources (75%), movement 17 (70,83%), matter that generated in nature 15 (62,5%), food 15 (62,5%), biological effect 12 (50%), oxygen 10 (4,16%), energy conservation 10 (4,16%) and life source 10 (4,16%). Some of the sentences that the students stated are given below:

S19: *He is losing his energy day by day.*

S12: *A fast going car has kinetic energy.*

S11: *There are renewable and nonrenewable energy sources in nature.*

S4: *A person's energy is supplied from the oxygen he takes.*

ÜAL students used energy as the sun 25 (83,33%), gravity 20 (83,33%), savings 19 (63,33%), movement 19 (63,33%), undefined 19 (63,33%), energy sources 16 (53,33%), work 15 (50%), potential energy 15 (50%), kinetic energy 14 (46,66%), energy conversion 13 (43,33%), food 10 (33,33%) and power 9 (30%) in their sentences. The sentences the students made are as following:

S25: *Energy can be produced from the sun.*

S21: *There are electrical gravitation forces between molecules.*

S20: *Turn the lights off for energy conservation.*

It is seen that students of BAL, İAL and ÜAL use the word, energy, commonly as force, kinetic energy, energy sources and movement. However, it is determined that the use of the word energy generally differed among the schools and that the students in the schools commonly stated the word energy with the same meaning as "force" and therefore, they have wrong or lacking knowledge about the concept of energy. As for the reason that the students stated different energy statements, it can be said that the teaching has been done with different teaching styles and during teaching, the topics that were focused on were different from each other.

As the third question, *"Are there other concepts which have the same unit with energy? What kind of a relation is there between these concepts?"* was asked to the students. While 47 (55,29%) of the students stated that there are other physical concepts with the same unit of energy, 11 (12,94%) of them stated that there are not. Besides, 27 (31,76%) of the students stated that they have no idea about the subject. The concepts which the students stated that they have the same unit with energy are in Table 4.

Table 4: Student Thoughts Regarding the Physical Concepts Having the Same Unit with Energy

Student answers	***Anatolian High Schools***		
	BAL	***İAL***	***ÜAL***
Work	10 (32,25%)	3 (12,5%)	13 (43,33%)
Heat	5 (16,12%)	5 (20,83%)	4 (13,33%)
Power	3 (9,67%)	-	-
Temperature	-	2 (8,33%)	-
Force	1 (3,22%)	1 (4,16%)	-
Mass	1 (3,22%)	-	-

Among concepts stated in Table 4, it is seen that work is at the top, followed by heat, power, temperature, force and mass in order. As a supportive statement to the answer that BAL students gave to the above question, it was observed that "power" was the statement they made, still it was determined that İAL and ÜAL students did not use the statement, "power" this time. Thus, it was revealed that especially BAL students thought that the concepts of energy and power were identical concepts. Regarding why the students stated these concepts, below is the information they had:

S21: *Energy is the ability to do work. Therefore, both of them have the same unit.*

S5: *As energy can convert into heat, energy and heat have the same units.*

S19: *As strong people have more energy, power and energy have the same unit.*

Based on these statements of the students, it is thought that the students have lacking or wrong information about the concept of energy.

The fourth question that was directed to the students was; *"Can the energies of coal and apple with the same mass be the same? If yes, on what conditions?"* While 47 (55,29%) of the students stated that the energies of coal and apple with the same mass will be the same, 28 (32,94%) of them stated that they won't be the same, and 10 (11,76%) of them stated that they do not have any idea on this subject. The statements of the students regarding on what conditions the energies of coal and apple will be the same and why they won't be the same are given below (Table 5).

