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Research Article

Secondary School Students' Views About the Use of Argument-Driven Inquiry in the Science Courses[1,2,3]

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Abstract

The vision of science teaching is to train individuals who can produce and evaluate scientific knowledge by following the scientific processes like the scientists in order to understand and be able to produce solutions to the problems they encounter in real life. Ensuring this is only possible by using effective teaching methods. One of these methods is the argument-driven inquiry method. In parallel, the purpose of the study is to identify secondary students' views about the use of the argument-driven inquiry in the science courses. In the research, the case study has been adopted. Participants of the study consists of twelve seventh-grade students in a secondary school located in the Aegean region in the 2016-2017 academic year. The research

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was carried out in six weeks. In the research, the 7th grade "Electric" unit was taught with argument-driven inquiry activities. In the research, the participants were given an electrical situation (serial-parallel connected circuits etc.). The research data was collected by a semi-structured interview form regarding the use of argument-driven inquiry method in science classes which is consisting of 18 open-ended questions in order to determine students' opinions. Content analysis method was used for analysis of the data obtained from the research. As a result of the research, it was determined that the participants mostly gave a positive opinion on the use of the argument-driven inquiry in science lessons. Students who gave negative opinions about the argumentation-based inquiry method said that they did not like this model on the grounds that they were afraid to express their own opinions in the lesson and they did not like to talk in the lesson. As a result, it can be said that the literature contributes to the determination of student opinions on the use of the model.

Keywords: *Argument-driven inquiry, science education, views of the students, secondary school student*

Ortaokul Öğrencilerinin Fen Derslerinde Argümantasyona Dayalı Sorgulama Yöntemi Kullanımına İlişkin Görüşleri

Öz

Fen öğretiminin vizyonu, öğrencilerin gerçek yaşamdaki olayları anlamak ya da karşılaştıkları sorunlara çözümler üretebilmek amacıyla bilim insanları gibi bilimsel bilgiyi üretebilen ve değerlendirebilen bireyler yetiştirmektir. Bunu sağlamak ise ancak etkin öğretim yöntemlerini kullanabilmekten geçmektedir. Bu yöntemlerden biri de argümantasyona dayalı sorgulama yöntemidir. Buna paralel olarak, bu çalışmanın amacı Fen Bilimleri dersinde argümantasyona dayalı sorgulama yöntemi kullanımına ilişkin ortaokul öğrencilerinin görüşlerini belirlemektir. Araştırmanın yöntemi olarak, durum araştırması benimsenmiştir. Araştırmanın çalışma grubunu, 2016-2017 öğretim yılında Ege bölgesinde yer alan bir ortaokulda öğrenim görmekte 12 yedinci sınıf öğrencileri oluşturmaktadır. Araştırma 6 hafta sürmüştür. Araştırmada, öğrencilere elektrik konusuyla ilgili bir durum (seri-paralel bağlı devreler vs.) verilmiştir. Bu ünite, çalışma süresince argümantasyona dayalı sorgulama öğrenme yöntemine göre işlenmiştir. Araştırmada veri toplama aracı olarak 18 açık uçlu sorudan oluşan fen derslerinde argümantasyona dayalı sorgulama yöntemi kullanımına ilişkin yarı yapılandırılmış görüşme formu kullanılmıştır. Çalışmadan elde edilen verilerin analizde içerik analizi yöntemi kullanılmıştır. Çalışma sonucunda, öğrencilerin fen derslerinde argümantasyona dayalı sorgulama yöntemi kullanımı hakkında çoğunlukla olumlu görüş bildirdikleri belirlenmiştir. Argümantasyona dayalı sorgulama yöntemi hakkında olumsuz görüş bildiren öğrenciler ise derste kendi fikirlerini belirtmekten çekindikleri, derste konuşmayı pek sevmedikleri gibi gerekçelerle bu modeli sevmediklerini ifade etmişlerdir. Sonuç olarak, bu modelin ortaokul düzeyinde kullanımı sınırlı olup, modelin kullanımına ilişkin öğrenci görüşlerinin belirlenmesi konusunda alanyazına katkı sağladığı söylenebilir.

Anahtar Sözcükler: *Argümantasyona dayalı sorgulama, fen eğitimi, öğrenci görüşleri, ortaokul öğrencileri*

Introduction

The world is changing fast. Change affects not only us but also the whole world. The main reason for this is the rapid change and progress in science and technology. This deeply affects and changes many of our daily life situations, such as the expectations of employers from trained manpower and the expectations of the individuals of the age in terms of business and living standards. This leads to the emergence of new types of professions that we cannot predict at the moment, but that will probably be popular in the future, and the diversification of the competences that people will have to work in these professions, and even the definition of new qualifications is happening. This process of development and change has made education the key to a serious future in terms of ensuring the socio-economic, political and geopolitical balances between countries and other countries they compete with. In other words, it can be stated that the education systems of the country have become a powerful industry that determines their squares. Since it has been observed that countries that do not attach importance to education cannot win every race in the race for rapid development and solid democratization. This has brought the discussion of the question of "what kind of education system and education program should we develop for countries?" It can be said that the science course came first among the courses that were affected by and affected all these discussions. Therefore, it is important to be able to accurately analyze how the current century shaped the world. In line with these analyzes, it is an inevitable necessity for countries to review their science education systems and curricula. Concordantly, our country has implemented serious reform in the 2005 Science and Technology and Science curriculum in 2013 and 2018 (Ministry of National Education [MNE], 2005; 2013; 2018).

In this context, the recent science education reform efforts have been carried out in the 21st century. It has been tried to determine what the characteristics that century individuals should have are. As a result, the vision of the 2018 Science Course Curriculum was emphasized as raising science literate individuals. In this context, it has been stated that in order to be successful in today's and future education and business lives, the science literate individuals produce knowledge and can use it functionally in life, be creative, innovative, critical thinkers, open to cooperation, solve problems, have high communication skills, use and develop entrepreneurial, stable, empathetic technology well, contribute to society and culture, etc. (MNE, 2018; Uluyol & Eryilmaz, 2015). Moreover, a science literacy individual understands science subjects, scientific processes and the epistemological aspect of science so that he can make personal decisions in the context of related issues in everyday life, participate in the relationship between society and culture, and rush these understandings to work for economic efficiency (National Research Council [NRC], 2005; 2012; 2013; Walker, 2011). In this context, it is seen that science teaching programs in different countries included teaching methods designed to help students grow up as science literate individuals and examples of the application of these methods. It can be said that one of them is a new method of learning, The Argument-Driven Inquiry Method (Grooms, 2011; Sampson, Grooms & Walker, 2011; Walker, 2011). The method of inquiry, which is the closest method of learning to this method, forms the basis of the research of scientists and the development of scientific knowledge; argumentation plays an important role in the 2007 communication of scientists through the scientific facts presented in the process of making science (Anderson, 2007; Duschl & Osborne, 2002; Sampson & et al., 2011). However, even this situation makes us see the shortcomings of research-inquiry and argument-driven learning methods. Because in the research inquiry method, discussion/communication about the scientific process is stored at the end or very little is done. This causes deficiencies/turmoil in the scientific facts of the research process carried out by students in their minds regarding many situations such as the accumulation of science and acceptances of theories and laws. Moreover, in argument-driven learning, sometimes processes such as hypothesis, data collection are not carried out and students are tried to be drawn into scientific debate over claims that are not their own. This prevents students from going through the process of making science and producing information. Here, argument-driven inquiry learning method can be considered to be an effective learning method that enables to eliminate/complete the deficiencies of all these two methods and to combine the good aspects (Walker & Sampson, 2013a; 2013b). In other words, it can be said that the method of learning inquiry based on arguments corrects the deficiencies in the inquiry process in the method of argument and argument-driven learning in the inquiry method.

In the method of argument-driven inquiry; students determine the research problem, decide on the appropriate research method in order to produce a solution to this research problem, decide how to collect the data, carry out the processes of collecting and analyzing the data, then make an argument and participate in the argument process with their peers as a result of this, ultimately reaching and reporting the scientific information that applies (Walker, 2011). In this context, thanks to this method, students can make sense of many processes of science through real lives, just as scientists do in their research.

