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Analysis of The Effect of The Use of Science Journals on The Students' Academic Achievements[1]

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Abstract

The aim of this study is to analyze the effects of the use of science journals on students' academic achievement. The participants of the study are 26 students, in 7th grade in 2017-2018 academic year at a state secondary school where students from middle socio-economic level are educated in Acıpayam District of Denizli Province. In the study, single group pre-test-post-test research design was used. The students in the group were taught in the "Electrical Energy" unit in accordance with the Science Program. In addition, students were asked to keep a science diary after each course. First of all, a pilot study was conducted with the students about the method of keeping a diary and the students were enabled to understand the method sufficiently effectively. "Electric Unit Achievement Test" developed by Aydın (2016) was used to collect the data of the study. The Cronbach Alpha reliability coefficient was found as. 85. After achievement test results were found to be reliable, It was applied twice as pre-test and post-test as a total. Firstly, arithmetic averages and standard deviations of the data obtained from the achievement test, were given, by doing descriptive statistical analysis. Then, statistical analysis (dependent-t test) based on deduction was performed. SPSS-20 package software was used for statistical analysis. In the interpretation of the analyzes, .05 significance level was accepted. In addition, the journals of three students randomly selected from the experimental group were examined. What the students write on their journals about the subject and the answers of the "Electric Unit Achievement Test" questions about the same subject were compared. The relationship between what is written in the journals and the responses given has been examined. In addition, the students' classroom performance was observed by the researcher during the application.

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Introduction

Since ancient times, people have always tried to access information. Information has always been of value in terms of sustaining the continuity of the communities and their development. Zamanla bilgiye erişme, öğrenme ve öğretme yolunda birçok farklılıklar olmuştur. In other words, learning behaviors of individuals have changed over time. This directed the researchers on the questions of 'How does learning take place?'or 'How does man learn?'.

It has long been the subject of curiosity for what learning is, how it happened and how effective learning can take place and studies related to learning have played an important role in psychology and educational science. Until recently, it has been widely accepted that learning is defined as behavioral change that occurs as a result of the experience and with little more permanent traces.

According to this definition, learning has three important features:

- A change in the behavior of the individual,
- This change is not caused by factors such as maturation, growth, sleep, medication, fatigue, but as a result of experience,
- This change is not temporary, but at least for a certain period of time (Açıkgöz, 2003).

Learning is generally defined by researchers as a permanent behavioral change resulting from experience.

Researchers have come up with a new problem about how this behavioral change occurs and what steps have taken in the mind of the individual: ‘How do people learn?‘

Today, the common view about education and teaching is 'how individuals learn' and ' whether they know the ways of learning' rather than 'what they have learned' (Çakıroğlu and Ataman, 2008).

In the same test, there may be students having lower grades, even though study more than their friends. In this case, what should be discussed is not how much the student works, but how he/she works, whether he/she is aware of his own abilities, and whether he/she knows the right methods for himself.

The common point of all studies in the fields of teaching-learning is to illuminate the dark points of two complementary processes and to make them more understandable with the help of new approaches. By developing appropriate theories for modern education, researchers have proposed effective methods and techniques appropriate to the needs of the era. Thus, they aimed to contribute the dimensions of education as 'teacher and student'. The task of teachers is to select, plan and apply the most appropriate and effective teaching model to the learning environments, the subject they will teach, the characteristics of the students, the conditions of the class or the school (Çakıcı, Alver & Ada, 2006).

According to the Meaningful Learning approach developed by Ausubel for the first time, it is essential that knowledge is understood by the individual.