Table 5: Student Views about the Energies of Coal and Apple with the Same Mass

Student Answers		***Anatolian High Schools***		
		BAL	***İAL***	***ÜAL***
Energies are Equal	***Equal Height***	7 (22,58%)	8 (33,33%)	6 (20%)
	Equal Density	1 (3,22%)	-	-
	Same Environment	2 (6,45%)	-	1 (3,33%)
	Equal Volume	1 (3,22%)	-	-
	Same Location	1 (3,22%)	-	-
	Equal Speed	2 (6,45%)	-	1 (3,33%)
	Equal Pressure	1 (3,22%)	-	1 (3,33%)
	Same Chemical and Physical Property	6 (19,35%)	2 (8,33%)	3 (10%)
	Environment without Gravity and Pressure	-	1 (4,16%)	-
	Same Shape	-	1 (4,16%)	-
	Equal Weight	-	1 (4,16%)	-
	Same Temperature	-	1 (4,16%)	2 (6,66%)
	Equal Force	-	1 (4,16%)	-
	Same Heat	-	-	3 (10%)
Energies are not Equal	***Different Matter***	3 (9,67%)	3 (12,5%)	12 (40%)
	Coal's Energy is Higher Because of Heat	2 (6,45%)	1 (4,16%)	-
	Different Chemical Properties	-	1 (4,16%)	-

Student views supporting the data in Table 5 are given below:

> ***S24:*** *Their energies are the same if they have the same speed and height.*
>
> ***S22:*** *If the energies of coal and apple with equal masses were equal, then apple would be used for heating instead of coal.*
>
> ***S14:*** *Their energies cannot be equal as each matter has different energy.*

In accordance with the students' views, while it was mostly stated that the energies of coal and apple with equal mass could be equal when they have the same height and the same chemical and physical properties, it was also stated that their energies would not be equal mostly because they are different matters. Besides, it was

determined that students were unable to relate coal and apple with each other and thought that due to thermal energy coal had, coal would have more energy.

The question; *"Rub your hands with each other in a quick way. Stop, after a while. What would you feel in your hands meanwhile and what would be the reason?"* was directed to the students as the fifth question in the research. 29 (93,54%) of the students of BAL, 21 (87,5%) of the students of İAL and all of the students of ÜAL stated that when they rubbed their hands with each other in a quick way, they felt heating. It is also seen that the energy conversions here were stated differently from each other by the students. Besides, two (6,45%) students from BAL and three (12,5%) students from ÜAL stated that they no information regarding the question. The answers that the students of BAL, İAL and ÜAL gave to the question are given in Table 6.

Table 6: Student Views Regarding the Energy Conversions that Took Place during the Rubbing of the Hands

Student Answers	***Anatolian High Schools***		
	BAL	***İAL***	***ÜAL***
Friction Force Has Converted into Thermal Energy	12 (38,70%)	17 (70,83%)	21 (70%)
Motional Energy Has Converted into Thermal Energy	12 (38,70%)	3 (12,5%)	7 (23,33%)
Mechanical Energy Has Converted into Thermal Energy	2 (6,45%)	-	-
Potential Energy Has Converted into Kinetic Energy, and Kinetic Energy Then Has Converted into Thermal Energy	1 (3,22%)	-	-
Potential Energy Has Converted into Thermal Energy	-	1 (4,16%)	-
Friction Force Has Converted into Thermal and Sound Energy	-	-	1 (3,33%)
Friction Force Has Converted into Magnetic Energy and Then Has Converted into Thermal Energy	-	-	1 (3,33%)

Even though most of the students stated that due to friction force's converting into thermal force, their hands were heated when rubbed together, there are data in the research which showed that there were also students who thought that their hands were heated because of the motional energy's, mechanical energy's and potential energy's converting into thermal energy.