Moreover, the method of argument-driven inquiry is a laboratory-based method that involves research and inquiry that contributes to the importance of argument in science education (Walker, Sampson, Grooms, Anderson & Zimmerman, 2012). The method of learning argument-driven inquiry attaches great importance not only to the experimental characteristics of laboratories (questioning, method development) but also to the presentation of scientific claims (argumentation, writing) in improving students' science literacy (Cetin & Eymur, 2018). In other words, this learning method combines argumentation with laboratory-based teaching to offer a broad perspective (Walker & Sampson, 2013a; 2013b). This method of learning is designed as a more original (authentic) or at least more realistic and educational learning that gives students the opportunity to design their own research, participate in argumentation, write scientific articles for a critical and knowledgeable audience, participate in the peer review process, and review their own articles in response to criticism brought to the article (Sampson & Walker, 2012; Walker, Sampson, Grooms, Anderson & Zimmerman, 2010; 2012). It can be stated that such a method of teaching teaches students to make science in a way that is consistent with the scientific research process, that is, scientific explanations of the events that exist in nature beyond learning about scientific facts, laws, theories and models. Moreover, the method of argument-driven inquiry encourages students to develop and use conceptual models, design and conduct research, develop explanations, share ideas and criticize, all of which allow students to develop the knowledge and skills they need to become science literate individuals (Sampson, Hutner, FitzPatrick, LaMee & Grooms, 2017). In this context, when the literature is examined, studies have been conducted with students from primary schools (Chen, Wang, Lu & Hong, 2019; Chen, Wang, Lu, Lin & Hong, 2016), secondary school (Aktas, 2017; Aktas & Dogan, 2018), high school (Amielia, Suciati & Maridi, 2018; Cetin, Eymur, Southerland, Walker & Whittington, 2018; Eymur & Cetin, 2017; Eymur, 2018; 2019; Kim & Hannafin, 2016) and also prospective teachers (Altun & Özsevgeç, 2016; Cetin & Eymur, 2018; Erenler, 2017; Eymur & Cetin, 2017). It can be said that these studies are mostly conducted with high school students and prospective teachers. For this reason, it can be considered that studies involving the applications of the argument-driven inquiry method at the level of secondary school students are needed. At the same time, when we examined the topics on which the method of learning based on argument was studied, the method in question was used to provide academic achievements/conceptual understandings of the students or teacher candidates (Aktas, 2017; Aktaş & Dogan, 2018; Cetin, Eymur, Southerland, Walker & Whittington, 2018), their participation in science learning (Chen, Wang, Lu & Hong, 2019), their level of argument and their desire to participate in the discussion (Aktas, 2017; Aktaş & Dogan; Amielia, Suciati & Maridi, 2018; Chen, Wang, Lu & Hong, 2019; Chen, Wang, Lu, Lin & Hong, 2016; Cetin, Eymur, Southerland, Walker & Whittington, 2018), cognitive and affective expectations (Cetin & Eymur, 2018), views on the nature of science (Eymur, 2019), their self-reliability (Eymur, 2018; Research examining the impact of Eymur & Cetin, 2017), scientific writing skills (Cetin & Eymur, 2018) and metacognitive awareness (Erenler, 2017) has been reached. As a result of these studies, quantitative findings have been obtained that this method positively improves the learning output of students or prospective teachers. Moreover, the majority of these studies were carried out in the form of quantitative studies (experimental research). However, it can be said that these studies are not intended to explain how the above-mentioned method of learning based on argument develops or changes academic achievement, upper bilingual skills, etc. Therefore, in this research, it is aimed to investigate the possible effects of this method on students in more detail by determining the opinions of secondary school students on the method of argument-driven inquiry. Accordingly, the problem of the research was determined as "What are the opinions of secondary school students regarding the use of argument-driven inquiry method in science course?"

Methodology

In this study, the case study was adopted as a research method. A case study is a research method used to understand, identify and describe the reasons, causes and consequences of a certain situation related to an event, person or group (Cepni, 2018). In this study, case study is considered to be suitable as it is aimed to examine in depth the student opinions on the use of the argument-driven inquiry method in science courses in depth.

Participants

The sample of this study consists of students studying in the 7th grade in a secondary school affiliated with the National Education Directorate of Usak Province. Within the scope of the study, research permission no. 29425508-605.01-E7688270 was obtained. When determining the students who make up the research group, the purpose sampling method was preferred. Therefore, in the process of identifying participants within the scope of the study; First of all, a way was taken to identify and educate the teachers of science courses, and then to determine one of the 7 classes in the school where one of these teachers was working. Within the scope of the study, teacher selection and education have an important place. Since the process of applying the argument-driven inquiry in question in science course was carried out by the teacher of the related course. For this reason, in the selection of teachers, first of all central secondary schools in Usak were determined and a list was created. Then, 4 different secondary schools representing public schools of different socio-economic levels were selected. In determining these schools, interactive board, internet access, active laboratory classes, student-parent socio-economic status and status are moderate, the number of immigrants (Syrian, Iraqi immigrants and Turkish non-mastery) students in the school is considered as small or none at all. In the next stage, four science course teachers (2 females and 2 men) were started to work, one teacher from each school. In determining these teachers, it was seen to that each teacher enters two seventh grade classes, the average academic achievement and socio-economic status of the classes are equivalent to each other. At the same time, in the selection of these teachers, it was emphasized that teachers are open, volunteering and willing to learn new teaching approaches and methods in science and to apply them in their courses. In addition, it has been taken care that teachers have sufficient pedagogical field knowledge of laboratory materials (e.g. simple electrical circuit installation, amperemeter-voltmeter use, etc.) and teaching technologies that help science teaching (e.g. smart board, simulation, video, etc.). For this, a one-question interview form was applied to the teachers. In this interview form, they were asked to briefly describe how they processed a week of science courses. Considering these responses from teachers, teachers who are thought to be able to perform this study have been preferred.

After the determination of the teachers, they were given practical trainings on theoretical and teaching materials that lasted 1 month on the method argument-driven inquiry. These trainings were held in one of the schools where teachers took part and during the seminar period with all the teachers coming together. In these trainings, first of all, information was given about the method of argument-driven inquiry learning aimed at carrying out within the scope of the research. Then, teachers were given theoretical information about the method of argument-driven inquiry. This information was carried out in a practical way using the argument-driven inquiry in accordance with the nature of the research subject. In other words, detailed information about what is the method of argument-driven inquiry by the researcher and advisor and how its stages are carried out has given the teachers practical trainings. Following the theoretical training presented about the method in question, practical trainings were carried out on how to apply the developed teaching materials in the science course. In this applied training, the general structure of the teaching material is introduced first and what to do during the use of the material is explained at the relevant stage of this method. Afterwards, macro teaching practices were carried out with each teacher within the scope of the research, covering four hours related to a teaching material selected by the teachers themselves. During these practices, the comments and comments from teachers were discussed. In this process, it was consensus that teachers should not inform students at the beginning, that they should try to question and direct students to argument as much as possible, and that they should always ask open-end questions for this. At the same time, teachers have been given hands-on training on how to use simulations that will be used during the summary or evaluation phase of the course.

However, 1 science teacher (female) was chosen to perform the experimental practice, as it was decided that the experimental practice should be carried out only in one secondary school. The designated science teacher has 20 years of professional experience and has been working at this school for the last 6 years. At the same time, he was a researcher (teacher) in many secondary schools supported by TUBITAK (4004, 4006, etc.) and also participated as a researcher (teacher) in TUBITAK 1001 Scientific and Technological Research Project. However, the designated science teacher has shown great dedication in participating in trainings on the method of argument-driven inquiry learning.

One of the 7th grades entered by this designated teacher was designated as a group of participants of this research. When we looked at the students who participated in the study, a total of 31 students, including 13 girls and 17 male students, participated in the study. In the study, science courses were processed using the argument-driven inquiry method for a period of 9 weeks. As a result of the process, students were selected for interviews among 31 students in order to determine their opinions regarding the argument-driven inquiry method. At this point, students' argumentation skills and academic achievements to be poor, medium and good and their willingness to participate was taken into consideration. Moreover, in determining the students, the grades that the researchers kept about the students were considered in the class observations. In these grades, it was tried to interview the most mentioned students about student development. At the same time, student activity pages were applied to determine the interview students. In these active pages, the responses of the students to the sections such as "What is our Research Question?", "Let's Design Our Application!!!", "What Data Did I Collect in My Research?", "Electrical circuit system I established in my research", "My Claim-My Evidence-Justification" were taken into account. Moreover, the selection of the students was carried out considering the information they wrote in the "RESEARCH REPORT" section, where they reported all the parts related to the experiments or research carried out by the students. In parallel, 12 students were interviewed.

Data Collection Instruments

In the study, semi-structured interview protocol was used to get the opinions of students regarding the use of argument-driven inquiry learning method in science course. In the study, when preparing a semi-structured interview form, the literature on learning primarily by argument-driven learning and argument-driven inquiry was examined. As a result of the literature review, a general framework has been established regarding what is the method of learning inquiry based on argument and what its characteristics are. Within this framework, 18 open-ended opinion questions were written in the science course regarding the use of the argument-driven inquiry learning method and the learning, skills and sensory characteristics of the students. It was then presented to the opinion of three academicians who conducted research on the method of learning based on argument and the method of learning based on research and inquiry in the science course for content and scope validity. In line with expert recommendations, the necessary simplifications have been revised to interview questions after studies such as extracting contradictory statements, removing and adding some questions. Then, interview questions were applied to five students with parallel features to the study group. According to the statements from the students, minor corrections were made to the interview questions and the final semi-structured interview protocol consisting of 18 open-end questions was developed.

Data Collection and Analysis

This study is a case study in which student opinions on the use of the argument-driven inquiry method in science courses are tried to be determined. Therefore, before the students were interviewed about the argument-driven inquiry method, an application was carried out on this method. The process for how this application is performed is details in an exemplary lesson plan given in ANNEX-1.

Interviews were conducted with 12 students who participated in the application after the practices based on the argument-driven inquiry method in question. However, the interview process varies from person to person, but lasted an average of 25 minutes with each student. The data obtained from these interviews were analyzed by content analysis method. Before going into analysis, all of the interview data collected from the students through the audio recording was transcribed and made into a written document. Then, student statements were examined and those suitable for the purpose of research were tried to be gathered under certain codes, categories and themes. In this context, approximately 20% of the data collected in order to ensure the confidence of the analysis results were analyzed by 3 independent researchers and the percentage of inter-encoder numbness was calculated as 83%. This suggests that the findings presented as a result of the analysis are highly reliable.

Findings

In this study, interviews were conducted in order to determine the opinions of secondary school students regarding the use of argument-driven inquiry method in science course. The data obtained from these interviews were analyzed by content analysis method.

Table 1 contains the percentage-frequency values of the students' answers to the question "What similarity or difference do you think there is when you compare the process of the Electrical Energy unit where the argument-driven inquiry method is applied in science class to the process of other units?"

