SAKARYA UNIVERSITY JOURNAL OF EDUCATION
Original Research Doi: 10.19126/suje.807577
Received: 08.10.2020 Accepted: 16.03.2021
Published: 30.04.2021 April 2021• 11(1) • 155-181

Middle-School Students' Perceptions of History of Science*

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Abstract. This study aims to investigate middle school students' perceptions of history of science. The participants were a total of 140 students who studied at 5th, 6th, 7th and 8th middle school grade levels. A Word-Association-Test (WAT) was used to collect data. After data collection, frequencies of response-words were determined. By using cut-point technique, concept webs were drawn. According to the findings, the most different response-words were gathered from the 5th graders, and the least different response-words were gathered from the 8th graders. Participants generally associated the history of science concept with the scientists who made inventions. Besides that, students in the lower grades gave the most different response-words while 8th graders generally associated the concept with the subjects in the science curriculum.

Keywords: History of Science, Word Association Test, Middle School

* The ethics committee approval for this study was obtained from the Ethics Committee of the Rectorate of Sakarya University, dated 02/09/2020 and numbered 61923333/050.99.

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Mısır, M. E., & Adıgüzel, O. (2021). Middle-school students' perceptions of history of science. *Sakarya University Journal of Education, 11*(1), 155-181. doi: https://doi.org/10.19126/suje.807577

1. INTRODUCTION

Science is a process that is difficult to define precisely due to its wide meaning and complicated visual effect although it takes place in almost every step of modern life. There have been long years of debate on the definition of science, and it is very challenging to make a single and universally accepted definition according to the general opinion. There are several reasons behind this situation: First of all, science is not static; that is, it has a constantly changing and developing structure. Many scientific developments have taken place since the dawn of humanity. The scientific knowledge that emerged with these developments either replaced the old scientific knowledge or increased their validity by strengthening them (İnce & Mısır, 2018). Inasmuch as scientific knowledge is not static, it is almost impossible to make a general definition of science. Another reason is that in terms of its method and scope, science is a complex formation that is multifaceted, being divided into different disciplines and having ambiguous boundaries (Yıldırım, 2012). Modern science is held under many different basic disciplines, and these disciplines have many sub-disciplines (İrez, 2019). Fitting such a complex and comprehensive phenomenon into a single definition has been a topic of discussion and struggle for science philosophers and educators for many years. Considering the long journey science has gone through, throughout history, there have been serious changes in the way science is perceived and the meanings attributed to it. Today, the traditional conception of science has been replaced by the modern one. There have been various changes in scientific methods by this new approach. In fact, the underlying reason for the change of conception in science is the change taken place in philosophy of science.

The discipline that examines the differentiation in the definition and the dominant view of science is the history of science (HoS). Thanks to the HoS, students have the opportunity to see the lives of scientists, their scientific activities, and their interactions with the society they live in (İnce & Özgelen, 2017; Köksal & Ertekin, 2015; Şimşek, 2011). In her study, Şimşek (2011) states that through a science program enriched with the HoS, students have the opportunity to see concrete examples related to the development of scientific knowledge, the studies and research processes of scientists. Thus, owing to the HoS, students have the opportunity to reach a more comprehensive view on science when they understand how scientific knowledge develops and how the historical, philosophical and technological context affects this development (Mısır & Laçin Şimşek, 2018; Özgelen & Öktem, 2013). In a course structured with this approach, students are able to understand that producing scientific knowledge is a process. Students see the dynamic structure of science and scientific knowledge. In addition, they are able to see that scientists carry out daily activities like other people, are a part of society and are not superhuman beings (İnce & Özgelen, 2017). Because of these benefits, elements of the HoS were included in the science curriculum by the Turkish Ministry of National Education in 2004. In the following years, middle school students encounter information about the HoS by these changes. Especially in recent years, the concepts of "hypothesis" and "theory" have been emphasized more frequently, and it has

been emphasized that scientific research methods and scientific knowledge may change over time (MEB, 2018).

Besides, students' access to the history of science elements is not limited to learning environments. Especially on social media, there is a lot of information about science and the history of science. It cannot be denied that the use of social media falls to very low age levels and affects users' learning (Doğan, 2015).

These platforms, which we think have a great influence on students, are thought to have great effect on students' perception of the history of science. Accordingly, in this context, this study aims to investigate the perceptions of middle school students of the history of science. While the earlier studies (e.g., Başlantı, 2000; İrez, 2009; Yamak, 2009) show that the textbooks generally depict a negative image of science that is science is a body of knowledge, this research focuses on how the students perceive science and the scientific process.

2. METHOD

In this section, the information about the research method, the universe-sample-study group and the data collection tool are presented respectively.

The aim of this study is to investigate the perceptions of middle school students towards the concept of "history of science". Therefore, this study is designed as a descriptive research design. Descriptive study can also be defined as a descriptive analysis study based on the words, expressions, language used, structure and characteristics of dialogues and symbolic expressions take place in qualitative analysis (Kümbetoğlu, 2005).

Participants

The participants (N= 140) of this study were 5th, 6th, 7th and 8th grade students who were studying in a state middle school in Sakarya, Turkey, where one of the current researchers works as a Science Teacher. There were 35 participants from each grade level. Participants were selected from the weekend support courses, who were sampled through convenience sampling. The reason for this is that although there were nine middle school classes in the school, students from each class of all class levels were placed in the weekend support courses. In this way, it was aimed to fulfill the assumption that the selected participants would represent the school in general.