In the interviews with the students which were carried out in order to support the data of the research, "*How do you explain the fact that the dynamo that rubs the wheel and the lighting up of the bulb that is connected to the dynamo while a bicycle is moving?*" was the question that was asked to the students. While 12 (66,66%) of the students explained that the dynamo that rubs the wheel and the lighting up of the bulb that is connected to the dynamo while a bicycle is moving, by the conversion of motional energy into frictional, thermal and electrical energy, five of

them (27,77%) explained it by the conversion of frictional force into thermal energy, thermal energy into motional energy, and then motional energy into electrical energy, and one (5,55%) by conversion of frictional force into electrical energy. It was determined that regarding the conversions of energy, the students gave different answers and some of them gave deficient and wrong answers. As another question, when the students were asked; "*Is the total energy, obtained from fuel in cars running with gas or diesel, used to move the car? Explain.*", three of the students (16,66%) stated that the total energy, obtained from fuel in cars running with gas or diesel, is used to move the car, and 15 (83,33%) of them said it is not. The views of the students who stated that the total energy was not used to move the car are as follows:

S4: *Chemical energy converts into heat, light, motion and electricity. ,*

S5: *Energy is used for wheels, dynamo, battery, air-conditioner and the engine.*

S13: *There are lots of mechanisms in the car. Even the windshield wiper Works with that energy.*

With the views of the students, it can be said that most of the students are not able to state into what kind of energies does the energy obtained from fuel in cars converts, and that those students who stated that the total energy obtained from fuel is used to move the car has lacking or wrong information. In general, about the energy conversions, based on the questions asked to the students both in the form and in the interviews, it was determined that after the completion of the teaching process of the subject of energy, the students had deficient or wrong information about energy conversions.

As the sixth question for the students who participated in the research; "*How does the energy change when a moving car stops by using the breaks*?" was asked. BAL, İAL and ÜAL students stated that according to them, when a moving car stops by using the breaks, its kinetic energy will decrease the most, and its motional energy will convert into thermal energy (Table 7).

Table 7: Student Views about How Energy Changes When a Moving Car Stops by Using the Breaks

Student Answers	***Anatolian High Schools***		
	BAL	***İAL***	***ÜAL***
Kinetic Energy Decreases.	13 (41,93%)	12 (50%)	12 (40%)
Motional Energy Has Converted into Thermal Energy.	8 (25,80%)	6 (25%)	9 (30%)
Does not Change.	5 (16,12%)	2 (8,33%)	2 (6,66%)
Kinetic Energy Has Converted into Potential Energy.	3 (9,67%)	-	3 (10%)
Mechanical and Kinetic Energy Decreases and Then Energy is Set to Zero.	2 (6,45%)	-	-

As Friction Force Increases When It Stops, Its Energy Increases.	-	2 (8,33%)	1 (3,33%)
The Energy of the Car Finishes When It Stops.	-	2 (8,33%)	-
Kinetic Energy Decreases, Car Stops and Energy is Set to Zero.	-	-	3 (10%)

When Table 7 was examined, it was revealed that the students gave different answers from each other. Also, from the student answers in Table 7, regarding the finishing or diminishing of energy, it can be derived that the students have wrong or deficient information.

The seventh question that was asked to the students was; "*What do you think is the reason that those vehicles which are required to go fast has sharp front parts*?" While all of the BAL and İAL students and 23 (95,83%) of the ÜAL students that participated in the research stated that the reason that those vehicles which are required to go fast has sharp front parts was to minimize the friction force, one (3,33%) of ÜAL students stated that he has no idea about this subject. From the views of the students, it was derived that the students thought that the front parts of the vehicles were sharp so to minimize the friction force, and thus the vehicles went faster.

The eight question that was asked to the students was; *"A man who is chilled with cold sits in front of an electrical stove. After a while the man gets hot and takes off his cardigan. Based on this information, explain how the man got warmed."* While 15 (48,38%) of BAL students who participated in the research, six (25%) of İAL students and 24 (80%) of ÜAL students stated that if a man, chilled with cold, sitting in front of an electrical stove, gets warm and takes off his cardigan, that's because the air which got warmer contacted him and there was an exchange of heat between the environment and his body, 15 (48,38%) of BAL students, 17 (70,83%) of İAL students and six (20%) of ÜAL students stated that the warming of the man was due to the conversion of the electrical energy which the stove had, into thermal energy. Besides, one (3,22%) of BAL and one (4,16%) of İAL students stated that they don't have any opinion about the subject. Students' views are given below:

> ***S2:*** *The air which was heated because of the electrical stove contacted the man's body. As a result of heat transfer, the man warmed up and took his cardigan off.*
>
> ***S21:*** *The energy that gets out from the electrical stove converts into thermal energy. As the man is in the same environment where the energy conversion takes place, he warms up quickly and takes his cardigan off.*

Based on the students' answers, it can be said that some of the students think that energy cannot be transferred without conversion and they cannot certainly distinguish the difference between energy conversion and energy transfer.

As the ninth question; "*Why do our mothers use oven gloves for holding hot wares in the kitchen? Is it important whether the oven gloves are wet or dry*?" was asked to the students. It was determined that all of the students participated in the research thought that their mothers wore oven gloves in the kitchen for holding hot wares in

order not to burn their hands and harm their skin. Also, when the students were asked whether it was important that the gloves were wet or dry, 43 (50,58%) of them said it was not important whether the gloves were wet or dry. Apart from this, while 10 (32,25%) of BAL students, six (25%) of İAL students, and two (6,6%) of ÜAL students were claiming that the gloves should be dry and defending their argument by stating that "liquid molecules conduct heat faster, so when the gloves are wet the heat will be conducted faster", those of the students who claimed that the gloves should be wet, 8 (25,80%) of the BAL students, six (25%) of the İAL students and 10 (33,33%) of the ÜAL students defended their argument by stating that "As the gloves will warm slowly when wet, our hands won't burn. When they are wet heat will be conducted slowly because thermal energy will first evaporate water and then heat the gloves". Based on the student statements, it was determined that they thought as the liquid molecules conduct heat faster the gloves should be dry and as wet gloves will dry slower, and as thermal energy will first evaporate water and then heat the gloves, the gloves should be wet. Even though the students gave similar answers regarding the reason for using oven gloves for holding hot wares, there were different views about whether it is important that the gloves be wet or dry. However, by the general consent of the students, it was determined that whether the gloves were wet or dry was not important as the gloves would not conduct heat.

As the 10th question, the students were asked; "*Explaining renewable and nonrenewable energy sources, tell us which energy sources should be chosen and why*?" All of the students stated that renewable energy sources should be chosen. Besides, Table 8 displays students' explanations about renewable and nonrenewable energy sources.

Table 8: Students' Views about Energy Sources

Student Answers		***Anatolian High Schools***		
		BAL	***İAL***	***ÜAL***
Renewable Energy	*Never Ending Energy*	19 (61,29%)	4 (16,66%)	19 (63,33%)
	Environment Friendly	21 (67,74%)	24 (100%)	21 (70%)
	Inexpensive Energy	10 (32,25%)	5 (20,83%)	1 (3,33%)
Nonrenewable Energy	*Dying Energy*	20 (64,51%)	24 (100%)	19 (63,33%)
	Harmful to Environment	25 (80,64%)	5 (20,83%)	18 (60%)

As seen in Table 8, it was revealed that the students stated that renewable energy sources should be chosen mostly because they are environment friendly and never ending. As for the nonrenewable energy sources, it was determined that these sources were found dying and harmful for environment. Besides, two (6,66%) of the students of ÜAL, though they stated that renewable energy should be chosen, stated that they think nuclear energy should also be used as it provides so much energy and is durable although it is not a renewable energy.