Table 1
Student Opinions and Percentage Frequency Values

Theme	Categories	Codes	f	%	f	%
It was similar. Because.. (n=9)	Properties that relate to the process of the course	Learning new information	9	4.79	21	11.17
		Using an interactive board	5	2.66		
		Writing	5	2.66		
		Doing experiment	2	1.06		
It was different. Because...(n=12)	Features of the course	Using concept caricature/scenarios, etc.	10	5.32	84	44.68
		Using simulation	10	5.32		
		Having a group and class discussion	9	4.79		
		Doing group work	9	4.79		
		Doing research	9	4.79		
		Using a video/documentary	8	4.26		
		Using an event booklet	7	3.72		
		Determining/solving research questions	6	3.19		
		Experimenting/observing	5	2.66		
		Talking about science and scientists	4	2.13		
		Using more interactive boards	2	1.06		
		Hypothesis developmenting	2	1.06		
		Encouraging think more	1	0.53		
		Writing a journal	1	0.53		
		Evaluating own and peer's research reports	1	0.53		
	Regarding the characteristics of the process based on the argument-driven inquiry	Determinig a research question	9	4.79	31	16.49
		Experimenting/observing	6	3.19		
		Claim-counter-claim	5	2.66		
		Evidence/promoters	5	2.66		
		Collect-save-analyze data	2	1.06		
		Hypothesis	1	0.53		
		Justifications	1	0.53		
		Rebuttals	1	0.53		
		Bounding	1	0.53		
	Features of the learning process	Fun	8	4.26	28	14.89
		Meaningful and lasting learning	6	3.19		
		Getting/sharing ideas	5	2.66		
		Doing Experiment	4	2.13		
		A better / different method	2	1.06		
		Understand in a shorter time	2	1.06		
		Easy learning	1	0.53		
	Teacher' s role	Not directly giving information/encouraging thinking	5	2.66	13	6.91
		Listening to and caring about students' opinions	3	1.60		
		Encouraging students the the course	2	1.06		
		Giving effective and re-feedback	1	0.53		
		Having a strong communication skills	1	0.53		

Theme	Categories	Codes	f	%	f	%
		Drawing attention to places that have been wronged	1	0.53		
	Student' s role	Having a scientific discussion with a band friend	5	2.66	11	5.85
		Listening to a banding friend	4	2.13		
		Valuing a band friend's opinion	1	0.53		
		Learning information from a groupmate	1	0.53		
Total			188	100	188	100

As seen in Table 1, students have expressed an 11.17% frequent similarity and 88.83% frequent difference to the question "What similarity or difference do you think is when you compare the process of the Electrical Energy unit where the argument-driven inquiry method is applied in science class to the process of other units?" 11.17% of the students presented reasons for the similarity between the electrical unit where the argument-driven inquiry method was applied and the course's courses. In this regard, 4.79% often stated that there is a similarity in the direction of learning new information, 2.66% frequently using interactive boards and 2.66% frequently writing. They said that there is a difference between the process of other science courses and the process of electrical unit courses in terms of 44.68% frequent courses, 16.49% characteristics of the inquiry process based on argument, 14.89% frequent learning process characteristics, 6.91% frequent teacher roles and 5.85% frequent student roles. At the point of the characteristics of the course, 5.32% frequently used concept caricatures, scenarios, etc., 5.32% frequent simulations, 4.79% frequent research were expressed as reasons for difference. In the characteristics of the argument-driven inquiry process, 4.79% frequently stating research questions, 3.19% frequently conducting experiments and observations, 2.66% frequently presenting claims and 2.66% frequently presenting evidence and support as differences. In terms of features related to the learning process, they indicated that electrical unit courses are 4.26% frequently fun, 3.19% often provide meaningful and lasting learning, and 2.66% often differentiate from other science courses in terms of receiving/sharing ideas. Another difference is that in teacher roles, 2.66% often make the teacher not give direct information/think, and 1.60% often listen to and value the opinions of students; In student roles, 2.66% often said to have scientific discussions with their groupmates and 2.13% frequently listen to their bandmates as a reason for the difference between the electrical unit and other science courses. Below are some student statements explaining this situation.

> *"...Everyone was working individually. For instance, when our teacher had an assignment, we said we wanted to be a group, but our teacher would not let us. It*

was just a class. We were inactive. For instance, we were not experimenting.... I understand better by feeling things by touch. But we did not do that in normal science classes.... But in the electrical unit, we made very good applications on the smart board. We practiced... So, we had an argument. We have formed groups. The best part was that we formed bands. I love group events... Not a single person in the groups has decided on one issue. One person said, for example, do you think about it? And he said yes or no. If he said no, he said his opinion and a joint decision was taken and written as such... There were events, we were all doing them. In my group, they were treated equally, treated fairly... (DG-Ö02)"

"I think there are differences. Because we have been doing classes abstractly before. I mean, he was verbal. He was doing it more like that. But we have taught concrete lessons in the electrical unit... We have done experiments... We understood the issue better with the electrical circuits we established ours in the electrical unit. We have set up a lot of electrical circuits ourselves. Because in the booklets given to us, we interpreted the topics ourselves with our group friends. We have experienced it ourselves here... Our band members did research. To learn about electricity. But in other science classes, our teacher was verbally telling us... We were not doing events or experiments. He was telling us about it. Here, most of our friends did not interpret what we learned. However, when we look at the circuit established in the experiments, you can interpret... The brightness of this is different, you might say... But provided we had processed the electrical unit as it used to be, we might not have been able to interpret the brightness of the lamp. Experiments made it easier for us to do experiments. I used to have trouble with electricity. I did not really understand electricity in sixth grade. However, I think I understand better the electricity we are currently processing... I set up a serial connected circuit and a parallel connected circuit. Or rather, my other friends set up the parallel connected circuit. We compared the two circuits. We have had that experience with electricity. Moreover, we have established various circuit mechanisms, whether it is related to voltage, whether it is about current, whether it is about creating simple electrical circuits... In normal science class, i.e. in previous science classes, we weren't interacting like this with our other friends. We were in a normal friendship, in class. However, when the electrical unit was processed, it was like this. Our friends, who did not attend many classes before, attended the class. My friend A, for example, is not a girl who expresses many ideas, but a successful girl. But when we formed a band, especially in our booklet 5, my friend A had a very say in our group. He expressed his opinions... I thought we were just interacting. I really liked this environment.... In other units our teacher is trying to give us instructions on the subject, but this experiment is not about observation. It is mostly about comments or abstract subjects. For example, he is just teaching the class. He expects us to run tests and do a re-run. It is very rare that we experiment in class... In the electrical unit, we have done as many experiments as we can. We collected data... We were giving it to evidence... Our friends had different claims. We were discussing why these allegations are not true... Or sometimes in the electrical unit, our teacher was setting up experiment mechanisms that were not right, but here, for example, our teacher was showing us concretely why the circuit was not working and making us discuss it. Here we were learning the electrical circuit concretely. I think we can interpret something that is concrete better. Because in science class, as our teacher told us in other units, we did not understand much there... However, since we learned by collecting and proofing

data by seeing electrical circuits in the electrical unit, we understood more easily and our teacher was more understandable and we interact more with our teacher. What's more, in the electrical unit, our teacher didn't give us the right answers directly. But in previous units, our teacher was giving us the answer when we answered directly and asked questions... However, in the electrical unit, we were more in dialogue with our friends, ingring ourselves to the information so that we could obtain information with our own experience just like scientists... (DG-Ö05)"

In Table 2, students are stating, "What do you think about the concept caricature, scenario, etc. activities used in electrical energy unit courses that we process with the method of argument-driven inquiry? What good did they do you? For what purpose could it be used? Why?" are included in the percentage-frequency values of their answers.

Table 2
Student Opinions and Percentage Frequency Values

	Categories	Codes	f	%	f	%
n=12	Properties	Beautiful/good/fun/remarkable	10	14.08	27	65.85
		Easy and understandable	8	11.27		
		Informative about topics	7	9.86		
		Events taken from daily life	2	2.82		
	Benefits	Making the course fun and fun	11	15.49	28	39.44
		Determinig easly the research question	9	12.68		
		Providing a review of previous information	5	7.04		
		Being able to see different views	2	2.82		
		Getting a discussion on the topic in a booklet	1	1.41		
	Purpose	Determining the research question	9	12.68	16	22.54
		Determining a research subject	5	7.04		
		Determining hypothesis	2	2.82		
Total			71	100	71	100

As seen in Table 2, students say, "What do you think about the concept caricature, scenario, etc. activities used in electrical energy unit courses that we process through argument-driven inquiry? What good did they do you? For what purpose could it be used? Why?" was answered by 65.85% of the concept caricatures, scenarios, etc. in the course for their purposes, 39.44% frequently for their benefits and 22.54% for their purposes. Students have stated that 14.08% of the introducing activities such as concept caricature, script, etc. are beautiful, good, tasted and remarkable, and 11.27% often have features that are easy and understandable. As for the benefits of concept caricature, scenario, etc., students often cited 15.49% to make the course fun and enjoyable, 12.68% often to be able to easily determine the research question and 7.04% often to review their previous knowledge of electricity. Regarding the purposes of concept caricature, scenario, etc., students often expressed their opinions at the point where they provided 12.68% frequent research questions, 7.04% frequent research topics and 2.82% hypothesis. Below are some student statements explaining this situation.

> *"It starts with the first step research question in the booklets we use. To create our research question, I think we're given a concept caricature or a script. So I think we can understand the issue and figure out what to investigate... (DG-Ö08)"*
> *"... In our previous lessons, I was mixing up some information. In sixth grade, for example, I was mixing things up with keys and hear conductors. But now I learned better when we did experiments in the electrical unit.... These cartoons made me remember what I learned about electricity in the sixth grade... I thought, what do I know? Whatever we were going to learn in that class, the cartoons were giving us information about him. We were also asking our research question... We were guessing what to find out.... I know how to connect the amperemeter voltmeter. It's more on the mind. For example, the amperemeter was serially connected to the commission. For example, let's say we connected the amperemeter in parallel, then our circuit was not used to the light bulb did not give light. That's how it stayed more in mind... We learned that there are different theories and different results can be achieved. That's how scientists achieve different conclusions, which is what we've learned... The lessons were more fun so... For example, my friend H didn't like to read much, but when there were caricatures, it was fun for him, and I think he started attending classes because I agree with his opinion or something... So, I think the caricatures made the lesson fun I had fun... (DG-Ö23)"*

In Table 3, students are stating, "What steps have you followed in the Electrical Energy unit that you have processed through argument-driven inquiry? Why did you follow these steps? Can you give me examples? How did you process the lesson? What have you done?"