Data Collection Instruments

A Word Association Test (WAT) was used as a data collection tool in order to collect data regarding the perceptions of students of the history of science. “History of Science'' was chosen as the key concept. The key concept was written ten times in a column creating a table. Usage of WAT was not just for determining opinion of students about “History of Science''. By using it, it is also intended to decide what kind of other associations the concept of “history of science” have in the student’s mind. According to Akcay,2006 it is

very important element of nature of science. In addition, it was intended to examine further conceptual structures that are formed by these associations.

History of Science……..

History of Science……..

History of Science……..

There are different techniques in WATs in terms of the way the key concept is presented. In this study, just one key concept is selected students were anticipated to give only one response. This technique is called discrete testing which refers to the testing of one element at a time, item by item (Nielsen, 2004). The other technique is a continued test which can be explained as students responding to the key concept written once. It is displayed only one time for the students. However, for the latter, some researchers (e.g., Atabek-Yiğit & Balkan-Kıyıcı, 2019; Bahar & Özatlı, 2003) claimed that there is a risk that students might associate their answers to the former word, which provides a chain or set of associations. Accordingly, this undermines the purpose of the research (Atabek-Yiğit & Balkan-Kıyıcı, 2019). For example, answers "density-volume-space-planet-earth-moon" that can be given for the key concept "density" are considered as a chain answer because instead of going back to the original concept each time, students use the previous answer as a key concept. That is why, these answers are not taken into consideration during the analysis process.

Data Collection

The ethics committee approval for this study was obtained from the Ethics Committee of the Rectorate of Sakarya University, dated 02/09/2020 and numbered 61923333/050.99. After the WAT was prepared, the data collection process started. Before data collection, the participants were informed about the application of the technique. Before giving the key concept of the study in order to prevent the chain response risk, the word "density" was given as an example, and the students were told that the possible error might be in the form of "density-volume-space-planet-earth-moon". Afterwards, the forms with the main key concept were distributed and students were given 1 minute to answer.

Analysis of Data

In this study, data collection was carried out by grouping the participants according to their grade levels. First, a frequency table was prepared by looking at the different answer words corresponding to the key concept. In order to represent clearly, findings were presented by concept webs visually. In the creation of the concept webs, the Cutting Point (CP) technique suggested by Bahar, Johnstone and Sutcliffe (1999) was used.

In accordance with the CP technique, the response words that were below by 3 to 5 points from the top value were determined. Then, the response words that were higher than this value were decided as associated with the key concept (Bahar, Johnstone &

Sutcliffe, 1999; Bahar & Özatlı, 2003). Then, the cutting point was pulled down in predetermined intervals, and the procedure continued until all the response words were on the map. In this study, the end of the cutting point was determined as 3 because WAT was studied with one key concept. Therefore, answer words with a frequency above 3 were shown in the concept network.

3. FINDINGS

Findings are reported as (i.) the number of different answer words according to the grade levels of the participants, (ii.) the graphs consisting of the answer words they gave according to the level of the grades they study and (iii.) the common answer words for all grade levels.

The answer words and their frequencies that the participants answered the key concept "history of science" are presented in Appendix 1. The number of different answer words responded by the participants to the key concept is shown in Table 1.

Table 1

Different Answer Word Numbers According to the Grade Levels of the Participants

Grade Level	Number of Different Response Words
5th	160
6th	137
7th	148
8th	134

The number of different answer words given for a key concept can provide an idea to the researchers about how many different words the participants associated with the key concept. The high number of answer words given to the key concept can be regarded as an idea that an individual makes better sense by associating the key concept with more words (Bahar, Johnstone & Sutcliffe, 1999). When Table 1 is examined, it is seen that the number of different answer words to the key concept is the highest at the 5th grade level (160 different answer words) and the lowest at the 8th grade level (134 different answer words).

The answer words of the participants to the key concept were classified according to their grade levels and graphs were created using the cutting point technique. Considering the number and differences of answer words given by the participants, the first cutting point was determined as CP≥15. Again, considering the number of different answer words, the graph preparation process was continued until CP≥3 by decreasing 3

points each time. Below, graphs of the answer words given by the participants at different grade levels are shown.

When the responses of the 5th graders are examined (see Figure 1), it is seen that the participants mostly associate the "history of science" (CP≥15) with the response words "science" and "scientist". With pulling down the cutting point (15≥CP≥12) once, the answer words "experiment" and "invention" are added to the graph. The response word "technology" emerges by pulling down the cutting point to the range of 12≥CP≥9. The response words "science", "Einstein" and "Thomas Edison" emerged as a result of pulling down the cutting point once more to the 9≥CP≥6. As a result of pulling down the cutting point for the last time to the 6≥CP≥3 range, "astronomy", "research", "science", "science lesson", "biology", "laboratory", "Cahit Arf", "historical artifact", "history", "TÜBİTAK (The Scientific and Technological Research Council of Turkey)", "information", "astronaut", "atom", "planet", "light bulb" and "chemistry" emerged.