Later, the question; "*What kind of conditions, does Turkey's location have in terms of renewable energy sources*?" was asked to the students in the semi-structured interviews. While 16 (88,88%) of the students stated that Turkey's location is very convenient in terms of wind energy, for 15 (83,33%) of them it was solar energy, for another 15 (83,33%) of them geothermal energy, for 12 (66,66%) of them hydroelectric energy, and for five (27,77%) of them it was biomass energy that was convenient in terms of the conditions of Turkey's location. It was determined that the students stated these types of energies as they thought that these were very convenient for Turkey's location. One (5,55%) of the students, on the other hand, thought that, due to financial inadequacy of the country, Turkey cannot make use of its renewable energy sources even though its location is convenient. When the answer to the question; "*What type of energies do you think will be available for use in the future? Why*?" was sought, based on the answers from the students, it was determined that 13 (72,22%) of them thought nuclear energy, six (33,33%) of them thought solar energy, two (11,11%) of them thought hydrogen energy, one (5,55%) of them thought wind energy and one (5,55%) of them thought that hydroelectric energy will be used. Students' views are given below.

> ***S14:*** *The cost of nuclear power plants that are built for obtaining nuclear energy is too much but in the long term they will be very useful. The renewed technology, also, supports nuclear power plants. When petroleum, which is among the nonrenewable energy sources, nuclear energy will be chosen as it gives more energy compared to renewable energy sources.*
>
> ***S4:*** *Thermal energy can be obtained from solar energy in wider areas.*
>
> ***S22:*** *Hydrogen energy, which is obtained by using various gases, can be widely used in cars in the future.*

Based on the answers of the students, it was determined that nuclear energy sources were thought to be the most used energy source in the future. Besides, although nuclear energy source is a nonrenewable energy source, it was revealed that it was seen as an alternative to petroleum by the students.

As the 11th question, the students were asked; "*What kind of a relationship is there between global warming and energy*?" All of the BAL students, 23 (95,83%) of İAL students, and 26 (86,66%) of ÜAL students stated that there is a relationship between global warming and energy, and that global warming was caused by sun rays, nonrenewable energy sources, and unstable and insensible use of energy sources. While one (4,16%) of the students of İAL stated that there is no relationship, seven (22,58%) students of BAL, seven (29,16%) students of İAL and four (13,33%) students of ÜAL stated that they don't have any idea about this subject. Some of the answers of the students to the question are given below:

> ***S1:*** *As the sun rays reach directly to Earth via the pierced ozone layer of the World, excessive energy accumulates on the Earth's crust and global warming occurs.*
>
> ***S9:*** *Rays coming from the Sun warms the Earth and reflect from the Earth to space. On the other hand, the gases getting out of fossil fuels block this reflection and our world warms excessively. Then the*

increased thermal energy melts the glaciers. Fossil fuels, which cause greenhouse effect, also cause global warming.

S30: *Unstable and insensible use of energy cause global warming.*

S1: *There is no relationship between global warming and energy.*

It was revealed that those students, who argued that there is no relationship between global warming and energy, have deficient knowledge, especially on the sources of energy.

As the last question, the students were asked; "*According to you, what can be done about energy saving*?" Regarding energy saving, it was determined that students mostly proposed the use of renewable energy sources, turning off the unnecessary lights, unplugging the electrical house wares when not in use and not leaving the taps open (Table 9).

Table 9: Student Views Regarding Energy Saving

Student Answers	***Anatolian High Schools***		
	BAL	***İAL***	***ÜAL***
Renewable Energy Sources Should be Used	28 (90,32%)	8 (33,33%)	17 (56,66%)
Unnecessary Lights Should be Turned Off	10 (32,25%)	8 (33,33%)	17 (56,66%)
The Taps Shouldn't be Left Open	10 (32,25%)	4 (16,66%)	9 (30%)
Electrical House Wares Should be Unplugged	10 (32,25%)	6 (25%)	13 (43,33%)
A Class Products Should be Used for Energy Saving	3 (9,67%)	6 (25%)	5 (16,66%)
Essays Should be Read About Energy Saving	1 (3,22%)	-	-
Public Transport Must be Used	1 (3,22%)	-	2 (6,66%)
Heat Insulation Must be Made	-	2 (8,33%)	6 (20%)
Biogas Should be Produced from Waste Oils	-	-	3 (10%)
Dead Batteries Should be Collected in Special Trashes	-	-	1 (3,33%)
Number of Theme Parks and Shopping Malls Should be Lowered	-	-	1 (3,33%)

Based on student answers, it can be said that the students have knowledge about the subject of energy saving.