Table 3
Student Opinions and Percentage Frequency Values

	Codes	f	%
n=12	Reading the topic written in the introduction event such as script/concept caricature, etc.	12	15.79
	Making an argument	12	15.79
	Experimenting/setting up circuits	10	13.16
	Determining the research question	9	11.84
	Argument developmenting	8	10.53
	Make an opposing argument	6	7.89
	Drawing a circuit diagram of argument (providing evidence)	5	6.58
	Determining variables	3	3.95
	Determining security measures	3	3.95
	Analyzing data	3	3.95
	Collecting and saving data	2	2.63
	Peer review	2	2.63

Codes	f	%
Hypothesis developmenting	1	1.32
Total	76	100

As seen in Table 3, students say, "What steps did you follow in the Electrical Energy unit that you processed through argument-driven inquiry? Why did you follow these steps? Can you give me examples? How did you process the lesson? What have you done?" 15.79% frequently read the subject written in the introduction event such as script/concept caricature, etc., 15.79% frequently making arguments, 13.16% experimenting and installing electrical circuits, 11.84% frequently determining the research question, 10.53% frequently developing arguments. Below are some student statements explaining this situation.

"...We read the concept caricature event first... Then we put forward our research question. For example, our research question was: is the current the same everywhere in an innings? We found this question by arguing with our friends. It is one of those caricatures. And then in our hypothesis, we thought the current was the same everywhere. We experimented with the materials given by our teacher. Then we collected data from these experiments. We have published this data to that booklet... Then we connected the circuit, experimented, collected the data, and created evidence. We had an argument. That the current is the same everywhere.... After discussing this claim with other friends, the peer and we made our own assessment. This peer and my self-assessment has improved my ability to bring criticism to events... (DG-Ö33)."

"... we were choosing ideas from cartoons... Then we picked one. We were hypothesizing. Or we were creating another hypothesis ourselves. So, we had an estimate of the outcome of the incident there. Then we were setting up an electrical circuit with our band members. We were turning the data we collected from this circuit into evidence. But when collecting data, it was required to take notes. For example, let's say we measure the voltage in the circuit, we measure it at regular intervals, or we measure the voltage between different points. For example, we were attaching voltmeters between the two ends of the A bulb and we were attaching voltmeters to both ends of the B lamp... But there were rules to be careful when installing electrical circuits. For example, we were writing about them, such as not biting the battery, not touching the tongue... We were competing our theories... Each group made different claims as a result of its experiment and we were discussing them... Finally, there was a theory that was true. Then he would explain to the whole class the theory that he could light that light bulb and, in the right conclusion, defended his circuit to us and was accepted... (DG-Ö29)"

In Table 4, students are stating, "What do you think of the processing of the electrical energy unit through argument-driven inquiry? What benefits/benefits have they had for you?"

Table 4.
Student Opinions and Percentage Frequency Values

	Theme	Categories	Codes	f	%	f	%
n=12	Advantages for developing cognitive, affected and psychomotor traits	Advantages of the learning process	Making the course more fun/beautiful/efficient	11	6.47	52	30.59
			Participating actively in the course/being able to explain thoughts	10	5.88		
			Having an argument environment	9	5.29		
			Groupworking by and sharing tasks	7	4.12		
			Respecting different ideas	6	3.53		
			Seeing different ideas	6	3.53		
			Being able to do peer teaching and reach a common view with their peers	3	1.76		
		Advantages of learning	More meaningful and lasting learning	9	5.29	26	15.29
			Asserting different claims/ideas	8	4.71		
			Reducing/removing concept misconceptions	3	1.76		
			Ensuring that you learn/understand the subject effectively	2	1.18		
			Recalling knowledge	2	1.18		
			Consolidating learn information	1	0.59		
			Associating information with daily life	1	0.59		
	Advantages of developing some skills	Life skills	Working with group/team	9	5.29	47	27.65
			Getting to contact	8	4.71		
			Developing sensory characteristics (interest, attitude, motivation, etc.) related to science course	6	3.53		
			Deciding	6	3.53		
			Being able to express oneself effectively	5	2.94		
			Self-confidence skills	5	2.95		
			Self-efficacy skills	3	1.16		
			Being able to explain/present thoughts in front of the public	2	1.18		
			Analytical thinking	1	0.59		
			Self and peer evaluationing	1	0.59		
			Critical thinking	1	0.59		
		Scientific process skills	Experimenting or observing/setting up a circuit setup	9	5.29	40	23.53
			Determining research questions	8	4.71		
			Being able to make a claim	6	3.53		
			Determining variables	5	2.94		
			Collecting-saving-analyzing to data	4	2.35		
			Being ability to refute the counter-claim	4	2.35		
			Being able to report scientific study	3	1.16		
			Being able to put forward hypothesis	1	0.59		
		Skills related to science	Accessing to information	3	1.16	5	2.94
			Sharing and discussing thoughts on science (history of science, development of science, scientific knowledge, etc.)	1	0.59		
			Being able to produce scientific knowledge	1	0.59		
	Total			170	100	170	100

As seen in Table 4, students say, "What do you think about the processing of the electrical energy unit through argument-driven inquiry? What benefits/benefits did they have for you?" Students stated that they developed some cognitive, affected and psychomotor traits related to 30.59% frequent learning process and 15.29% frequent learning. In this context, students offered reasons such as 6.47% frequently, the course became more fun, tasteful, beautiful and efficient, and 5.88% were able to easily explain their active participation and thoughts. Regarding learning, students expressed opinions as 5.29% often provided more meaningful and lasting learning, and 4.71% often made different claims/ideas. In the theme of the advantages of processing the electrical energy unit with argument-driven inquiry method, 27.65% often expressed opinions about life skills, 23.53% often scientific process skills and 2.94% frequently developed science-related skills. In the life skills category, students often mentioned that they developed skills such as group/teamwork and 4.71% frequent communication. In the category of scientific process skills, students stated that there is a development in the scientific process skills category, such as 5.29% frequently experimenting and observing, in other words, being able to set up experiments, and 4.71% frequently determining the research question. At the point of science-related skills, students emphasized that 1.16% often developed skills such as access to information, 0.59% frequently being able to share and discuss their thoughts on science (history of science, development of science, scientific knowledge, etc.). Below are some student statements explaining this situation.

> *"...I wouldn't understand if our teacher told us about the electrical unit just by printing it. In the sixth grade, our teacher just printed and told us the information without much experimenting. I didn't understand much at the time. But with the booklets you give, you know, creating questions, not writing like him, but writing boringly. You know, the electric circuit, the lamp, writing like this. Here are the features of the electrical circuit or the descriptions of its elements that would not in any way enter my head. But there have been places I've coded. Amperemeter ampere, longer than volts. I thought it was diagonal, and the amperemeter is serially connected, and I've done coding like this in my own way, shorter than the series parallel. Then I understood the properties of the circuits. Why, because I experimented more with my band friends or on my own throughout the electrical unit. I've set up a circuit. If we didn't work like this and say this is the series parallel and draw it and write it down, I wouldn't understand anything... My theory, for example, has been debunked in many places. And I've been looking into my friends' theories. Why is this the case... I asked my friends why they thought so... In fact, my friends in the other group told me why their theories were true during recess or something. I discussed with myself why their theories were true, and I set up their circuit setups and tried what they did. I thought the theory of their thoughts was correct. For example, but our argument in the last lesson was also my theory correct... We worked with different groups in the electrical unit. There's a lot of*

different ideas when you work with the group. And we're getting it out of those ideas. We're telling you why we removed it. We're experimenting on this, we're observing, and we're reaching one as a result of all of them, and that's when the people who stayed with me helped me... It's fun for me to do the lesson like this. So, it was fun... We were investigating why a knowledge might be true... (DG-Ö05)"
"... There were different ideas coming out of each person, and we paid attention to which one was more reliable when each person had a different idea in mind. Here we understood how scientific knowledge was created and how this information was proven in the process of creating it... these affected my perspective on science more closely. I mean, I felt like I was closer to science because we were experimenting. We've provided science closer. We're getting closer to science. It made me love science... It didn't hurt me to do this to the class, it made me better. Because we made some mistakes in the electrical circuit when we were installing electrical circuits. Sometimes we couldn't light our light bulb, sometimes we could light the light bulb. That's why he taught us the truth. What's more, my interaction with my band friends has evolved throughout this class. Then he took the ideas of my band friends and let me see that there was more ideas about one... (DG-Ö18)."

In Table 5, students were told, "What was the most challenging thing for you in science class, where the argument-driven inquiry method was used in the electrical energy unit? Why?" are included in the percentage-frequency values of their answers.