The researcher divided this approach, which is called learning by presentation, into two groups as mechanical and meaningful learning. Ausubel argues that learning should be carried out meaningfully in order to make the information permanent and easy to transfer to other fields (Kara and Özgün-Koca, 2004). Demirel (2005) defined meaningful learning as" learning a subject without considering all its details and understanding its quality and meaning". For the meaningful realization of learning; the knowledge to be learned must have an integrity and meaning in itself; The student must have the correct pre-knowledge about the subject to be learned, willing to learn and determined (Fidan & Erden, 1986). The main purpose of the Science Education Curriculum is to educate all individuals as science literate. Science literacy, as a general definition; it is a combination of, developing individuals' research, inquiry, critical

thinking, problem solving and decision making skills, being lifelong learners and, skills, attitudes, values, understanding , knowledge related to science which are necessary for their environment and their curiosity about the World (MEB.,2005) For students to be educated as a science literate, teacher-centered traditional teaching methods such as lecture, note-taking and verification-type laboratory activities are not sufficient (MEB., 2005). In the program, it is foreseen that the courses will be conducted in the learning environments (problem, project, cooperative learning) based on students. In order for the students to learn information meaningfully and permanently, classroom / in-school and out-of-school learning environments are designed according to research and inquiry-based learning strategy (MEB., 2018).

In this context, students should be actively involved in the learning process in order to be able to learn the information meaningfully and permanently and to be educated as a science literate.

The teacher will take on the role of mentor, not the informant. At this point, science journals appear both as an evaluation method and as a teaching method.

The science journals are records in which students note what they do in science classes. They are the works that the problems that the students try to solve, the instructions they use, the observations they made, the impressions they have obtained, expressed. The science journals allow students to learn from different perspectives by examining their interaction with their peers, their approach to science experiences, their drawing, writing and interpretation. It also allows students with different learning and development rates to monitor themselves and raise their awareness about themselves (Çavuş and Özden, 2012).

Science journals are generally seen as records in which students write what they do in science classes. Science journals, also called science notebooks, appear as a product of students' daily science classroom experiences. Students; Thus, they can explain the problems they are trying to solve, the instructions they use, their observations, the results and the impressions they reach (Erduran-Avcı, 2008; Zengin & Küçük, 2018).

In our country, most science teachers keep a book on their students during the course. They often ask students to note the important points, problems, solutions and important details that they consider important for students. Science journals are completely home-work. All kinds of learning activities carried out outside school time are considered as home works (Çavuş and Özden, 2012).

Science journals are a reflection of what the student experienced when he went home after school in the science course of that day. The student notes, all his/her experiences in the science course at that time, learning process, what he/she did while he/she was learning and what he/she did not do, what methods they follow when learning the subject, to these journals.

In doing so, he/she can benefit from all sorts of drawings, graphics and tables. He/she can evaluate himself/herself on that day after the writing of the diary.

He/She can see how he/she understands the subject and how he/she understands it better. The journals can be seen as a mirror of the student's learning process. However, this mirror shows the whole process as it is, and gives clues about how the process will be more efficient.

Keeping a diary is one of the important windows for people to experience their teaching experience. It is very important for students to evaluate what they have learned according to their point of view, to express what they have learned, to make their own sentences. In fact, It can be said they understood the subject, for the students who expressed their expression in the lectures. Working by writing increases the permanency of learning (Du ve Wagner, 2005). Because to write, you need to think about what to write first, to configure it in the brain by blending all of the learned. It can also be said that the keeping diary is the direction of writing rules, narration, and paragraph knowledge (Polat and Uslu, 2012).

Students record all the steps related to the learning processes in the course of the lesson before, during and after the course. This enables the student to receive data from the first source of what the student does or does not do in the learning process.

Science journals allow students to behave like a scientist by sharing what they have learned through notebook or group discussions (Black vd, 2002; Moon, 2010). These are genuine tools used by many scientists to conduct research. In elementary school classes, using science journals gives students the opportunity to share their research, findings and results with other people. Like scientists, having the opportunity to share their research made their efforts even more meaningful. Science journals allow primary school students to be both investigators and curious while sharing their work. These notebooks are used to convey scientific concepts and processes; It can be said that they act as a tool in teaching, learning and evaluation (Wiggins, 1989; Walker, 2003; Wormeli, 2004; Unrau, 2008; Uslu, 2009). The aim of this study is to investigate the effect of the use of science journals on the academic achievement of the students while science course 7th Grade 'Electrical Energy' unit is taught. When the Science Courses Program (MEN, 2013), which is valid in the academic year in which the study was conducted, is examined, it is revealed that the highest gain in the subject of "electricity" is in 7th grade. In addition, at the 7th Grade level, the students encountered the subject such as voltage, current, voltage and current relationship, serial and parallel bonding, power generation in power plants, regarding the subject of "electricity" for the first time.