The Result, Discussion and Suggestions

In this research, with obtaining the thoughts and knowledge of the students on the energy, before the study, and on energy, energy conservation, energy conversion and energy sources after study, it was determined that, first of all, regarding energy, most of the students in two schools, before the study, thought that energy cannot be seen with a powerful microscope, and students in one school thought it can be done. The conceptual error regarding the visibility of energy is often seen in literature (Hırça et.al., 2008; Küçük et.al, 2005; Solomon, 1982; Trumper, 1998). Apart from

students' thoughts that energy can be seen because it is similar to atom, electron, proton, neutron and lightning, it was also revealed that they thought electrical, thermal, motional energy can be seen, calculated, and as microscope is used to see the particles that cannot be seen by naked eye, it can also be used to see energy. Besides, it was also determined that some of the students thought energy cannot be seen as it is not a matter, not solid, because it travels with the speed of light, and only its effect can be felt. Based on these results, it is believed that the teaching with experiments, videos, games and animations about the concept of energy will be effective in reaching the correct information for the students (Hırça, Çalık & Seven, 2011). When the students were asked to picture energy, it was seen that they most of them pictured it with the sun, running man, car, lightning, explosion and strong man respectively. As different from the research result, in literature, it was determined that students picture energy as house, cloud, light, electrical circuit, fan and computer (Pastırmacı, 2011; Yürümezoğlu, Ayaz & Çökelez, 2009). Based on the students' pictures, it was revealed that energy was pictured as energy sources and the form of energy. When the drawings of the students were examined, it was seen that students thought that energy can be in still living things, it is visible, a kind of power, able to appear all of a sudden or during motion, obtained from foods, and that they can state it via energy sources, and picture it with its perceivable effects as they do not think it is visible. Besides, it was revealed that, the students who stated that everything in nature and themselves have energy, thought that energy is in living things, it can only be explained by kinetic and potential energy, and it is obtained from living things, energy sources in nature, human activities, body functions, oxygen, applied force and foods. Similar data can be found in the research of Çoban, Aktamış and Ergin (2007) and Gilbert and Pope (1986). It is observed that, when the students are asked to use the word energy in a sentence, they commonly use it with the same meaning as power, kinetic energy, energy sources and motion. Also in the researches so far, it is seen that energy is thought of as a kind of power, motion is needed for energy (Gilbert & Pope, 1986; Kesidou & Duit, 1993; Kruger, 1990; Küçük et.al., 2005; Özcan, 2006; Seçer, 2008; Solomon, 1982; Trumper, 1990; Trumper & Gorsky, 1993; Watts, 1983). As different from the literature, when the students looked for the first time at the entry picture about the subject of energy in their course books, it was determined that they thought that the content of the subject will be mostly about energy sources, place of energy in daily life and types of energy, and that the picture motivated them and the subject would start with the teaching of energy sources. Besides, it was determined that the students mostly related the subject of energy with energy sources before the teaching of the subject of energy started. When the students were asked about the physical concepts having the same unit as energy, it was determined that together with the fact that the students stated that the concept of energy and the concept of work had the same unit, they stated the concepts of heat, power, temperature, force and mass. On the basis of the obtained results, it can be said that the students have deficient or wrong information. The statements of the students are present in the studies in literature as conceptual errors (Aydoğmuş, 2008; Kesidou & Duit, 1993; Küçük et.al., 2005; Seçer, 2008; Shymansky, 1997; Trumper, 1990). At the same time, when the students were asked if apple and coal, with equal mass, would have equal energy or not, it was determined that most of the students of one school thought that apple and coal, with equal mass, would have equal energy, and

