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The State Of Science High School Students' Associating Physics Lesson With Life And With Other Science Lessons

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Abstract
This study was conducted to find out how science high school students associate physics lesson with life and other science lessons. To this end, 13 open-ended questions about physics lesson and a demographic information form were given to a total of 43 students studying at 9th, 10th and 11th grades of a science high school in Samsun. The data obtained were analyzed and assessed. The results of the assessment showed that while the students used descriptive and attributive expressions to explain physics and science concepts, they associated the physics lesson with topics in school curriculum. The subjects which aroused interest in students about physics lesson were body systems and the formation of space and universe. In addition to students who associated physics lesson with chemistry, biology and mathematics lessons, there were also a great number of students who associated it with geography lesson due to natural events. While the areas students wanted to work in the future were restricted with biology and medicine, physics and engineering, it was found to be surprising that they did not want to work in areas related with chemistry. While no association was found with open-ended questions in terms of demographic characteristics, it was found that the students of science high school did not have access to technological devices and scientific studies and did not follow scientific developments. Thus, the intensity of physics curriculum should be decreased and students should be exposed to activities in which they can understand the core of physics discipline and make associations between the disciplines of physics-chemistry and biology.

Key words: physics education; science education; science hıgh school

Introduction

Physics can be expressed as the most important of science lessons in high school curriculum in terms of making students understand nature, explaining natural events, presenting new ideas and developing cognitive skills. Physics lesson is an important discipline since it helps students use scientific methods and laws of physics in making sense of events, develop solutions and make right decisions by thinking objectively (Taşlıdere & Eryılmaz, 2012). In our age, individuals are expected to learn ways of reaching information to

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be able to select which information they need and to be creative and productive (Gök & Sılay, 2008). 21st century is called the age of technology since information increases due to developments and scientific studies in technology. Technology and the bulk of information make it impossible for individuals to have all the information possible. Thus, there are changes in education systems while the structure of the society changes fast in parallel with scientific studies and technological developments (Gönen & Kocakaya, 2005). In new generation education system, it is important to educate individuals who internalize the existing information and produce new information and technology rather than individuals who use ready information (Akkoyunlu, 1996). Abbott (1999) stated that the aim of education is to educate individuals who take responsibility of their own learning, who know how to use information and produce new information by following existing information.

Considering that technology is in every part of our lives and as vital as water and bread, our students should produce every kind of technology as well as using technology. Considering all these, as long as classical teaching continues in physics discipline, students will be insufficient to understand and comprehend the core of physics and students will not be able to communicate with other disciplines and technology and thus this will prevent real learning. When the results of the Examination for Transition into Higher Education (YGS) and the Undergraduate Placement Exam (LYS),which are held in Turkey every year, are examined for 2016 on the basis of physics lessons, the average achieved by the 2,084,091 candidates sitting the YGS examination and answering the 40 question science test, including 14 questions for physics, was 4.7,while the average of the 315,939 candidates sitting the LYS examination physics test was 6.46 for 30 questions (ÖSYM, 2016). The results which show the failure of students who are exposed to at least two hours of physics lesson a week in secondary education are really thought provoking and worrisome. Since physics is a discipline that tries to understand and explain the universe, it is inevitable for physics to be associated with a great number of disciplines. In physics curriculum TTKB, (2013) it is stated that there should be an association between physics and mathematics and physics should make use of mathematics while the association of physics with chemistry and biology is stated in expressions such as "(…)concept will not be taught, (…)will be taught only in chemistry or biology lesson". In explaining physics, associations should be made with other science lessons and an interdisciplinary approach should be used since physics uses basic information. Interdisciplinary teaching approach is expressed as organizing information and skills about different disciplines and using these by expressing the association between them correctly (Yıldırım 1996; Akpınar & Ergin, 2004). Physics, chemistry and biology lessons which are thought without making associations although they have similarities and associations in terms of the contents of subject cause students to perceive the same concepts as different (Gürdal, Bayram & Şahin, 1999). Science teachers should associate their own branches with concepts in other science branches, integrate these into their own knowledge and then make studies about how to present these to their students. According to Sherman (2000), teachers should make integrations in science branches in order for students to be able to make correct associations between science concepts and learn these easily. Since a great number of teachers do not have the necessary accumulation of knowledge to make associations between science concepts, it is impossible for them to teach these concepts to students multi dimensionally by making necessary associations. Teachers' inabilities in seeing the multifaceted associations between different disciplines will cause them to bring limitations while transferring knowledge to students and this will in turn cause students to learn concepts as information independent from each other and not to make significant associations between subjects, concepts and disciplines (Gürdal, Bayram & Şahin, 1999; Güneş & T.Akdağ, 2016). Thus, instead of teaching the target concepts to students, students