Table 5
Student Opinions and Percentage Frequency Values

	Themes	Categories	Codes	f	%	f	%
n=12	Difficulties/insufficiencies regarding argumentation skills	Difficulties arising from personal characteristics	Inability to present their ideas in public	9	14.29	22	30.92
			Lack of self-confidence	5	7.94		
			Accepting an opinion of a friend who is thought to be more knowledgeable	4	6.35		
			Not having enough information on the subject	2	3.17		
			Not knowing manners to (sometimes being unnecessesary opposition or having a fixed mindset)	2	3.17		
		Difficulties arising from working with the group	Inability to put forward a joint claim with groupmates	5	7.94	9	14.29
			Inability to reach a common research question with groupmates	2	3.17		
			Inability to decide on a common circuit arrangement with groupmates	2	3.17		
	Difficulties/ insufficiencies in the	Difficulties with the research process	Raising more than one research question	6	9.52	18	28.57
			Not saving data	4	6.35		
			Inability to identify variables in research	3	4.76		
			Suggesting more than one hypothesis	2	3.17		
			Inability to set up the electrical circuit	2	3.17		
			Inability analyze data	1	1.59		

Themes	Categories	Codes	f	%	f	%
	Difficulties with the argument process	Inability to make a claim based on the data collected	5	7.94	9	14.29
		Inability to put forward opposing arguments	2	3.17		
		Inability to refute opposing arguments	1	1.59		
		Not supporting argument	1	1.59		
	Difficulties with the evaluation process	Inability to peer evaluate	1	1.59	3	4.76
		Inability to critically evaluate oneself	1	1.59		
		Not being able to correct his report according to criticism	1	1.59		
	Difficulties before research	Inability to u nderstand the topic in the introductory activity, such as a scenario, concept cartoon	1	1.59	2	3.17
		Inability to determine the research question	1	1.59		
Total			63	100	63	100

As seen in Table 5, students say, "What was the most challenging thing for you in science class, where the argument-driven inquiry method was used in the electrical energy unit? Why?" 45.21% frequently expressed an opinion that they experienced difficulty/inability to question based on their argument skills and 54.79% often based on the questioning process based on the argument. In the theme of difficulties/inadequacies related to their argument skills, students said that 30.92% often had difficulty working with the group because of their personal characteristics and 14.29% often because of their personal characteristics. In the category of difficulties/inadequacies due to personal characteristics, students often presented their opinions about themselves as reasons such as inability to present their opinions in public and 7.94% frequently due to lack of self-confidence. In the category of difficulties/inadequacies caused by working with the group, students often said 7.94% of the working electrical unit with their groupmates as a reason for not being unable to make a common claim and 3.17% often not being unable to create a common research question. In the theme of difficulties/inadequacies related to the questioning process based on argumentation, students said that 28.57% often experienced difficulties in the research process and 14.29% often in the argument process. In the category of difficulties related to the research process, students stated that they faced difficulties such as 9.52% frequently suggesting multiple research questions and 6.35% frequently recording data. In the category of difficulties related to the argument process, students 7.94% often said that there were difficulties such as not making a claim based on the data they collected and 3.17% often not making opposing arguments. Below are some student statements explaining this situation.

"...The thing that pushed me the most was answering some questions. We had some questions in our modules. Like the connection of the amperemeter. I made mistakes in some questions like that, and I developed them after a while. In other words, I had difficulty establishing a circuit layout and determining the research question on the circuit setup... there was no other stage where I had difficulty... (DG-Ö15)."
"... We were throwing out a theory as a group. But when some friends thought differently that theory changed. That's why we were having trouble finding a common theory with our band friends. Then we all sometimes put-up different research questions. Because sometimes we understood different things from the caricature or script which we were given... Then we were trying to show each other evidence. On that evidence, we were trying to make a claim. We were having a hard time there... D's in the band I'm in with my friend. That friend of mine wasn't saying his ideas... he didn't want to talk... He kept saying he couldn't do it... It forced me to be a band with him. It was lowering our motivation... Then, at first, some of our friends argued that their claims were true during the class discussion... Our group was proving that most of the time our claim was true, but he was still unconvinced... sometimes he was arguing in vain... it was hard to work with him... (DG-Ö11)."
"... What I had the most difficulty with was finding the problem with that cartoon. So are my friends... I had a hard time hypothesizing about that. You know how we're trying to say something about the answer to your question before we're experimenting yet, and that's where I had a hard time... (DG-Ö10)."

In Table 6, students are stating, "What are the situations that you consider the most successful in science class where the argument-driven inquiry method is used in the electrical energy unit? Why?" are included in the percentage-frequency values of their answers.

Table 6
Student Opinions and Percentage Frequency Values

	Categories	Codes	f	%	f	%
n=12	Work with a group	Being able to express opinions comfortably	9	9.78	40	43.48
		Fulfilling duties and responsibilities	8	8.70		
		Questioning and criticizing the arguments of their peers	7	7.61		
		Being able to appeal to the community	5	5.43		
		Being able to conduct research on the subject	5	5.43		
		Being able to make constructive and positive criticisms	4	4.35		
		Encouraging peers to work	2	2.17		
		Sharing duties and responsibilities	2	2.17		
	To be able to do research	Determining the research question	10	16.13	36	39.13
		Being able to predict the subject of research	7	7.61		
		Being able to determine the materials to be used in the electrical circuit	7	7.61		
		Being able to set up and operation to electrical circuit	6	6.52		
		Data collecting and saving	4	4.35		
		Converting data to evidence	2	2.17		

Categories	Codes	f	%	f	%
To be able to make an argument	Asserting a data-driven argument	5	5.43	9	9.78
	Being able to refute your friends' argument	3	3.26		
	Being able to defend your argument	1	1.09		
Ability to evaluate the research report	Being able to recognize the deficiencies and errors in the research report he has written	3	3.26	7	7.61
	Being open to criticism from peers	3	3.26		
	Being ability to evaluate their peers' reports	1	1.09		
Total		92	100	92	100

As seen in Table 6, students say, "What are the situations that you consider the most successful in science class where the argument-driven inquiry method is used in the electrical energy unit? Why?" students said that they saw themselves as successful in working with the group 43.48% frequently, conducting research with 39.13% frequently, making arguments 9.78% frequently, and evaluating research reports 7.61% frequently. In the category of working with the group, students see themselves as successful in 9.78% frequently expressing their opinions comfortably and fulfilling their duties and responsibilities 8.70%. In the category of research, students evaluate themselves as successful in terms of features such as 16.13% frequently identifying the research question and 7.61% frequently predicting the research subject. In the category of being able to make an argument, students can make an argument based on data with 5.43%, 3.26% often refute their friends' argument; In the category of being able to evaluate the research report, 3.26% often write in the research report to notice the deficiencies and errors, 3.26% often consider themselves successful in cases such as being open to criticism from their peers. Below are some student statements explaining this situation.

"...I consider myself most successful in the process of collecting data and creating evidence. When I'm most difficult, don't turn my evidence to the other side, so don't express myself. In fact, it's not hard either, but it was hard in booklet 5. In general, the creation of research questions was very simple. It was very simple in data collection and electrical setup. It was very simple in creating evidence. My favorite of these stages is evidence creation. Data collection. Because when I'm on the board, based on that data and my evidence, I can explain things to my friends in the other group. If I hadn't done this, my friends wouldn't have trusted me, they wouldn't have believed my claims. Or they couldn't admit it was true. That's more of a plus for me when it comes to increasing credibility. That's why I like and like it better. So, I like to observe the data there by setting up a circuit and argue about it with my friends and make our claim to create my evidence... (DG-Ö02)"
"... I think I've succeeded at all stages. But I think the most successful stage is interpretation. Because, for example, I like to talk more than I like to write. That's why it's more interesting to me to say an image or a post I saw there after I've filtered it in my head. So, I'm more interested in discussing my thoughts with my friends or why their opinion is right or wrong. I think I'm successful here... What I

saw as the most successful point in this class discussion process was telling the other side of my thoughts and persuading them to do so. Because I can clearly express my own thoughts... (DG-Ö07)"
"... I think the work is very good, we see that we can produce something together. We learned to make a common decision and, for example, to make a common decision, not the opinion of a single person, and to present that decision to the class and discuss it. He was filling out the booklets he distributed to our teacher together. At the end of the week, we were evaluating our own booklets and our friends' booklets. I consider myself successful in this regard... (DG-Ö17)"

In Table 7, students are told, "What do you think about working in groups with your friends in science class where the argument-driven inquiry method is used in the electrical energy unit? What did working as a group contribute to you? Why?" are included in the percentage-frequency values of their answers.

Table 7
Student Opinions and Percentage Frequency Values

	Categories	Codes	f	%	f	%
n=12	Student change-development	Being able to look at things critically	9	13.04	33	47.83
		Making learn easier	5	7.25		
		Being able to collaborate with groupmates on a topic	5	7.25		
		Respecting different ideas	3	4.35		
		Ability to establish effective communication/dialogues	3	4.35		
		Being able to participate in scientific discussion	3	4.35		
		Testing your own knowledge and the knowledge of the peer	2	2.90		
		Taking responsibility	1	1.45		
		Be a good listener	1	1.45		
		Being open to change and improvement	1	1.45		
	Benefits to the learning process	Providing learning	8	11.59	30	43.48
		Learning-loving working with a group	8	11.59		
		Exchanging ideas with friends	5	7.25		
		Learning information from a groupmate	4	5.80		
		Coming to reach a common decision	2	2.90		
		Seeing that you have different thoughts	2	2.90		
		Getting the most accurate and valid information together	1	1.45		
	Negative effects on the learning process	The lack of contribution of the peer to the group	6	8.70	9	13.04
		Peer's lack of knowledge	2	2.90		
		Not wanting to share your peer's thoughts	1	1.45		
Total			69	100	69	100

As seen in Table 7, students say, "What do you think about working in groups with your friends in science class where the argument-driven inquiry method is used in the electrical energy unit?

What did working as a group contribute to you? Why?" students said that working with the group often creates some changes and developments in them, 43.48% often has benefits for learning and 13.04% often has negative effects on the learning process. In the category of change and development, students have stated that working with the group in the category of change and development makes it 13.04% often to look critically at events, 7.25% to learn frequently, and 7.25% often to collaborate with groupmates on a subject. In the category of benefits of working with the group to the learning process, students said they had benefits in situations such as 11.59% frequently providing learning, 11.59% frequently learning and loving working with the group. In the category of negative effects on the learning process, students stated that 8.70% often have negative effects of working with the group on issues such as the lack of contribution of their peers to the group and 2.90% frequently the lack of knowledge of their peers. Below are some student statements explaining this situation.