students of two other schools thought that they would not be equal. Based on the views of the students, it was seen that the students thought the energies of coal and apple with the same mass can be equal mostly when they have the same height and the same chemical and physical properties, and also as they are different matters they cannot have equal energies. Besides, it was determined that the students could not relate coal and apple, and thought that coal has more energy because it has thermal energy. Similar conceptual errors of students were determined in the research carried out by Çoban, Aktamış and Ergin (2007). When it is kept in mind that the students who thought that energy is only in living things also stated that coal and apple have energies, it can be recommended that the teaching of the subject of energy must be valued and deficient information must be eliminated. Moreover, the research revealed that the students thought that energy can be obtained from foods like apple, yoghurt and ice-cream, but cannot be obtained from water, phosphor, carbon dioxide and oxygen. It was determined that the reason why the students mostly thought that energy cannot be obtained from carbon dioxide, water, oxygen and phosphor was that they thought carbon dioxide was exhausted and it was a constituent, water as a regulator, inorganic and liquid, phosphor as joining the constitution in body, a mineral and organic, and oxygen as again a constituent. It was revealed that the students were correct about their thoughts which claimed that energy cannot be obtained from water, carbon dioxide, phosphor and oxygen, however, in their explanations, some of them showed that they cannot distinguish between organic and inorganic matters and had no knowledge about the inability of inorganic matters in providing energy. The findings in the research carried out by Köse, Bağ, Sürücü and Uçak (2006), are supporting the result of this research. When the views of students about energy conversion are examined, it was determined that the students said that when they rubbed their hands with each other quickly, they felt warming. It was also determined that they explained this warming by the conversion of frictional force into thermal energy, and conversion of motional energy, mechanical energy and potential energy into thermal energy. It can be said that as the students needed information about the concepts of force and work, the students who could not properly explain the energy conversion had deficient or wrong information (Çoban, Aktamış & Ergin, 2007). It was determined that they thought that when a moving car stopped by using the breaks, kinetic energy would be the most decreased energy of the car and that its motional energy would convert into thermal energy or that there would be no changes in the car. As it was determined that there were students who stated that there would be no change in the car and, besides, energy would be set to zero and died, it was revealed that the students had conceptual errors. (Driver & Warrington, 1985; Gilbert & Pope, 1986; Kesidou & Duit, 1993; Küçük, Çepni & Gökdere, 2005; Solomon, 1982; Watts, 1983; Tatar & Oktay, 2007; Trumper & Gorsky, 1993). As for the lighting up of the bulb that is connected to dynamo which rubs the wheel while the bicycle is moving, it was determined that the students explained it by the conversion of motional energy into frictional, thermal and electrical energy, frictional force into electrical energy, frictional force into thermal energy, thermal energy into motional energy and motional energy into electrical energy. It can be said that, based on the answers of the students, they, again, have deficient or wrong information (Töman & Çimer, 2012; Yürümezoğlu et.al. 2009). Besides, it was determined that the students were unable to use their theoretical knowledge about energy conversions when