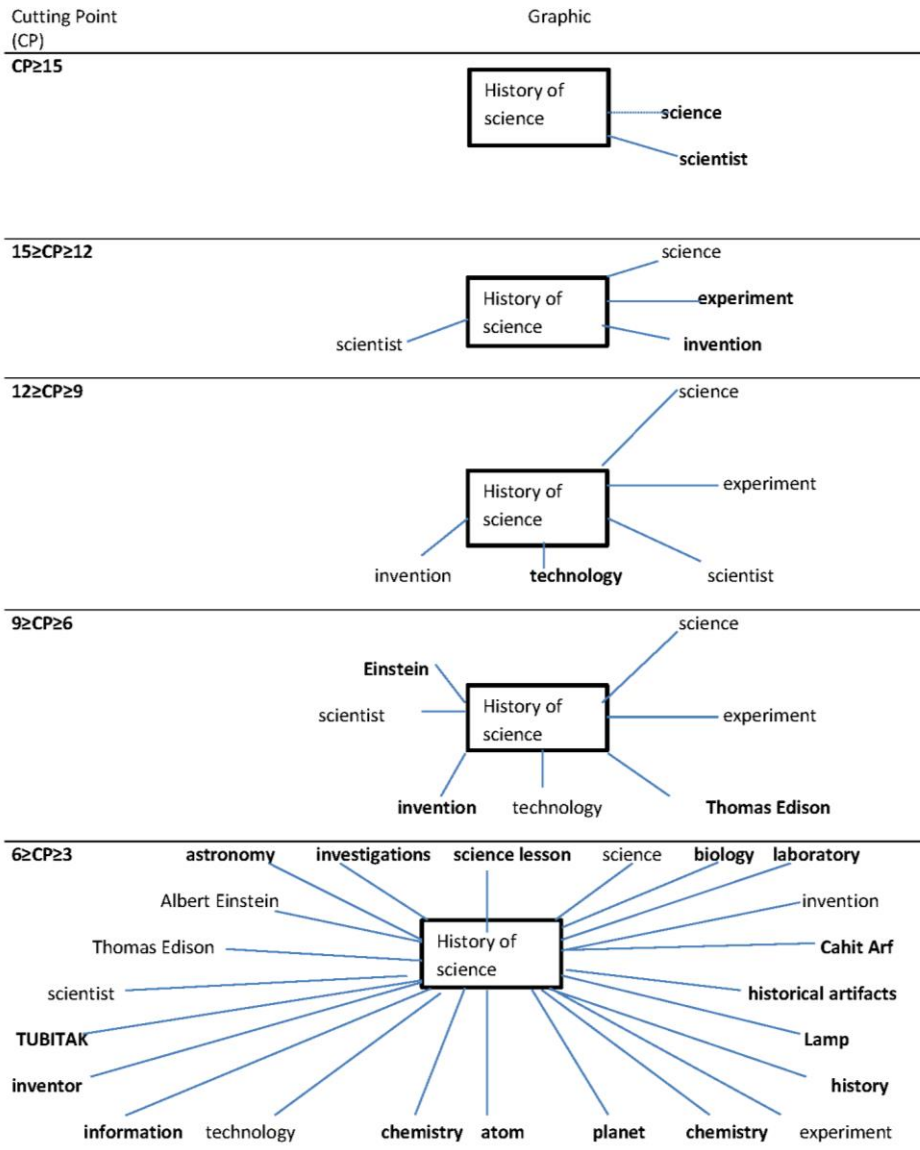

Figure 1. The response words of the 5th Graders

When the responses of 6th grade students were examined (see Figure 2), it was seen that the students mostly associate the HoS with the answer words "scientist" and "invention" (CP≥15). The answer words of "Aziz Sancar", "Thomas Edison" and "science" were added to the graph by pulling down the cutting point once (15≥CP≥12). The answer words "technology" and "experiment" emerged by pulling down the cutting point to the 12≥CP≥9 range. The response words "Einstein", "science", "telescope", "telephone" and "gravity" emerged as a result of pulling down the cutting point to the 9≥CP≥6 range once more. As a result of pulling down the cutting point to the 6≥CP≥3 range for the last time, the response words "microscope", "Nicola Tesla", "astronaut", "universe", "past", "Newton", "future", "history", "space", "Atatürk", "computer", "Cahit

Arf", "light bulb", "planet", "laboratory", "robot", "flying car", "artificial intelligence" and "electricity" emerged.