are directed to memorization (Akpınar & Ergin, 2004). Since concepts are memorized, students cannot make significant associations between concepts within the same discipline or other disciplines and thus learning does not occur in real terms (Şahin & Oktay, 1996).

It does not seem possible for students who cannot make associations between concepts of high school science disciplines to internalize information, make deductions and produce different ideas. In Science High Schools, in which the most successful students of secondary schools who are interested in occupations related with science are educated, there is an intense lesson curriculum and tests and memorization are prioritized and students cannot experience practical learning with applications although these high schools are expected to educate scientists in the field of science. The regulations that changed in 2013 introduced "The Objectives of Secondary Education Institutions" under one title. According to the regulations of Secondary Education Institutions (2013) item 7, "Science high schools aim to educate students as scientists in the fields of science and mathematics, to prepare students to future by equipping them with the knowledge and skills required by our age, to teach students the skills to think critically and to give students qualified education by making use of technology". When the objectives of secondary education institutions are considered, students need to be able to access tools such as telescope and microscope while following scientific studies and current developments in science in the world and in our country. To be able to do this, firstly teachers, who are the most effective examples in front of students, are expected to act curious and eager. Students' internalizing the concepts in physics by developing a multi directional perspective is expected to give an idea about their success and productivity in their future occupations.

Thus, the objective of this study is to assess the perceptions of a total of 43 students at 9th, 10th and 11th grades of a science high school and to find out how students associate physics with other science lessons.

Method

Our study was conducted with 43 students studying at 9th, 10th and 11th grades of a science high school in Samsun. The students were asked 13 open-ended questions and demographic questions. The answers given to open-ended questions were analyzed through content analysis method. Due to students who stated more than one theme, analysis was made according to the number of students who reported suitable themes and the number of students differed according to questions.

Results

Table 1. Demographic data

		N	%
Gender	girl	22	51.2
	boy	23	48.8
Grade	9	17	39.5
	10	14	32.6
	11	12	27.9
Housing	boarding	14	32.6
	day	29	67.4
Following scientific journals	yes	14	32.6
	no	29	67.4
Following current developments in science	yes	29	67.4
	no	14	32.6
Can you reach laboratory equipment when you want,	yes	9	20.9
	no	34	79.1

Table 2. What is science? Explain. Frequency and percentages.

Answers	**f**	**%**
Descriptive	10	23.3
Attributive	29	67.4
Making life easier	7	16.3

Students' descriptive expressions were 'it investigates the formation of the universe, the order in the functioning of the universe, the structure of each particle and the functioning of every living being', 'it is the phenomenon that forms and develops while trying to explain the events in the universe', 'it is interested in natural events and it makes people more knowledgeable', 'practical studies with factors such as experiments about the physical or natural phase', 'group of knowledge that explains the universe', 'causes and results of the events that occur in the universe', 'the effort to explain the events that occur in universe through reasoning, observations and experiments', 'the way to understand the world and the laws of the world'.

Students' attributive expressions were 'provable information based on experiments and observation', 'follows the steps of scientific method and presents objective data', 'explains the events in our life within cause and effect relationship', 'researching the details and rules of any area', 'the things scientists do to create something or to develop something that exists', 'It is the term that comprises all the information from a scientific subject or area. It is universal.', 'They are the systematic studies people do to reach information', 'dreaming, making plans useful for people through systematic information', 'it is the sun and air for people'.