commenting on a case. In the research, carried out by Tekbıyık (2010), it was determined that the students were unable to state properly into what energies does the energy obtained from fuel, in cars converts, and also that students who stated that the total energy obtained from fuel in cars was used to move the car had deficient or wrong information, and also these obtained results were seen in the research. As supporting the results, it was revealed that the majority of the students thought that the total energy obtained from fuel in cars running with gas or diesel, is not used to move the car and the chemical energy obtained was converted into thermal, light, motional and electrical energy, energy was used for the wheels, dynamo, battery, air-conditioner and engine, and a part of the energy was used for friction, producing thermal energy. When the students were asked why the vehicles which are required to go fast has sharp front parts, it was determined that the majority of the students stated that it was for minimizing the frictional force. Thus, it was determined properly, with the views of students, that in order to minimize air friction and the energy used because of the friction, the vehicles which are required to go fast has sharp front parts. When the views of the students who participated in the research, about energy transfer were examined, it was determined that most of the students of two schools stated that a man, chilled with cold, sitting in front of an electrical stove, gets warm and takes off his cardigan, that's because the air which got warmer contacted him and there was an exchange of heat between the environment and his body, students of one school stated that stated that the warming of the man was due to the conversion of the electrical energy which the stove had, into thermal energy. It can be said that the students think that energy cannot be transferred without any conversion. In this respect, it was determined that the students were not able to properly state the difference between energy conversion and energy transfer, or they did not have any information (Tekbıyık, 2010). It is thought that it is necessary to carry out a detailed teaching of the concepts of energy conversion and transference by relating them to daily life (Çoban, Aktamış & Ergin, 2007). Besides, it was determined that the students thought that the reason their mothers wore oven gloves for holding hot kitchen wares was to avoid burning their hands and prevent any harm to their skins. It is known that oven gloves block the heat transfer between our hands and hot materials, and therefore there is no transfer of energy due to this insulated system. When the students were asked if it was important whether the gloves were wet or dry, thinking that in both cases the gloves would not transfer heat, it was seen that they stated that it was not important for the gloves to be wet or dry. Moreover, it was determined that the reason that the students thought the gloves should be dry was that liquid molecules conducted heat faster, and the reason for those who stated that the gloves should be wet, was that it would take time for the gloves to dry, thermal energy would evaporate the water first and then warm the gloves, thus the gloves would warm in a longer period. When it is thought that liquid molecules conduct heat faster, it can be said that, based on the student answers saying that the gloves should be wet, they have wrong or deficient information. When the students were asked a question about the global warming related with energy, it was determined that the students thought that global warming and energy were related and global warming was caused by sun rays, nonrenewable energy sources, and unstable and insensible use of energy. It was revealed that those students who said that there is no relation between global warming and energy, or who did not answer the question after the teaching of the

subject, had deficient information especially on the energy sources. Supporting the results of the research, in literature, there is information about students who think that when the sun rays do not reflect back from the crust of the Earth, and with the piercing of the atmosphere layers, harmful sun rays reach the Earth and because of the greenhouse effect, global warming occurs, and as a result the temperature of the Earth rises, glaciers melt and animal and plant species extinguish one by one (Kırtak, 2010; Ünal, 2011). Also, in the research, it was determined that the students thought that the renewable energy sources should be chosen against the nonrenewable energy sources which are believed to cause global warming, as they are environment friendly and never ending. Besides, although some of the students stated that renewable energy sources should be chosen, it was determined that they also thought that nuclear energy which is a nonrenewable energy source should be used as it provides much energy and durable. Together with the detection in the studies so far that students showed a positive attitude towards renewable energy, it was also observed that they had deficient information about renewable energy (Çelikler & Kara, 2011; Çolak et. al, 2012; Kaldellis, Kapsali & Katsanou, 2012). Finally, in the research, it was determined that most of the students stated that Turkey's location had suitable conditions in terms of wind energy, solar energy, geothermal energy, hydro electrical energy and biomass energy. In Tekbıyık (2010)'s study, it was determined that the students mentioned solar, nuclear, wind and geothermal energy. It was revealed that some of the students thought that although Turkey's location was suitable, due to inefficient financial situations, there is not enough usage of renewable energy sources in our country. Besides, it was determined that the students thought that nuclear energy, solar energy, hydrogen energy, wind energy and hydro electrical energy would be used in the future. It can be said that the reason that the students thought that nuclear energy would be the mostly used energy in the future, is that is seen as an alternative to petroleum. Today, greater importance is given to the teaching of nuclear energy in developed and developing countries each day. In this sense, it is thought that the teaching should be done via theoretical and practical way, firstly by increasing the knowledge level of the teachers, and then by increasing the educational attainment towards the teaching of nuclear energy in teaching programs (Benzer, Bayrak, Eren & Gürdal, 2014).

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