The problem statement of the research is; "What is the effect of the use of science journals on the academic achievement of students in the 7th grade science course electrical energy unit?".

Method

Research Model

In this study, single-group pre-test-posttest control-free semi-experiment pattern was used as the trial model. This model is one of the pre-trial models. In this model, an arbitrary variable is applied to a randomly selected group. In the pattern, the significance of the difference between the pre-test and post-test values of the single group is tested (Karasar, 2010).

The research was carried out on the 7th Grade "Electric Energy Unit" in primary education. For this unit, "Electric Unit Achievement Test (EUAT)" was applied as a pre-test. The students in the experimental group were taught in the "Electrical Energy Unit" course in accordance with the Science Program. In addition, students were asked to keep a science diary after each course.

First of all, a pilot study was conducted with the students about the method of keeping a diary and the students were enabled to understand the method sufficiently effectively. At the end of the application, "Electric Unit Achievement Test (EUAT)" was applied as a final test. At the end of the study, it was looked at whether there is a significant difference between pre-test and post-test. The experimental design of the study is given in Table 1.

Table 1. Experimental design of research

Group	Pre-tests	Experimental Operation	Post-tests
Study group	EUAT	Using Science Journals in addition to the Curriculum	EUAT

EUAT: Electric Unit Achievement Test

In the research, the dependent variable is the academic achievement measured by the Electric Unit Achievement Test. In the Science course, the use of science diary was determined as an independent variable.

Experimental group

The experimental group consisted of 26 students, in 7th grade in 2017-2018 academic year at a state secondary school where students from middle socio-economic level are educated in Acıpayam District of Denizli Province. The distribution of the students in the experimental group according to their gender is given in Table 2.

Table 2. Gender distribution of participants in the experimental group

Gender	Using Science Journals in addition to the Curriculum
Girl	16
Boy	10
Total	26

Data Collection and Analysis

In the study, the data were collected by the Electric Unit Achievement Test (EUAT), science journals and unstructured observations. The Electrical Unit Achievement Test (EUAT) was applied to the experimental and control groups as a pre-test and post-test in order to observe the changes in the achievement of the students in the 7th grade science course Electrical Energy unit. EUAT; Developed by Aydın (2016). At this study firstly, 29 questions have been prepared by considering the gains within the unit and 290 students applied statistical analysis. As a result of these analyzes, it was decided to remove the two questions from the test. The Cronbach Alpha reliability coefficient was found to be .85 for the 27-item achievement test consisting of two questions as a result of question analysis. Thus, the results of the achievement test were found to be reliable.

In order to ensure the validity of the scope, expert opinion was consulted. The degree of difficulty item by item and item discrimination index of EUAT are given in Table 3.

Table 3. Electrical Power Unit Success Test Article Difficulty Degree and Achievement Discrimination Index

Question Number	**Difficulty**	**Item Degree**	**Item Distinction Index**
1		0.73	0.33
2		0.66	0.51
3		0.59	0.46
4		0.63	0.38
5		0.34	0.51
6		0.36	0.50
7		0.64	0.45
8		0.46	0.51
9		0.56	0.24

10	0.49	0.39
11	0.57	0.58
12	0.47	0.77
13	0.51	0.65
14	0.45	0.65
15	0.43	0.62
16	0.55	0.82
17	0.41	0.39
18	0.63	0.71
19	0.49	0.69
20	0.60	0.67
21	0.60	0.61
22	0.35	0.40
23	0.41	0.54
24	0.28	0.34
25	0.61	0.56
26	0.66	0.55
27	0.32	0.39

The table of indications created to show which problem is measured by EUAT is shown in Table 4.