Students' expressions related to making life easier were 'it is based on experiments and observation and it makes people's lives easier', 'it provides healthier and easier life', 'studies conducted to find solutions to people's problems and to develop', 'finding solutions to problems around us', 'it aims to raise life standards', 'designing tools to make life easier'.

Table 3. Students' answers to the question What does the science of physics basically deal with? Frequency and percentages.

Answers	f	%
Associating with the subjects in the curriculum	13	30.2
Laws of the universe	13	30.2
Making life easier	1	2.3
Associating with chemistry	5	11.6
Transformation of direct definition and memorized information	17	39.5

The expressions students associated with the subjects in the curriculum 'Laws of movement, analysis of energy sources', 'power', 'movement of matter', 'operation systems of mechanisms', 'waves, light, optic, magnetism, lens, buoyancy', 'power and everything affected by power', 'matter, heat', 'energy'. Students' expressions about the laws of universe 'unchanging laws in the universe (gravity, force of friction)', 'laws of the universe', 'explains laws of the nature, 'examines the potential-kinetic energy rules and events in the universe', 'formation of the universe', 'tries to explain the causes of events'. Students' expressions related to making life easier were 'They are events which make our lives easier and cause life to continue'. Students' expressions about association with chemistry were 'change of matter', 'events such as decomposition of matter', 'phases of matter', 'events related with matter', 'it is related with the building stones of matter'. Students' expressions related with direct definition and memorization were 'it is about matter, energy and the relationship between these', 'tries to solve the relationships between energy and matter'.

Table 4. Students' answers to the question What would you like to investigate the most if you were a physicist? Frequency and percentages.

Answers	f	%
Engineering	5	11.6
Formation of the universe, space	27	62.8
Speed of light, time travel	6	13.9
Atom's structure	4	9.3
I don't want to be a physicist	2	4.6

Students' expressions about engineering were 'I would like to be an engineer who researches the functioning of computers and machines', 'planes, machines'. Students' expressions about the formation of the universe and space were 'the formation of the universe', ' space, relativity of time, distortion', 'invisible rays', 'is there a concept called heat in space?', 'I would like to research whether the planets in universe are suitable for living beings', 'dark matter, dark energy', 'bigbang theory', 'astrophysics, sky and heavenly bodies', 'different galaxy, star and nebulas', 'black hole and space', 'existence of the Earth', 'meteors, theory of relativity'. Students' expressions about speed of light and time travel were 'I would like to research whether I would meet my own image with the speed of light', 'what would the consequences of moving with speed of light be?', 'quantum physics', 'teleportation'. Students' expressions about the structure of atom were 'I would like to research atom', 'atom energy', 'atom and the parts of atom'. Two of the students said 'I don't want to be a physicist.

Table 5. Students' answers to the question What do you think the most important problem of our world will be in the future? Frequency and percentages.

Answers	f	%
Natural Resources and energy	28	65.1
Human behaviors and their influences	8	18.6
Global warming	10	23.3
Air, water, technology pollution	11	25.6

Students' expressions about natural resources and energy were 'extinction of petroleum and water resources and energy resources', 'water problem', 'extinction of natural resources', 'extinction of resources and natural disasters', 'radiation', 'extinction of nutritional sources'.

Students' expressions about human behaviors and their effects were 'as a result of wars between countries', 'our education system is very bad, there are a lot of illiterate people', 'overpopulation', 'capitalism', 'ambitions of countries, greed, not seeing science important', 'technology dependence', 'the only problem in our past, today and future is us', 'not only one place will survive because of people's greed'. Students' expressions about global warming were 'weather conditions will change', 'global warming', 'global warming and icecaps melting', 'climate changes'. Students' expressions about air, water and technology pollution were 'environmental pollution', 'water pollution', 'air pollution', 'concretion', 'nuclear pollution', 'pollution'.