> *"...Now some of the circuits I set up didn't burn. That's why we didn't collect much data. When our other friends went up to the board to tell us their theories, we found that sometimes they couldn't collect the data. Here's what we can do. I just thought about it. We can all sort the data one by one. We changed the wire, and in 2011, we could have said that our problems were our mistakes. It'd be more scientific. I think we could have made more scientific statements.... It happened while defending my own opinion during the debunking of my theory. Because I used all my defensive things and there was nothing left. There they disproved my theory, and I had a hard time... this usually happened at all events. But at the third event, I defended the thoughts of us two children. You know those kids talking, cartoons? We defended two of them in the first place. I defended one of my band friends and the other boy. Then we thought that both might be true, and we set up a circuit for these two views... We didn't know at the beginning which one would be true when I interpreted the data we collected in the circuit and I saw that his claim was true... I wanted to defend theirs there too... and mine... When we got to the board, my friend said that our group was thinking about it first, but then we found this... I liked that he explained my initial thoughts as well... Because it was group work... Other groups, for example, disproved that theory. Again, yes, my theory proved correct, but I was sad that a theory with our band friends had been disproved... but I thought it was fun working with the band... we could learn a lot of things at the same time..."(DG-Ö31)."*
>
> *"...My group friends didn't usually agree with the research question. There were only two groups I was in. My friend A, B and the group I'm in. My friend C, D, E and the group I am. My friend A didn't agree at all. My friend B was trying to join again.... Because most of my band friends didn' ...(DG-19)."*

In Table 8, students were stating, "Did you not like or see anything missing from the method of learning based on arguments when the Electrical Energy unit was processed? What were those? Why?" are included in the percentage-frequency values of their answers.

Table 8

Student Opinions and Percentage Frequency Values

Categories		Codes	f	%	f	%
n=5	Yes	More documentaries and science stories on the subject should be included	3	25.00	5	41.67
		More simulations should be included	1	8.33		
		More scientific discussions must be held	1	8.33		
n=7	No		7	58.33	7	58.33
Total			12	100	12	100

As seen in Table 8, students to the question "Did you not like or lack the method of learning based on arguments when the Electrical Energy unit was processed? What were those? Why?" 58.33% frequently answered no and 41.67% often answered yes. Students have often said that more documentaries and science stories on the subject should be included and 8.33% should often be included in more simulations about what they do not like or see missing in the method of learning based on arguments when the Electrical Energy unit is processed. Below are some student statements explaining this situation.

> *"...I don't think there's anything to fix... (DG-Ö01)"*
> *"... I liked them all, so I liked it because we were doing group work, experiments and stuff... (DG-Ö17)"*
> *"... I think more documentaries or animations can be featured... (DG-Ö31)"*
> *"... You know those Tesla videos that we watched in class, I think there could be more room for things like that... I thought it was a lot of fun... (DG-Ö17)"*

In Table 9, students were told, "Would you like the argument-driven inquiry method to be used in other units of science? Why?" are included in the percentage-frequency values of their answers to the question and some student statements.

Table 9

Student Opinions and Percentage Frequency Values

Categories		Codes	f	%	f	%
Yes. There must be room. n=10	Regarding the functioning	Fun and fun	10	15.87	34	53.97
		Tutorial and tutorial	10	15.87		
		Self-learning	9	14.29		
		Learning with a group	5	7.94		
	Regarding its benefits	Making learn easier	8	12.70	24	38.10
		Providing the opportunity to conduct research (experiments)	6	9.52		
		Permanent and meaningful learning	6	9.52		

Categories	Codes	f	%	f	%
	Expressing and defending our own ideas	2	3.17		
	Learning the opinions of your friends	2	3.17		
No, there should not be n=2	Writing is boring	2	3.17	5	7.94
	I don't like to talk	2	3.17		
	I don't like your opinions being questioned.	1	1.59		
Total		63	100	63	100

As seen in Table 9, students said, "Would you like the argument-driven inquiry method to be used in other units of science? Why?" 92.06% frequently answered yes and 7.94% often answered no. In other science courses, students expressed opinions on the functioning of the argument-driven inquiry method with 53.97% and the benefits of 38.10%. In the category related to the functioning of this method, students expressed positive opinions such as 15.87% frequently fun and tasted courses and 15.87% frequently educational and instructive. In the category regarding the benefits of the argument-driven inquiry method, students made it 12.70% often easier to learn and 9.52% often provided the opportunity to conduct research (experiments). In other science courses, students who expressed a negative opinion about the use of argument-driven inquiry method stated that writing is boring with 3.17% and 3.17% often do not like to speak. Below are some student statements explaining this situation.

> *"...I'm because I'm more interested in science. For experimenting, doing group work in class. Our conversations in group work increased more information for me. I feel confident. Because I wasn't participating in group work more, but I did after that because I came up with my opinion because we presented everyone's opinion. It was nice to be able to say my opinions, even though it was wrong. What is more, I don't have much trouble setting up experimental setups. I did what I did with how the amperemeter was connected to the commission, how the voltmeter was connected to the commission. Then I found out what happened when we removed or added a light bulb in the serial connected circuit and then removed a light bulb in the parallel connected circuit. I've never been scared, but I've been excited. Because I was excited to respond to some of our friends when they went up to the board and said, "This is not the case... (DG-Ö11)"*
>
> *"...I don't like writing, so I don't like a lot of them. If it was all about the conversation or if I was asked questions about the events, I would love it... Let's not write it down. Ask me these questions by talking. It's more fun to do things, experiment, set up circuits ourselves and collect data by arguing with our friends in this way rather than just writing or doing boring things, as we do in normal science class. That's how it should be done in other science classes. Our friends who didn't attend the class started to attend the class. Normally my friend A attends class, she's a successful girl. But he's shy and he doesn't make much noise. But he tried to defend the idea of the room. Other than that, my friend B is a very successful girl. But he's so shy. Again, he offered his opinion. So it's better for each of us to attend class. Because together we can argue more with more ideas and get better results. But my friend F still doesn't like these events because he doesn't like to talk, he doesn't want to do it... (DG-Ö10)"*

Discussion and Conclusion

In this study, semi-structured interviews were conducted in order to determine the opinions of their students regarding the method of questioning learning based on argument. The data obtained from these interviews were analyzed by content analysis. As a result of the analysis, students emphasized that there is a similarity in terms of learning new information, using interactive boards and writing when they compare the process of the Electrical Energy unit where the argument-driven inquiry learning method is applied in the Science course and the process of other units. However, they said that there is a difference between the Electrical Energy unit and other units in terms of the course's process (concept caricature, scenario, simulation, group and class discussion, etc.), the characteristics of the inquiry learning process based on argument (research question determination, experiment-observation, evidence and supporting, etc.), the characteristics of the learning process (fun, meaningful and permanent learning, etc.), teacher roles (referral to thinking, etc.), and student roles (scientific discussion with friends, etc.). Based on these views of the students, it can be said that the method of learning argument-driven inquiry is a student-centered learning method. This brought to the agenda the requirements of teachers to design-execute-terminate the research method of a science problem and to develop arguments in this process and to new teaching methods that allow them to discuss and criticize it with their peers (Kaçar & Balım, 2018; Sampson, Grooms & Walker, 2009a; 2009b). It can be said that the inquiry method based on argument is an effective method that can meet this requirement. The method of learning inquiry based on argumentation is a method in which students identify their own research question, design-conduct-end the most appropriate method to solve this question and conduct all stages of this process by discussing them with their peers (Kaçar & Balım, 2018; Sampson and Gleim, 2009). In this context, it can be said that the findings obtained from these studies show parallels with the literature. In this case, it can be stated that students are aware of the similarity or difference between the nature of the questioning learning method based on argument and the process of other science courses.

As a result of this research, students responded to the concept caricature, scenario, etc. activities used in electrical energy unit courses processed by argument-driven inquiry learning method for their benefits and purposes. Students have stated that introducing activities such as concept caricature, script, etc. are beautiful, good, tasteful and remarkable, easy and understandable, and informative about the subject. It can be said that this result is in compliance with the literature (Evrekli, 2010; 2016; Evrekli & Balım, 2015; Evrekli, Inel & Balım, 2009; Inel, 2012; Forester, 2018). In the studies of İnel, Balım & Evrekli (2009), they have concluded that students offer opinions about concept caricatures that are fun, fun and increase their interest in the course. As for the benefits of concept caricature, script, etc., students cited making the course fun and fun, being able to easily determine the research question and reviewing their previous knowledge of electricity. In the literature, Başarmak and Mahiroğlu (2015) found that thanks to cartoon animations, students are able to think more comprehensively, interpret the message they want to be given and connect to the subject. Moreover, in this research, students expressed their opinions on the purposes of concept caricature, scenario, etc. at the point where they were able to determine the research question, research topic and hypothesis. As a result of a study conducted by Bilir in 2015, students related to science courses processed with research and questioning approach said that they learned the course better by trying, their hand skills improved, the knowledge obtained in the course was more permanent, they were more active in the course and learned by having fun. In 2012, in the findings obtained as a result of a study conducted by İnel, he emphasized that the students processed the course with caricatures and stories the most, experimented in lessons, answered questions, identified and solved problems, conducted research, worked collaboratively. Evrekli and Balım (2015) studies have stated that students develop their questioning learning as a result of concept caricatures. In the light of all these results, the concept caricatures and scenarios preferred as input activities in the questioning learning method based on argument can be interpreted as effective in attracting students' attention to the subject, informing them about the subject and directing them to research.