Table 4. Table of Indication

GAINS	QUESTIONS
7.6.1.1. Discovers how to connect in series and parallel, draws a circuit diagram consisting of bulbs connected in series and parallel.	1, 2, 4
7.6.1.2. Observes the luminosity differences in the cases where the bulbs are connected in series and parallel, and interprets the result.	5, 6, 25, 26
7.6.1.3. Knows that electrical energy sources provide electrical current to electric circuits and electric current is a kind of energy transfer .	3, 9
7.6.1.4. Refers the value he/ she read, to the current intensity and refers to the unit by connecting the ammeter to the circuit in series.	10, 11, 12, 15, 16,
7.6.1.5. By connecting the voltmeter to the circuit in parallel, it measures the voltage (potential difference) between the circuit ends and expresses the unit.	13, 14, 15, 16
7.6.1.6. Discovers the relationship between the voltage between the ends of a circuit element and the current passing through it.	17, 18
7.6.1.7. Relates the reason for the difference in brightness in cases where the bulbs are connected in series and parallel with the electrical resistance.	7, 8, 27

7.6.2.1. Performs experiments on how electric energy turns into heat and light energy and observes the result.	22
7.6.2.2. Gives examples of technological applications based on the transformation of electrical energy into heat and light energy. Emphasizes the importance of electrical fuse in terms of safety.	23, 24
7.6.2.3. Comprehends that electrical energy is transformed into motion energy and motion energy is converted into electrical energy. It is emphasized that robots are developed based on the conversion of electrical energy into motion energy.	20, 21

The journals of three randomly selected students were studied. Students write their journals about any topic and the answers of EUAT on the same subject were compared. The relationship between the journals and the answers given was examined. In addition, in-class performance of the students was observed by the researcher during the application.

Application

At the beginning of the application process, students in the experimental group were asked to keep a science diary out of the science book. In this context, students were informed about science diary. However, as the students are not used to keep the science diary, they are distributed in a draft of how they will follow in their journals.

In this draft, there are questions and directions that will guide the students. After this guidance, Electrical Power Unit Achievement Test (EPUAT) was applied as a pre-test to the students in the experimental group.

After the pre- tests were applied to the students in the experimental group, the study of the "Electric Energy Unit" was started.

Achievements in the unit are given to the students in the same way as they are included in the Science Teaching Program. In addition, the students in the experimental group kept the diary after each lesson in the draft prepared by the researcher. In the weekly curriculum of Science course, two blocks of courses were taught as four in total. The students in the experimental group kept a diary at the end of each block course. Thus, the students in the experimental group kept the diary twice a week.

In the last stage of the study, the Electrical Energy Unit Achievement Test (EEUAT), which was applied as a pre-test to the experimental group, was applied as the post-test. The study lasted seven weeks (28 hours).

Data Analysis

The data obtained from the data collection tools used in the study were analyzed with SPSS 20.00 program. First of all, descriptive statistical analyzes of the data obtained from the achievement test were performed and arithmetic means and standard deviations were given. Then, statistical analysis (dependent t test) based on deduction was made. This test is an analysis that is used to test whether there is a significant difference between the same measurement tool over the same group when the measurements are taken twice, and the averages for these measurements (Turgut, 2009).

Findings

In this part of the research; Before and after the experimental procedure, data obtained through data collection tools, data analysis and comments were included.

Findings Concerning the Results of "Electric Unit Achievement Test"

The research question of the study; "In addition to the curriculum in Elementary School of Science and Technology" 7th Year of Science Course Electrical Energy "unit, is there a significant difference between the results of the students from the "Electrical Energy Unit Achievement Test" in the experimental group keeping the science diary before and after the experimental procedure?