Table 6. Students' answers to the question Which subjects should physicists work on to shed light on which problems in the future? Frequency and percentages

Answers	f	%
Energy sources	10	23.3
Laws and theories	4	9.3
Explaining the universe, technology	12	27.9
Making life easier	9	20.9
Air and water pollution	5	11.6
Structure of atom	3	6.9
Natural resources and natural disasters	9	20.9

Students' expressions about energy resources were 'energy resources', 'renewable energy resources'. Expressions about laws and theories were 'gravity', 'quantum'. Students' expressions about explaining the universe and technology were 'technology should be made useful to universe', 'mechanisms about the use of natural resources', 'depths of the universe, dark energy'. Expressions about making life easier were 'finding new planets to live on', 'studies that will provide air and water to people', 'finding things that will be more necessary'. Expressions about air and water pollution were 'pollution', 'air and water pollution and desertification'. Expressions about atom were 'related with atom', 'related with sub-atom particles, teleportation'. Expressions about natural resources were 'use of natural resources', 'related with natural resources', 'related with water sources', 'hunger, thirst'.

Table 7. Students' answers to the question What do you think the continuity of life in our world depends on? Frequency and percentages

Answers	f	%
Use of natural resources, energy	32	74.4
Human characteristics	12	27.9
Destroying the balance of nature	6	13.9

Students' expressions about the use of natural resources and energy were 'depends on the amount and functioning of energy resources in the world', 'depends on the way existing resources and the environment are used', 'depends on the use of natural resources', 'water, air, food', 'depends on the Sun', 'all cars, planes, factories, etc. should be stopped, public transportation should be obligatory, wastes should be decreased with recycling'. Expressions about human characteristics were 'depends on humans' efficient and economic use of resources', 'depends on humans' getting on well with each other and the nature', 'depends on humans' attitudes and on the young people who think about their grandchildren', 'tolerance and politicians', 'political relationships between states', 'depends on scientific developments'. Expressions about destroying the balance of nature were 'depends on the protection of the balance of natural life', 'depends on the protection of physical events'

Table 8. Students' answers to the question Considering the formation and functioning of the universe, how do you thing the end of universe will come? Frequency and percentages.

Answers	f	%
About humans and beliefs	10	23.3
Extinction of natural resources	11	25.6
Universal laws	23	53.5
The universe won't end	1	2.3

Students' expressions about humans and beliefs were 'not related with the laws of universe, but with religious events', 'through wars', 'physical end of everything, doomsday', 'the sun will rise from the west', 'people will destroy the balance of universe', 'people will destroy each other and the environment'. Expressions about the extinction of natural resources were 'extinction of natural resources', 'desertification with the extinction of water resources', 'extinction of oxygen and water', 'extinction of food'. Students' expressions about universal laws were 'stars' energy will end and the universe will be plunged into darkness', 'things that exist cannot vanish, thus the universe will not vanish but it will transform', 'stars will explode, planets will die', 'with the explosion of the Sun as a result of the deorbiting of the Earth and crushing other planets'. One student said 'the universe won't end'.

Table 9. Students' answers to the question Which subjects of physics can you associate with chemistry or biology? Frequency and percentages.

Answers	f	%
Biology	22	51.2
Chemistry	33	76.7
Nature	3	6.9
Structure and Functioning of Human Body	6	13.9

Students' expressions about biology were 'photosynthesis', 'adhesion, cohesion, events in cell', 'formation of living beings', 'matter exchange in cell', 'optic', 'looking at microscopic ameba', 'surface tension', 'spark when atoms come together'. Students' expressions about chemistry were 'atom and sub-atom structures', 'reaction of chemical matters', 'reaction', 'quantum, optic, atom', 'nanotechnology', 'absorption'. Expressions about nature were 'formation of the Earth', 'analysis of nature', 'formation of lightning'. Expressions about the structure and functioning of human body were 'reactions in our body', 'humans embody every subject, and humans are complicated'.

Table 10. Students' answers to the question Which events in nature can you associate with physics? Frequency and percentages.