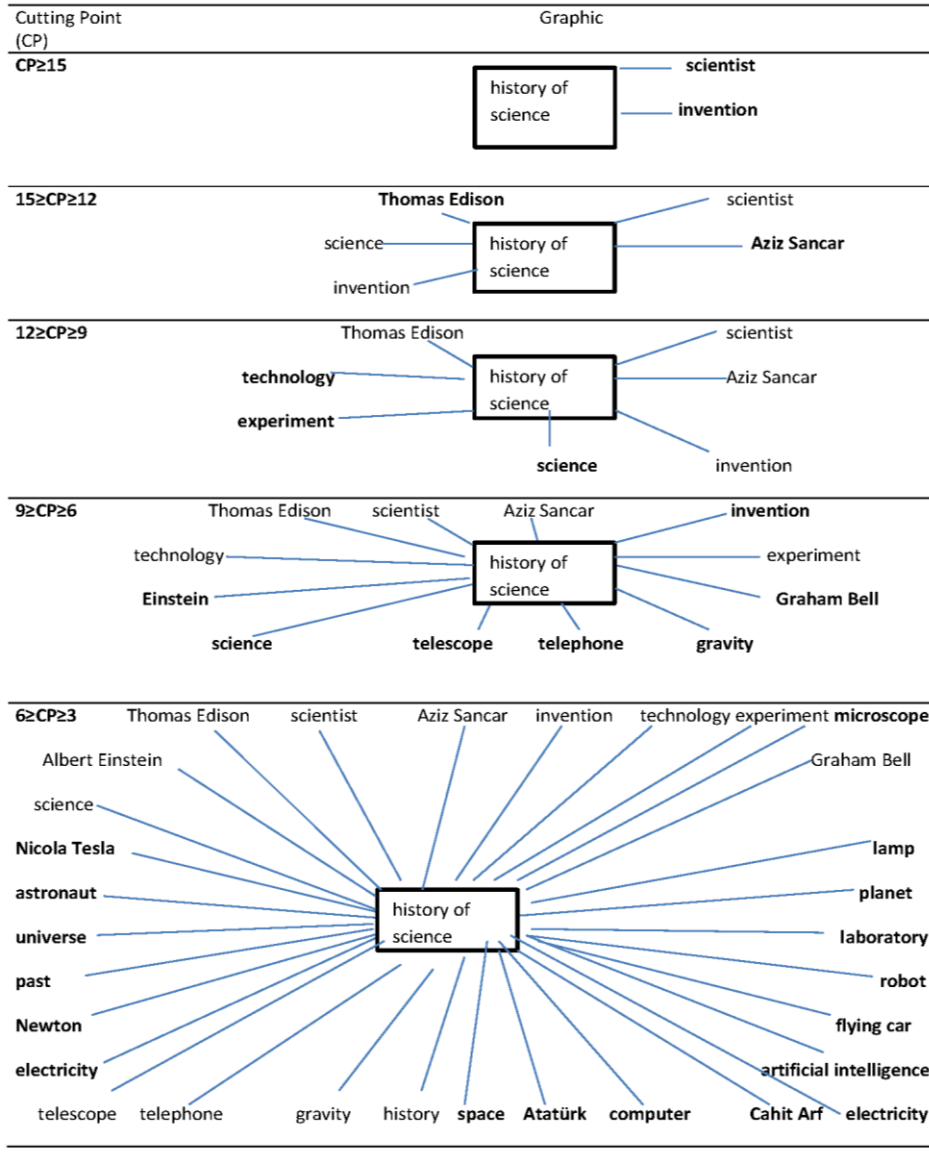

Figure 2. The response words of the 6th Graders

When the responses of 7th grade students were examined, it was seen that the students mostly associate the HoS with the answer word "invention" (CP≥15). By pulling down the cutting point for the second (12≥CP≥9) the response words "scientist", "Thomas Edison" and "telescope" emerged. The response words "light bulb", "Newton", "space", "Einstein", "discovery", "NASA" emerged by pulling down the cutting point to the 9≥CP≥6 range. As a result of pulling down the cutting point to the 6≥CP≥3 range, the response words "observatory", "phone", "tablet", "Galileo", "atom", "black hole", "Ali

Kuşçu", "science", "experiment", "Grahambell", "Nicola Tesla", "Science", "gravity", "wheel", "pioneers of science" emerged.

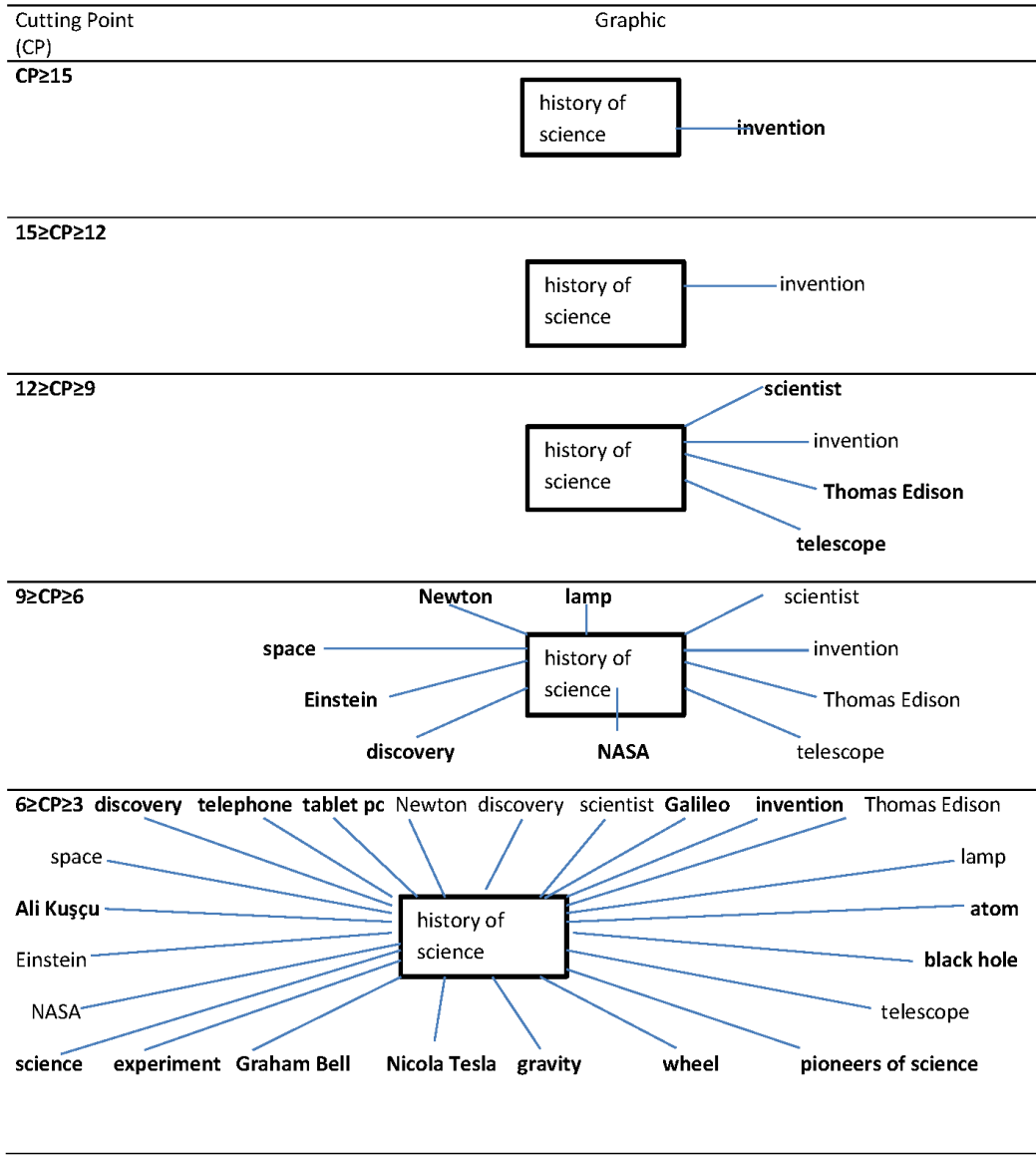

Figure-3. The response words of the 7th Graders

When the Figure-4 drawn with the data of 8th grade students were examined, it was seen that the participants mostly associate the "history of science" with the response words "Thomas Edison" and "Einstein" (CP≥15). By pulling down the cutting point for the second time (12≥CP≥9) the answer words "light bulb", "Aziz Sancar", "Nicola Tesla" and "Madam Curie" emerged.