As a result of the research carried out, students expressed the opinion that the processing of the electrical energy unit by argument-driven inquiry learning method improved cognitive, sensory and psychomotor characteristics and some skills. In this context, students have given reasons for the advantages of the learning process, where the course becomes more fun, tasteful, beautiful and efficient, they can easily explain their active participation and thoughts in the course, the argument environment is formed, they can work as a group and share tasks within the group. Regarding learning, students have expressed opinions such as providing more meaningful and lasting learning, making different claims/ideas, decreasing or eliminating concept misconceptions. When the literature is examined, it can be said that the studies carried out on the method of learning based on argument and research inquiry are in parallel with the findings obtained from this study (Alouf & Bentley, 2003; Arslan, Ogan Bekiroglu, Süzük & Gürel, 2014; Berg, Bergendahl, Lundberg & Tibell, 2003; Bliss & other, 2007; Booth, 2001; Bozkurt, Ay & Fansa, 2013; Duran, 2015; Gibson and Chase, 2002; Jakupcak, Rushton, Jakupcak & Lundt, 1996; Kilic, 2007; Red Crescent, 2013; Longo, 2011; Piper and Hough, 1979; Rakow, 1986; Von Secker, 2002; Yasar & Duban, 2009). Ozdem (2009) and Jiménez-Aleixandre (2007) emphasized that collaboration and interactive contexts were directed to discuss students. Şen, Yilmaz and Erdogan (2016) of the laboratories based on questioning; motivation, active participation in courses, positive opinions for laboratories, self-reassion, learning desire, student-student interaction and teacher-student interaction. In the studies conducted by Duran (2015) and Longo (2011), students have obtained the result that the activities developed based on questioning are fun, that the lessons are more fun, that they like to conduct experiments and activities, and that their interest in the course increases. As a result of Köksal (2008) and Wu and Hsieh (2006) research, they stated that the guided questioning research method was particularly effective in students' development of positive attitudes towards science and technology course, especially in academic, self-suffredness, anxiety, interest, career, pleasure and usefulness. Moreover, studies have been found in the relevant literature that emphasize the result that the method of learning based on argument and research-inquiry is effective in the meaningful and permanent learning of students (Alkan-Dilbaz, 2013; Bozkurt, Ay & Fansa, 2013; Hardworking, 2008; Kilic, 2007; Sağlamer-Yazgan, 2013; Tashkoyan, 2008; Tatar, 2006). In this context, it can be said that the findings obtained from this research are in parallel with the literature.

In this study, students expressed opinions about the advantages that processing an electrical energy unit using an argument-driven inquiry method improves some skills in them, while life skills, scientific process skills, and science-related skills develop. In the life skills category, students mentioned that they have developed skills such as Group/teamwork, communication, affective characteristics related to the science course, and decision making. In the study of the relevant literature, studies have been found that argumentation-based learning and research query-based learning methods improve the affective characteristics of students (Bliss & et al., 2007; Blumenfeld & et al., 1991; Can, 2012; Calıskan, 2008; Eilam, 2002; Genctürk & Türkmen, 2007; Lord & Orkwiszewski, 2006; Polman, 2000; Sen, Yilmaz & Erdogan, 2016; Taskoyan, 2008; Tatar, 2012; Tuan, Chin, Tsai & Cheng, 2005). Sen, Yilmaz and Erdogan

(2016) stated in their study that query-based laboratory activities enable the development of positive attitudes towards biology course. Hofstein, Navon, Kipnis and Mamlok-Naaman (2005) and Friel, Marawi and Albaugh (2005) as a result of research studies and inquiry-based laboratories responsibilities of the students by learning more in the course of participation, the learning process is more effective, the students develop their ability to ask better questions and to ask questions on the subject are more motivated, self-confidence and an improved ability to reported that there is an increase in the scientific process. As a result of the Bilir (2015) study, the research stated that students learned by having fun and effectively in the sense of learning, learned based on experimentation and observation, learned that their knowledge is permanent and participated effectively in the lesson; motivation in the affective sense and positive attitude towards the lesson, learned by doing group work in the sense of social impact. At the same time, as a result of this study, it can be said that the method of learning arguments-driven inquirys parallels the views expressed by students about the development of skills such as communication and decision-making in themselves with literature. In this context, studies have been found that research-inquiry-based learning improves problem-solving skills, in-depth thinking, conceptual understanding and creativity in students (Bilir & Özkan, 2018; Bliss & et al., 2007; Duban, 2008; Yasar & Duban, 2009; Wu & Hsieh, 2006; Wallace & Kang, 2004). As a result of the study of Bilir ve Özkan (2018), students ' feelings of help and sharing in terms of social impact increased, their self-confidence improved, their responsibility consciousness and communication skills improved, they learned with their peers, they were interested in the environment and lesson in affective sense. Norma (2001) concluded that research-inquiry-based activities help students shape ways to find answers to their questions through work and communication with their peers. In this context, it can be said that the results obtained from this research are parallel to the literature.

In the category of scientific process skills, students have stated that there is a development in skills such as being able to conduct experiments and observations, to determine the research question, to make claims, to determine variables. When the relevant literature is examined, the research of the inquiry-based learning method (Arslan, 2013; Aydogdu & Ergin, 2008; Demircioglu, 2011; Güney, 2015; Kocagül, 2013; Koray, Köksal, Ozdemir & Presley, 2007; Myers & Dyer, 2005; Roth & Roychoudhury, 1992; Ulu, 2011) and the method of learning based on argument (Demircioglu, 2011) have been found to improve the scientific process skills of students. In his study, Demircioglu (2011) found that the method of questioning based on arguments improved the scientific process skills of his students and that there was a significant difference in the favor of the experimental group in terms of scientific process skills. In the study by Ulu (2011), he found that the use of research inquiry-based writing activity improved the scientific process skills of secondary school students. As a result of the Güney (2015) study, research has stated that the inquiry learning method has an effect on the ability to hypothesize, variable determination, conclusion, and predict. However, Erdogan (2005) stated in his study that research-inquiry-based learning is not effective in improving students' scientific process skills. Roychoudhury and Roth (1992) emphasized that interrogation-type laboratory applications develop higher scientific process skills with non-traditional laboratory experiments in which students are given the freedom to experiment. In the study by Bilir (2015), students' observations about social and sensory processes prior to implementation in the process; after the application, it stated that it included observations about social, sensory and cognitive processes. In his study, Orcutt (1997) revealed that questioning-based science learning improved the basic process skills of its students. Beishuizen, Wilhelm and Schimmel (2004) found that computer and internet-aided interrogation-based learning activities improve students' scientific process skills such as hypothesis, controlling variables, planning experiments, and interpreting results. In the laboratory and learning process category based on questioning in the studies of Şen, Yilmaz and Erdogan (2016), the teacher candidates; they explained their general views on the laboratory environment based on questioning and emphasized that they have expressed views on problem determination, experiment design and learning together. At the same time, studies have been found that research inquiry-based learning method improves students' critical thinking skills (Evren, 2012; Tatar, 2006). In the Universe (2012) study, it was found that there is a relationship between students' questioning learning skills, critical thinking tendencies and attitudes. Moreover, in this study, students emphasized that their ability to access knowledge, share and discuss their thoughts about science (history of science, the development of science, the ability to produce scientific knowledge, etc.) and produce scientific knowledge has improved at the point of science-related skills. In the study by Yasar and Duban (2009), it was determined that the laboratory courses based on questioning were more fun and that the positive opinions of the students towards science and scientists were formed. In this context, it can be said that this method is an effective method for improving the scientific process skills of students based on data obtained from student opinions on the method of questioning learning based on argument.

In other science courses, students who expressed a negative opinion about the method of questioning based on arguments stated that writing is boring, not like to talk and not to like the questioning of their ideas. When the relevant literature was examined, Bilir (2015) emphasized that as a result of his observations, students expressed negative opinions about the method of research inquiry due to not loving the course, boredness and not finding it fun, reluctance to teach, finding himself inadequate and passive. In his study, Hofstein and Lunetta (1982) reported that students enjoyed laboratory work and that these laboratory experiences resulted in positive and improved attitudes and interest in science. Marlow and Ellen (1999), Keefer (2002) and Freedman (1997) stated that students' interest and success in the course increased in research-inquiry science courses. In the study by Kizilaslan (2013), teacher candidates expressed positive opinions about laboratory activities based on questioning and reached the conclusion that subsequent laboratory activities were conducted based on questioning. In this context, it can be said that the opinions of the students on the processing of science courses by argument-based interrogation method coincide with the literature.

Suggestions

Given that the argument-driven inquiry learning method tested in the study has many positive effects on students, it can be said that it will be useful to prepare and implement activities related to this method for other units in Science Education. At this point, it is also thought that it is necessary to focus on issues in which students experience more problems. In the study, students who reported negative opinions often expressed dissatisfaction with situations such as writing and questioning their opinions. In this context, it can be stated that the transmission of argument-driven inquiry method is supported by digital (online-offline) and face-to-face learning environments will solve this problem.

Statements of ethics and conflict of interest

"I, as the Corresponding Author, declare and undertake that in the study titled as "*Secondary School Students' Views About the Use of Argument-Driven Inquiry in the Science Courses*", scientific, ethical and citation rules were followed; Turkish Online Journal of Qualitative Inquiry Journal Editorial Board has no responsibility for all ethical violations to be encountered, that all responsibility belongs to the author/s and that this study has not been sent to any other academic publication platform for evaluation."