Answers	f	%
Laws of Physics	26	60.5
Natural Events and the formation of the Universe	24	55.8
Engineering	2	4.6
Living Beings	3	6.9
All events	12	27.9

Students' expressions about the laws of physics were 'force of gravity, energy transformation among living beings', 'force of friction', 'refraction of light'. Expressions about natural events and the formation of the Universe were 'formation of rainbow', 'formation of rainfall with low and high pressure', 'natural disasters', 'formation of cyclones', 'tides, formation of geographical shapes', 'rainfall', 'day-night', 'thunder, weather events', 'formation of the universe', 'meteor fall', 'formation of seasons', 'earthquake, fire, tsunami', 'orbital speed of the Earth'. Expressions about engineering were 'mechanical events such as the working of vehicles', 'floating of ships on water'. Expressions about living beings were 'voice coming from vocal cords', 'everything that moves', 'vomiting, eating and drinking'.

Table 11. Students' answers to the question Which subjects are common subjects of physics-chemistry-biology? Frequency and percentages.

Answers	f	%
Energy, Atom	6	13.9
Living Beings	30	69.7
Natural Events, formation of the Earth	9	20.9
Scientific Information	2	4.6

Students' expressions about energy and atom were 'it is energy', 'atom and nucleus', 'photosynthesis', 'energy production'. Expressions about living beings were 'human', 'ecosystems', 'movements of living beings', 'functioning of living organs', 'looking at the molecules in the DNA of euglena', 'everything in the body of the living', 'human and all living beings'. Expressions about natural events and the formation of the Earth were 'water cycle', 'natural disasters', 'formation of the Earth', 'physical events in nature'. Expressions about scientific knowledge were 'ways to reach scientific information', 'provable subjective judgments'.

Table 12. Students' answers to the question Which disciplines can you associate with the subjects of physics? Frequency and percentages.

Answers	f	%
Biology	31	72.1
Chemistry	32	74.4
Mathematics	23	53.5
Geography	15	34.9
Astronomy	15	34.9
Meteorology	3	6.9
Religion	1	2.3
History	1	2.3
Medicine	2	4.6
Geology	1	2.3
Geometry	1	2.3
All Disciplines	2	4.6

Table 13. Students' answers to the question Which subject of science are you happiest the most to study about science? Frequency and percentages.

Answers	f	%
Living Beings	21	48.8
Astronomy	9	20.9
Events to make human life easier	3	6.9
Experimental subjects	4	9.3
Researches on the internet	1	2.3

Table 14. Students' answers to the question Which field of science do you aim to work on? Frequency and percentages.

Answers	f	%
Biyology	15	34.9
Medicine	10	23.3
Physics and Engineering	16	37.2

Discussion

The efforts to understand the universe, nature and natural events and to explain the functioning of nature form the basis of science and the primary aim of these efforts stem from the thought of making human life easier and dominating nature. The interest of students to science who can answer the question 'What is Science?' and who can comprehend the nature of sciences and their success in science increase and they carry their countries forward in science and technology and thus the country makes important steps about being a productive country. Considering all this information, the students were asked the question 'What is Science?' and it was found that students could not define science correctly. 23,3% of the students made memorized definitions, 67,4% made descriptive expressions and 16,3% made a definition of 'the thing that makes human life easier' (%, table 2). Very few of the students made a correct definition. The fact that a great number of students made attributions without even making full sentences showed that they could not structure the definition of science in their minds and that they tried to memorize the definition. In a study about the nature of science, Köseoğlu (2010) put forward that students had misconceptions such as scientific theory, law and observation and that these were difficult to change and required more difficult and longer processes. In another study about the view of science, Lederman (1992) stated that students and teachers did not have enough perspectives about science. Thus, it can be seen in our study that students' memorized constructs about the concept of science did not change. Very few of the students assessed science in terms of its products and used expressions about science making life easier. When the answers are considered in terms of students who aim to work in the field of science, the results seem negative. This result shows us that students miss what they really have to learn about science and the nature of science while trying to memorize concepts by indulging into details. Students who cannot express the concepts of science cannot be expected to make scientific studies.

When the answers of students to the question 'What does the science of physics basically deal with' are analyzed, it can be seen that 39.5% transferred information directly from memory, 30.2% associated physics with the subjects in the curriculum, 30.2% associated with the laws of universe, 11.6% associated with chemistry and 2.3% made expressions about

making life easier (%, table 3). The fact that a great number of students used memorized expressions while explaining the interests of physics and that they made explanations about the subjects in the curriculum show that they cannot see the association between physics and life. In parallel with our study, previous studies have put forward that students are insufficient about applying their knowledge in physics to daily life (Gürel et al. 2003; Göçmençelebi & Özkan 2011).