"John Newlans", "Biruni", "DNA discovery", "Graham B ell", "Harezmi", "periodic table", "Döbereiner", "gravity", "invention", "experiment", "fossil", "Newton" and "telephone" emerged by pulling down the cutting point to the 9≥CP≥6 range. As a result of pulling down the cutting point for the last time to the 6≥CP≥3 range, "space", "Moseley", "Stephan Hawking", "science", "Earth", "electricity", "element", "apple", "universe", "science", "Galileo", "Ibni Sina", "discovery", "Mendeleev" and "microscope" emerged.

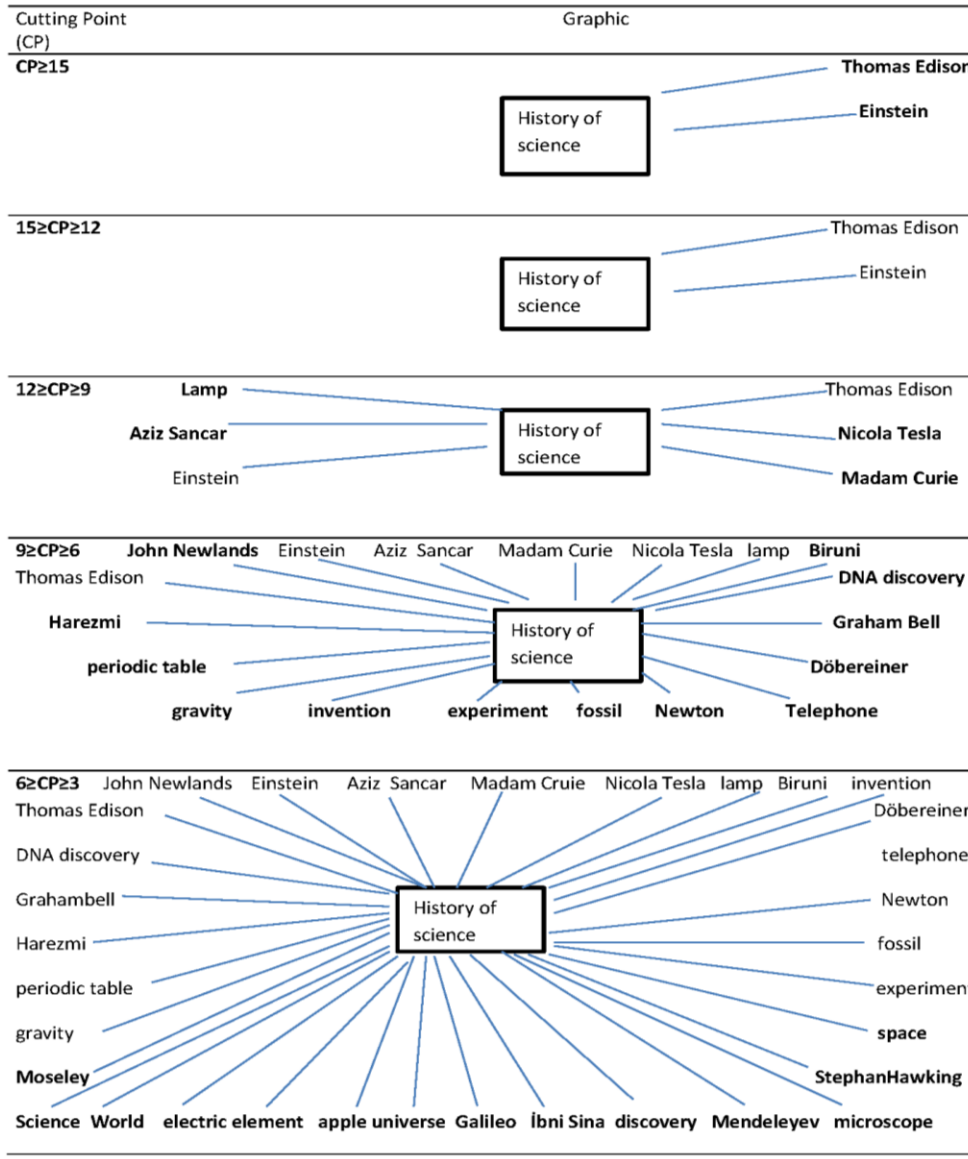

Figure 4. The response words of the 8th Graders

The common answers given by students at all grade levels to the key concept HoS are shown in Table 2.

Table 2

Common answer words that all respondents answered to the keyword

Astronaut	Microscope	Thomas Edison
Bulp	Newton	Telescope
Computer	Planet	Wheel
Einstein	Science	
Experiment	Scientist	

As indicated in Table 2, students mostly associate the key concept HoS with scientists, especially with those who conducted experiments and had inventions that are about space.

4. RESULTS, DISCUSSIONS AND SUGGESTIONS

In this study, the middle school students' perceptions about the key concept "history of science" were examined. Also, the similarities and differences between the answer words given at the 5th, 6th, 7th, 8th grade levels were examined. In addition, the relationship between the answer words and the interdisciplinary core subjects as well as the relationship between answer words with the concepts in the Science curriculum were investigated.