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ANNEX 1. EXAMPLE FROM COURSE PLANS

CHAPTER 1

Name Course	SCIENCES
Class	7st
Unit Name	PHYSICAL EVENTS/ELECTRİCAL ENERGY
Subject	SERIES and PARALLEL CONNECTED LAMPS
Recommended Learning Time	4*40’

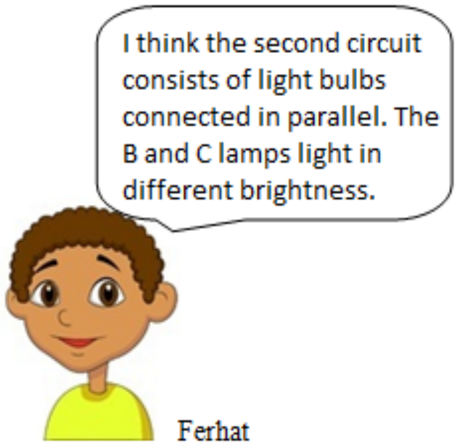
CHAPTER 2

Purpose	In this event, it is aimed for students to learn the difference between the serial and bonding patterns of the bulbs and the brightness of the serial and parallel connected lamps.
Relevant Science Acquisitions	7.6.1.1. Discovers what serial and parallel bonding is like, draws a circuit diagram consisting of series and parallel connected bulbs. 7.6.1.2. Observes brightness differences on the circuit and interprets the result in cases where bulbs are connected serially and parallelly.
Prior Knowledge	
Materials and Preparation	-Large number of batteries at different volts (1.5V; 3V, etc.) -Large number of bulbs at different volts (1.5V; 2 V; 3V, etc.) -Connecting cables -Hears -Battery bearings -Keys
Bilimin doğası ve bilimsel araştırma teması	What is experiment?
Crosscutting concept	

CHAPTER 3:Teaching-Learning Activities

IMPLEMENTATION of the ACTIVITY: ARGUMENTATION-BASED TEACHING METHOD
Step 1: Introducing the task Teacher hands out “Worksheet-3: I am connecting the bulbs in different ways!!!” activity to students. Then, the teacher first asked the students to read the scenario of the three different electrical circuits that Arzu teacher brought to the class and then examine the electrical circuits that Arzu brought with the teacher. The teacher asks the students to determine the research question about what they are asked to investigate in this event based on the circuits brought by Arzu teacher and what the students named Hilal, Yavuz, Ferhat, Simge and Alp in the concept caricature of these circuits say. In this process, students individually determine the research questions and write them in the **"1st Research Question"** section of the worksheet. Then, as a result of this research, they predict the results and reasons they foresead to reach. Some of the results that students aim to achieve as a result of the

research question are included in the speech bubbles of concept caricatures consisting of students named Hilal, Yavuz, Ferhat, Simge and Alp. In the speech bubbles in this concept.
For example;
"My Research Question: What is the circuit consisting of light bulbs connected in series and parallel? What can be said about the brightness of the light bulbs connected in series and in parallel?
I guess:



Because:
The current passing through the B and C lamps is different from each other.
B and C lamps have different resistances."
This is how students fill out the relevant sections in worksheet 3.
For this stage, students are given 20 minutes.

Step 2: Designing the method and the data to be collected

The important thing at this stage is that small groups of 3-4 students decide with their friends how to follow a way/method in order to find answers to research questions, develop their methods and apply them.
For this reason, the teacher visited the groups of students and told the students,*"What is a circuit consisting of serial and parallel connected bulbs? What can be said about the brightness of the series and parallel connected bulbs?"* "What method/path should you follow?" It asks, "What can we do, we can find answers to our research question?" Students who have no thoughts about what to do can be guided by the teacher on what kind of process they should follow using different tools related to the issue of electricity on the table.
At this point, the teacher asked the students, "Which of the circuits that Arzu teacher brings, which series can be an example of parallel connected bulbs?" "What do you think parallel means?" It encourages us to think about what kind of research method they should use by asking questions such as "Can you give an example of parallel connected things in our daily lives?"
At this stage, after deciding how to follow the process to answer research questions, students are asked to write the materials they will use in the research sections in the section "2nd Let's Design Our Application!" in the second part of the worksheet, "Materials to Use", "Security Procedure you will follow in our study", "How did I follow my research question?" and "Why did I follow this method?"
At this stage, small groups of students are expected to set up a circuit consisting of serial and parallel connected bulbs and set up an experimental system to compare their brightness and use amperemeters in it. In the application process, students are directed to take notes and do experimental work. The important thing at this stage is to allow students to discover that the direction of the current is from the plus pole to the minus pole of the battery and that the amperemeter must be serially connected to the battery to measure the severity of the current. Therefore, students are asked to note and observe how they install a circuit consisting of serial and parallel connected bulbs and the data on the change in brightness of the serial and parallel connected bulbs when they open the switch. At this point, the teacher guides students to take notes and do experimental work.

Students can often direct various questions to the teacher during the application because they encounter a method, they are not familiar with. The teacher should refrain from answering these questions directly and ask, "Why do you think that?", "Shouldn't we measure the severity of the current in this study?" It should give the student thought-provoking clues, such as "How do you think we can measure the current on the circuit?" Where groups produce improper solutions, the teacher should encourage students to consider different aspects of the research with guiding questions.
For this stage, students are given 35 minutes.

Step 3: Analysis of data and development of temporary arguments

This stage allows students to say, *"What is the circuit consisting of serial and parallel connected bulbs? What can be said about the brightness of the series and parallel connected bulbs?"* the temporary arguments that they think are the answer to the research question are the stage in which they produce. At this stage, first of all, each group of students will be 2nd. They analyze the data they collect as a result of the experimental research process they conduct at the stage. As a result of their analysis, each group presents their temporary arguments. In this, they can also benefit from students named Hilal, Yavuz, Ferhat, Simge and Alp or make a new claim themselves. Each group determines their evidence and evidence-based justification for supporting their claim. At this stage, students can also produce evidence and justification based on the data they collect. At this point, the teacher drawes from the table in figure 1 to the board as much as the number of small groups in the class and the number of different arguments.

Research Problem	
Your Claim	
Your Proof	Your Justification

Figure 1. Student temporary arguments

Here, the claim is the answer to the research question. The evidence is based on the collected data and is formed as a result of analyzing the collected data and interpreting it through the brain filter. The justification is the statement explaining why students chose this evidence. Thus, students relate evidence to justification by making assumptions and comments that guide the analysis and interpretation of the data they collect. At this point, the teacher walks between the rows and fills the table in figure 1 with student expressions, based on what the students write in their research reports. The number of small groups in the class and the number of different arguments is generated from the table in figure 1. Thanks to this table, different claims, evidence and reasons regarding the direction and severity of electric current are written on the board and shared with other groups.
If there are groups of students who are struggling to make a claim regarding data collection and data, the teacher should make students think about why they are doing this work and why they are following such a method/path. For this, students are asked "what are you trying to understand in your research?", "Why is it important that you collect this data in your study?" "What do we know about the concept of serial and parallel depending?" Encourage students with questions such as "In what way are serial connected bulbs included?" and direct them to collect data.
At this stage, students were asked if the worksheet was "3. What data did I collect in my study? What have I done to make sure the data I collect is reliable? What have I done to reduce the error in the data collection process?", "How did I analyze the data I collected? Why did I decide to analyze it this way?" and "As a hero with super abilities, I am going to walk around the conductor cable. According to the data I have, I will draw on why the lamps give light of the same or different brightness in the electrical circuit I have agreed with." and "My 6th Claim and Proof", "7. My reasoning" sections.
For this stage, students are given 20 minutes.

Step 4 and 5: Argumentation process and Direct reflective discussion process
At this stage, each group presents its own claims, evidence and justifications to other groups. They also evaluate the alternative arguments produced by other groups regarding the electrical circuit consisting of serial and parallel connected bulbs and the brightness of the bulbs. Students participate in the class scientific discussion in order to refute the evidence and justifications and other alternative claims, evidence and justifications that defend their claims in order to reach the most general and valid opinion on the brightness of the B and C and D and E bulbs in the circuit consisting of serial and parallel connected bulbs. This is the stage where class discussion is held. At this stage, students explain the implementation process they have designed and their own data collection processes. They will tell you why your friends' claims are invalid. For this, the teacher should encourage students to be able to speak their own mind and ask the students, "How did you analyze their data?" "Could it be that the data you collected does not support your claim?" "And what do you think of what your friend said?" He should direct them to the scientific debate process by asking questions such as "Why do you think so?" In this way, students learn to critical the opinions of others. After the entire class discussion is over, the teacher makes statements that he considers necessary. For this stage, students are given 40 minutes. In this section, the students are also asked, "What kind of work have you done by you?" "What do you think experimental work is?" is asked, emphasizing that there is intervention in experimental work and variables should be mentioned in order for a study to become an experimental study. For this, students are given 30 minutes.
Step 6: Writing the research report
This stage can be carried out together with the first four stages or independently of them. Students can be given time after a class discussion. However, in this study, 5. Take the stage to the top 4. We tried to complete it simultaneously with the stage. At this stage, if there is a similarity or difference between the general claim reached after the class discussion from the students and the initial claims of the students, they should think about it as "8. Changing Ideas" sections. For this part, students are given 10 minutes. That way, I am going to go to the 4th. It will be the end of class.

CHAPTER 4: ASSESSMENT AND EVALUATION

Homework
7th and 8th. Stages are given to students as homework.
Step 7: Double-sided blind peer rating
At the beginning of the first lesson of the ongoing week, the research proposal and report are distributed to the students in the peer (referee) evaluation guide and the worksheet belonging to another group. For example: The study report belonging to a student named Ayşe in group A is given to the student named Mehmet in group B for evaluating. The persons evaluating and evaluating this process are carried out blindly on both sides without being known. The worksheets given for evaluation in the first lesson of next week are collected from the students and delivered to the relevant work leaf owner. This process is managed by the teacher.
Step 8: Correction of the report by return
Students make the necessary corrections to their worksheets in line with the evaluations of the peers and deliver them to their teachers.