When the answers of students to the question 'What would you like to research the most if you had been a physicist' are analyzed, it can be seen that 62.8% of the students are interested in the formation of the universe and the subjects of space (table 4). The curiosity for the unknown since the beginning of humanity have led humans to scientific studies and the equipments developed for space found their place in our daily lives. Individuals should be equipped with the skills of reaching information, organizing information, assessing information, presenting information and communication during their education (Aydın, 2003). Thus, since space research has taken speed these days and since it is still popular in the media, we believe that the students show a construct in this direction.

When the answers of students to the questions 'What do you think the most important problem will be in our world in the future' (table 5), 'Which subjects should physicists work on to shed light on which problems in the future?' (table 6) and 'What do you think the continuity of life in our world depends on?'(table 7) are analyzed, it can be seen that a great majority of students 65.1 % (table 5), 44.2% (table 6), 74.4% (table 7) gave the answers natural resources and energy. Students stated the biggest problem of the future as environmental problems. However, in their study Seçgin et al. (2010) stated that primary school students could not make associations between environmental problems and daily life. In our situation, it can be seen that the environment perceptions of science high school students are a bit more different.

When the answers of students to the question 'Considering the formation and functioning of the universe, how do you thing the end of universe will come?' are analyzed, it can be seen that 53.5% of the students gave answers about universal laws (table 8).

When the answers of students to the question 'Which subjects of physics can you associate with chemistry or biology?' are analyzed, it can be seen that 76.7% of the students associate it with chemistry, while 51.2% associate with biology. When the contents of the answers are analyzed, it can be seen that students mentioned the parts where physics subjects are made use of in chemistry and biology (table9).

When the answers of students to the question 'Which events in nature can you associate with physics?' are analyzed, it can be seen that 60.5 % associated with laws of physics such as the force of friction, the force of gravity and refraction of light, while 55.8% associated with natural events and the formation of the universe (table 10).

When the answers of students to the question 'Which subjects are common subjects of physics-chemistry-biology?' are analyzed, it can be seen that 69.7% of the students focused on subjects about living beings (table 11).

When the answers of students to the question 'Which disciplines can you associate with the subjects of physics?' are analyzed, it can be seen that 74.4% associated with chemistry, 72.1% associated with biology, 53.5% associated with mathematics and 34.9%

associated with astronomy and geography (table 12). While physics is expected to be associated with chemistry, biology, astronomy and mathematics, its association with geography was found to be interesting. When the whole test was assessed, it was thought that the students associated physics with geography since they stated that physics explained natural events.

When the answers of students to the questions 'Which subject of science are you happiest the most to study about science?' and 'Which field of science do you aim to work on?'are analyzed, it can be seen that 48.8% of the students stated they were happy to study about subjects related with living beings (table 13), while 58.2% aimed to work on biology and medicine and 37.2% aimed to work on physics and engineering (table 14). It is interesting that students do not want to work on a scientific field related with chemistry although they have the same hours of chemistry class with physics and biology. These results are in parallel with the results of Yücel et al. (2001). In their study with high school students, the researchers stated that students had low attitudes towards chemistry lesson.

It is known that physics is the basic science to understand nature and natural events. Thus, physics teachers should blend their knowledge and skills, save their teaching from monotony and present all their knowledge to students in line with new studies and technological developments by making them understand that all the information is about their lives. Today, all teaching programs should organize teaching in a way that knowledge can be used for daily life and productive societies can be formed in order to make teaching more effective.

References

Abbott, S. & Ryan, T., (1999). Constructing Knowledge, Reconstructing Schooling, Educational Leadership, 66-69.

Akkoyunlu, B. (1996). Computer Literacy Competency With The Effects Of Integrated To The Existing Curriculum Student Achievement And Attitude. *Hacettepe University Journal of Education. 12*, 127-134.