Findings and concept webs indicated that the total number of different answer words provided by students differed by the grade levels. The high number of concepts associated might indicate that the interpretation of the key concept is strong (Atabek-Yiğit & Balkan-Kıyıcı, 2019). As also reported in Table 1, it was the 5th-grade students who provided the most different answer words (number of different answer words: 160). The grade level that gave the least different answer words was the 8th grade (number of different answer words: 134). As Ercan, Taşdere, and Ercan (2010) also stated the higher the number of different answer words, the stronger the interpretation of that key concept. This study showed that a different image of the history of science was drawn at each grade level.

When the results are examined, it is seen that the participants at the 5th grade provided more different answer words than the other grade levels. This result can be interpreted as the imagination of the 5th grade level participants is less limited than the other classes. Similarly, in Kostova and Radonyosvka's (2010) study, it was reported that more

answer words were given at lower grade levels. Participants studying at the 5th grade level mostly associated the key concept of "history of science" with the response words "scientist" and "science". The reason why the key concept the "history of science" was associated with the answer word "scientist" may be that the 5th grade Science Textbook (MoNE, 2018) discusses scientists and the scientific development of concepts repeatedly starting from the first unit. In addition, at the 5th grade in the Social Science Studies course during the Technology and Society unit, there are common characteristics of the inventors and scientists. For the first time at this grade level, students are studying the topic of scientists and their works. Therefore, it is meaningful for students to associate the response word "scientist" with the key concept "history of science". The fact that the science answer word was one of the most given answers may be due to the fact that the word science is directly mentioned in the name of the "Science" course. When the cutting point was pulled down once, it was seen that the key concept "HoS'' was associated with the answer words "experiment" and "invention". Participants interpreted the key concept "history of science" as the discoveries made by scientists conducting experiments in the field of science. It can be said that they have the perception that the key concept "HoS'' is a concept that has to be related to inventions. Besides, 5th grade is the first and basic level for teaching History of Science, and it is usual for students at this level to associate the response words "scientists" and "experiments" more often. In addition, the frequent mention of "experiments", "inventions" and "scientists" in the teaching process of the science course normalizes the emergence of these answer words. Similarly, these words are frequently encountered in higher education levels, too (Taşdere, Özsevgeç & Türkmen, 2014). In addition, the fact that the number of answer word "TUBITAK" at the 5th grade level was higher than that of the students at other grade levels shows that they were very impressed by the TUBITAK 4006 science fair that were being held in their schools at the time of the study. The fact that the answer word "fair" appears only at this grade level also supports this view.

6th graders mostly associated the key concept "HoS" with the answer words "scientist" and "invention". When the cutting point was pulled down once, it became evident that the key concept "HoS" was associated with the answer words "Thomas Edison", "Aziz Sancar" and "science". When these concepts are considered, it can be interpreted that students have the tendency to associate the "HoS" key concept with the scientists who conduct experiments and make inventions. The situation becomes more clear by their examples like "Thomas Edison" and "Aziz Sancar". This result can be interpreted in two different perspectives: First of all, Thomas Edison was mentioned in the Science course recently when the data were collected. The emergence of the answer word "Aziz Sancar" shows that students are influenced by sources such as television and social media in daily life and that they associate their learning with the key concept "history of science". In addition, it is possible to establish a relationship between the "Nobel prize" answer word given only by the 6th graders and the answer word "Aziz Sancar".

7th grade students mostly associated the key concept "history of science" with the answer word "invention". When the cutting point was pulled down for the second time, a relationship was established with the concepts of "scientist", "Thomas Edison" and "telescope" by the students. When the answer words are thought, it can be interpreted that students have the tendency to associate the key concept "HoS'' with the scientists who made inventions. That is why they provided "Thomas Edison "as an example. The answer word "telescope" was cited more frequently (7th grade: 10) at this grade level than the others (5th grade: 1, 6th grade: 1, 8th grade: 2) because of their being familiar with "telescope" in the 1st unit of 7th grade science textbook: Solar System and Beyond. On the other hand, the relationship between the discovery of the telescope and Galileo is mentioned in the same unit. Since the answer word "Galileo" was repeated 3 times, the participants establish a meaningful relationship between "telescope" and "Galileo". The repetition of the answer word "NASA" for 6 times, the answer word "observatory" for 3 times (only in this grade level), and the answer word "space" for 8 times suggests that the 7th grade participants were overwhelmed by the unit Solar System and Beyond.

It was seen that 8th graders mostly associated the key concept "history of science" with the answer words "Thomas Edison" and "Einstein". When the cutting point was pulled down for the second time, a relationship was established with the answer word "Aziz Sancar", "Nicola Tesla", "Madam Curie" and "light bulb". When the answer words "Simple machines", "peas", "Biruni", "DNA discovery", "element", "apple", "John Newlands", "Avicenna", "gene", "Madam Curie", "periodic table" that were given only by 8th graders are examined, it is seen that the participants at this level chose the answer words mostly from the curriculum with the effect of the High School Entrance Exam. This findings suggests that the participants think narrowly about a key concept and feel obliged to give the correct answer word for the key concept they encounter. In short, it is thought that exam psychology and pressure might narrow the perspectives of the participants studying at this level.

Generally considered, when the answer words of the students are examined, it is seen that they mostly emphasized the scientists who made inventions and their works. That is not a desired finding for science. As in the study of Irez (2009) was mentioned, science is perceived as collection of facts, not as a dynamic process of generating and testing alternative explanations about nature. Inspired by the study of Chiappetta, Fillman and Sethna (2004), as the basic and general aim of the science education is to achieve science literacy, science should be portrayed as *(i.)* a body of knowledge, *(ii.)* a way of investigating, *(iii.)* a way of thinking, and *(iv.)* the interaction of science, technology and society. There should be a balance among those scientific themes in order to give a realistic image of science (Mısır, 2014). As main sources for school science, textbooks and teachers must categorize themes of science with a great accuracy so that the intended message which is tried to be conveyed to the audience would be understood correctly.