Akpınar, E.,&Ergin, Ö. (2004). A Sample Instruction Towards Integration of Physics, Chemistry and Biology in Science Teaching, *Marmara University Journal of Educational*. *19*, 1-16.

Aydın, H.,&Uşak, M. (2003). The Importance of the Investigation of Alternative Conceptions in Science Classes: A Theoretical Aproach. *Pamukkale University Journal of Education*. *13*(1), 121.

Göçmençelebi, İ.Ş.,&Özkan, M. (2011). Does the Use of Technology and Reading Scientific Publications Affect the Ability to Relate Science Lesson Knowledge to Daily Life A Comparative Study of Turkish Primary School Students. *Uludağ University Journal of Education. 24*(1), 287-296.

Gök, T.,&Sılay, İ. (2008). The Effects of Problem- Solving Strategies on Students' Achievement, on the Cooperative Learning Groups in Physics Teaching, *H. U. Journal of Education. 34*, 116-126.

Gönen, S., Kocakaya, S. (2005). The Comparison of Physics Achivements and Computer Attitudes of The First Year Students of A High School According to Two Different Instruction Methods, *Pamukkale University Journal of Education*.*17*(17), 11-19. Retrived from http://pauegitimdergi.pau.edu.tr/DergiPdfDetay.aspx?ID=76 (27.07.2016)

Güneş, T., &T.Akdağ, F. (2016). Determination of Perceptions of Science High School Students on Energy and Their Levels of Interdiciplinary Association,*International Journal of Social Sciences and Education Research.* 2*(2), 2016.*

Gürdal, A., Bayram, H., & Şahin, F. (1999).*Teaching The Energy Issue With Integration in Primary Schools,* Karadeniz Technical University, 3rd National Symposium of Science Education, Ankara: MEB, 204-208.

Gürel, Z., Güven, İ., &Gürdal, A. (2003). Evaluation of Skills of Skills of High School Students in Interpreting Daily Life Events in Lighth of the Knowledge They Learn in Their Physics Lessons. *Marmara University Journal of Educational*. *18*, 65-78.

Köseoğlu, F., Tümay, H., &Üstün, U. (2010). Paradigm Changes About Nature of Science and New Teaching Aproaches, *Ahi Evran University Journal of Kırşehir Education Faculty.11*(4), 129-162.

Lederman, N.G. (1992). Students and teachers conceptions of the nature of science. *Journal of Research in Science Teaching.29*(4), 351-359.

Secondary Education Institutions of Ministry of Education. (2013).Retrived from *http://www.resmigazete.gov.tr/eskiler/2013/09/20130907-4.htm (28.07.2016)*

Secondary Physics Curriculum. 2013. http://ttkb.meb.gov.tr/www/guncellenen-ogretim-programlari/icerik/151 (08.08.2016)

ÖSYM, 2016. Retrived From. http://dokuman.osym.gov.tr/pdfdokuman/2016/YGS/2016_YGS_Sayisal_Bilgiler.pdf (27.07.2016)

Seçgin, F., Yalvaç, G., & Çetin, T. (2010). *Environmental Problem Perceptions of 8th Grade Students Through Cartoons*. International Conference on New Trends in Education and Their Implications. 11-13. ISBN: 978 605 364 104 9

Sherman, S.J. (2000). *Science and Science Teaching.* Newyork: Houghton Mifflin Company.

Şahin, F.,&Oktay, A. (1996). Related Conceptual Change With Cell Respiration In Primary Schools.*Marmara University Journal of Educational.8*, 227-236.

Taşlıdere, E.,&Eryılmaz, A. (2012). Development of Attitude Scale Towards Simple Electric Circuits and Assessment of Students', *Journal or Turkish Science Education*. 9(1), 31-46.

Yıldırım, A. (1996). Interdisciplinary Education Concepts And Its Consequences About The Results Programs,*Hacettepe University Journal of Education.12*, 89-94.

Yücel, S., Seçken, N.,&Morgil, F.İ. (2001).High School Students Measurement Of Learning Degree In Symbols, Constants And Units Of Chemistry Teaching,*G.Ü. Journal of Gazi Educational Faculty*. *21*(2), 113-123.