In addition, it has been observed that the answer words mostly related to the concepts and scientists they had been taught in the lessons. The main reason for this might be the students' exam-oriented thinking. Students contextualize their learning in a way that they can use in the exam.

This study consists of only 5th, 6th, 7th and 8th grade students who were studying in a state middle school in Sakarya, Turkey and 35 participants were chosen from each grade level, totaling 140 students. It is strongly suggested that further research is to be done with high school and university level students. Only the Word Association Test was used as a data collection tool. Using a single tool for the data collection process can be considered as a limitation. For further research, using additional data collection tools and methods are suggested in order to have a wider understanding of the phenomena.

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Appendix

The different answer words and their frequencies that the participants provided for the key concept "HoS"

Response Word	5th grade	6th grade	7th grade	8th grade
A History of Science Made			1	
Activities				1
Age		1		
Airplane		2	1	
Ali Kuşçu		1	5	
Alphabet			1	
Ambition			1	
Ancient History	1		1	
Android Robots				1
Angular Wheel				1
Apple		2		3
Application	1	2		
Archaeology		1		
Archeologists				1
Are There Any Aliens in the World?	1			
Aristotales	1			
Article		1	2	
Artificial Intelligence		3		
Artificial Privacy	1			
Astrology			1	
Astronaut	3	4	2	1
Astronomy	5		3	
Ataturk		3	1	1
Atom	3		5	1
Atom Bomb				1
Atomic Fission		2	1	1
Automatic Opening Door			1	
Aziz Sancar	1	14		11
B.C				1
Beautiful Quotation Of Science	1			
Beginning Of Science				1
Benjamin Franklin				1
Bequer				1
Big Bang Theory			1	
Binoculars	1			

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Biodiversity	1			
Biology	4			
Birthday			1	
Biruni				8
Black Hole		1	3	1
Board	1			1
Book		1		
Bulb	4	4	7	9
Buoyancy				1
Cable				1
Cahit Arf	4	3		
Car		1	2	
Carl Benz		1		
Carpenter	1			
Celebration Day			1	
Cell		1	2	2
Change of Idea			1	
Chemical Products			1	
Chemistry	3	1		
Church Pressure			1	
City of Science	1			
Colony		1		
Colored Liquids	1			
Communication through Smoke Signals				1
Compass		1		
Computer	2	3	2	1
Contemporary			2	
Continents				1
Copyright		1		
Çelebi				1
Da Vinci			1	
Definition of Science	1			
Democritus			2	
Development	1	1	1	1
Development of Science in History		1	2	
Development Process				1
Dinosaur	2			
Discovery			6	4
Discovery of the Shape of the World		2		

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Districts	1			
Discovery of DNA				8
DNA	1			
DNA Repair		1		
Doctors	1			
Döbereiner				6
Ease				1
Effort			1	
Eggplant				1
Einstein	6	6	6	16
Electric Car		1		1
Electric Circuit			1	
Electric Loads				1
Electricity		3		5
Electron				1
Electronic		1		
Element				3
Elevator			1	
Elixir	1			
Elon Musk		1	2	
Engineer	1			
Enlightening the Future	1			
Eraser				1
Escalator			1	
Events	1			
Excavation Work		1		1
Exercises	1			
Experiment	14	10	5	7
Experiment House		2	1	
Explorer			1	
Explosion	1			1
Fair	2			
Farabi			2	2
Felix				1
Fiction			1	
Fire		1	1	
First Era			1	
First Microscope		1		
Flying Car		2	1	

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Force		1		
Formation of the Sun	1			
Formulas	1			
Fossil				7
Francestain				1
Freedom			1	
Freedom Restrictions			1	
Future	1	3		1
Future Hope			1	
Galaxy		1	1	
Galileo			3	3
Gases	1			
Gazi Yaşargil		2		
Gene				1
Generation of Plants	1			
Geography	1			
Gifted People	1			
Going into Space			2	
Good Technology		1		
Graham Bell		7	5	6
Ground Shot		6	5	8
Gunpowder			1	
Harezm			2	8
The First Fermentation of Yoghurt			1	
Hazini			2	
Historical Artifacts	4	1		
Historical Beauty	1			
Historical Books	1			
Historical Events	1			
Historical Information	1			
Historical Monuments	2			
Historical Objects	1			
Historical Remains	2			
Historical Science	1	1		
History	3	4	1	
History Information	2	3		1
History of Enlightenment			2	
History of Science	1		1	
History of Technology	1			

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
History of the Ancient Science	1			
History of the Ancient Times	1			
History of the Old	1			
History Speech	1			
Housework Getting Easier	1			
Hubble Space Telescope			1	
Humanity				1
Hypothesize		1		
Ibn Sina				4
Idea		1		
Importance of Science			1	
Impossible			1	
Improving by Making Mistakes	1			
Infinity			1	
Information Technologies		1		
Information	3			
Information Course	1			
Innovation			2	
Innovations Made			1	
Inquisitiveness	1			
Intelligence	1	2	1	
Intelligent Human	4	1		
Intelligent Things	1			
Internet	2			
Invention	14	28	17	8
Invention of Clothing	1			
Invention of Education	2			
Invention of Electricity			2	
Invention of Health	1			
Invention of Safety	1			
Invention of the Washing Machine	1			
Inventor	4	1	2	1
IQ			2	
İbni Haldun			2	
John Newlands				8
Knowing		1		
Known History	1			
Laboratory	3	3	1	
Landforms				1

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Landing on the Mars			1	
Landing On the Moon				1
Laptop			1	
Lens		2	1	
Lesson	2			1
Life History of Science		1		
Light			1	
Living Things		1		
Machines	1			
Madam Curie				11
Magnifying Glass	2			
Making Life Easier		1		
Making New Things	1			
Mammoth	2			
Mass			1	
Massive Buildings				1
Math	1		1	1
Matter		1		
Mechanism		1		
Mediciation	1			1
Medicine		1		
Meditation	1			
Mendeleyev				5
Messy Hair			2	
Micro Uzi			1	
Microorganisms			1	
Microscope	2	5	2	3
Milky Way		1	1	
Mind	1	2	1	
Mind Controller				1
Mirrors			1	
Modernizing		1		
Modern Aircraft				1
Molecule				1
Money		2		1
Moon		1		
Moseley				3
Museum	2			2
Nanotechnology		2		

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Nasa			6	2
Natural				1
Nature		1		
Neil Armstrong		1		
New Future			1	
New Items	1			
Newton	2	3	8	7
Nicola Tesla		5	5	11
Nobel Prize		2		2
Nuclear Energy				1
Nuclear Power Plant Explosion				1
Numbers				1
Observation			1	2
Observatory		2	3	
Ocean				1
Oktay Sinanoğlu	1			
Old Age			1	2
Old Books				1
Old Communication Tool	1			
Old Information	1			
Old Men		1		
Old Period	1			1
Old Phone		1		
Old Scientists		1		
Old Technology	1			
Old Time	1			
Old Years	2			
Omniscient	1			
Oncology				1
Ottoman				1
Our Creation			1	
Overhead Projector		1		
Padishahs	1			
Paleontology				1
Paper		1		
Past Events		1		
Past Science		1		
Pasteur	1			
Patent Right		1		

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Patience			1	
Pea				1
People in White Lab Coat		1		
Pepper				1
Period	1			
Periodic Table				8
Periscope			1	
Perseverance			1	
Physical Laws				1
Physics	2		2	
Pioneers of Science			3	
Pisagor	1			
Planet	3	4	1	1
Plants	2			
Pole Star			1	
Pollination				1
Power of Science		2		
Printing Press		1	1	1
Problem-Thinking		1		
Process			2	
Professor		1		
Progress				1
Proton				1
Pythagoras			1	
Quality Life		1		
Quantum Theory				1
Quick Life		1		
Recognizing The Sun			1	
Reducing The Needs	1			
Remains		1		1
Renaissance			1	
Researches	4	1		1
Result		1		
Robert Hooke			1	
Robot		3	2	
Rocket		2	1	
Rotating Phone				1
Ruler				1
Saints				1

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Satellite		1		1
Saturn				2
School	1			
Science	22	18	9	8
Science and Technology				
Science Book	2			
Science Course	4			
Science Day				1
Science Exhibition	2			
Science Fiction	1			
Science Genius	1			
Science History Classes	1			
Science History Courses	2			
Science History Games	1			
Science In Ancient Time			1	
Science Museums	1			
Science Projects	1			
Science Studies			1	
Science Teacher	2			
Science Tools	3			
Sciences	1		1	
Scientific Quotation	2			
Scientific Technology	1			
Scientists	18	26	10	2
Simple Machines				1
Siphon			1	
Skeleton System		1		
Sky		1		1
Smart Board		1	1	
Smart Pens		1		
Social Studies		1		
Solar System		2		
Space	2	5	8	5
Space Experiments			1	
Space Science	1			
Space Station		1	1	
Space Technology			1	
Spacecraft	1	1	1	
Star		2		

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Statue		2		
Step			1	
Stephan Hawking			2	3
Stone				1
Stopwatch			1	
Struggle			1	
Studying	1		1	
Sturdy	1			
Success			1	
Sumerians			1	
Tablet PC		1	3	1
Technological Tool	1	1		
Technology	10	10	2	1
Technology and Design				1
Technopark		1		
Telegram	1			1
Telephone		7	3	7
Telescope	1	1	10	2
Television			1	
Text Form of History	1			
Textbook			1	
Theories			2	
Thomas Edison	6	12	10	17
Time	1	2	1	
Time Machine		2		
Tools	2	3		
Traditional Experiment	1	2		
Transfer				
Trials	3			
Truths			1	
Tube		1		1
Tube Baby	2			
Tubitak	5		1	
Turks	1			1
Uluğ Bey			1	
Universe		3		4
Unmanned Aerial Vehicles		1		
Unmanned Cars		1		
Variability		1	2	

Response Word (Cont.d)	5th grade	6th grade	7th grade	8th grade
Very Old Time				1
Wars	1			
Water				1
Water Bear				1
Weight			1	
Well-Qualified Human		1		
Wheel	1	1	6	2
Wonder		1	1	
Work		1		
World				3
World Life			2	
X-Ray		1		1
Yacht	1			
Yuri Gagarin				1
Zero			1	
Number of Response Words	305	339	304	338
Number of Different Response Words	160	137	148	134

The ethics committee approval for this study was obtained from the Ethics Committee of the Rectorate of Sakarya University, dated 02/09/2020 and numbered 61923333/050.99.

Statement of Contribution of Researchers to the Article:
1st author contribution rate: 60% 2nd author contribution rate: 40%
Conflict of Interest Statement:
There is no conflict of interest.
Statement of Financial Support or Acknowledgment:
No financial support was received from any institution for this study. We would like to thank Prof. Dr. Fatime BALKAN KIYICI for his support during the writing process and proofreading.