The scores obtained from the "Electrical Energy Achievement Test (EEAT)" before and after the experimental procedure were evaluated by using parametric statistical methods t-Test for Dependent Groups. The results of the t-Test for the Dependent Groups were given in Table 5 to determine whether there was a significant difference between the scores obtained from the EUAT by the experimental group before and after experimental procedure.

Table 5. t-test results of the experimental group for pre-test-post-test dependent groups of EUAT

	N	Avarage	Standart Deviation	Degree of freedom	t	p
Pre-Test	26	19,1538	4,01689	25	-2,339	0,028
Post Test	26	20,2308	3,90187			

When the findings in Table 5 were examined, a statistically significant difference was found between the pre-test and post-test results of the students in the experimental group (T = -2,339; p <0,05). In order to determine which test is in favor of the difference, it is seen that the average of the posttest scores is higher when the mean scores are examined. It was concluded that this statistical significance arose from the last test.

Findings for Science Journals

In this section, the findings of the relationship between the results of the study and the results of the success test of 3 students randomly selected from the experimental group, were included. In accordance with the ethics of the research, the students' names are kept secret and the students are named with A, B and C codes. Of the students chosen, A is male , B and C are girls and they are all 13 years old. Student A 's Science grade was 70, student B 's grade was 80 and student C 's grade was 90.

Findings Related to Student A

Student A showed a silent appearance in the classroom during the application. In his diary, he stated that he did not like to keep a diary, but that he loved his teacher and that he kept a diary because he did not want to upset him. When his diary was examined, it was observed that he was telling very long the experimental days. In addition, it was noted that the forms of the experiments were recorded in his diary. For example, in the "Electromagnet Activity", ' First, we wrapped a cable in a nail and we were coiled. Then, we connected the two ends to the plus and minus pole of the battery and a magnet formed. We poured iron dust on the paper. The magnet that we made pulled them. You can see the figure below. I think I understand this very well', he wrote as his statement.

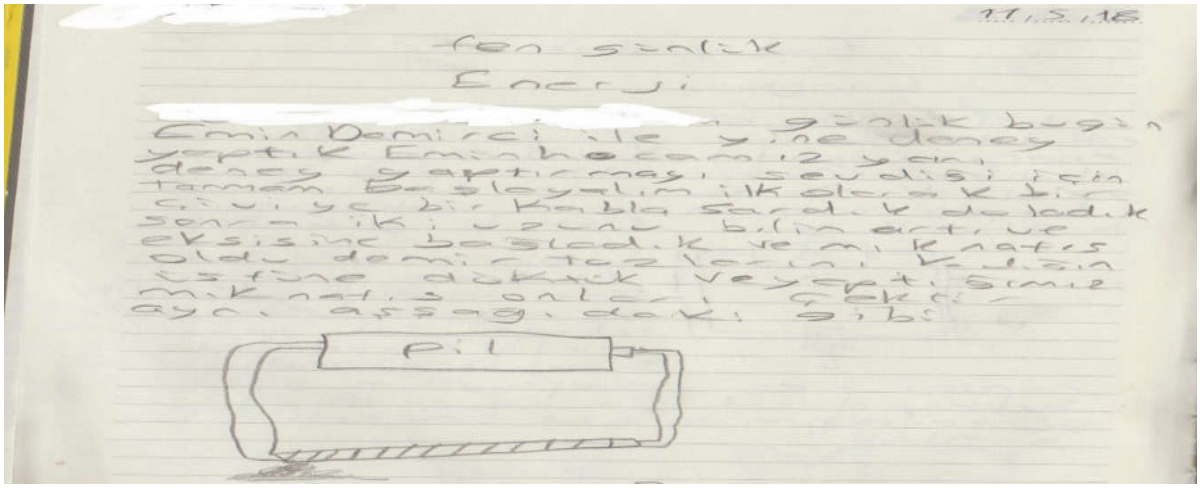

Figure 1. 'Electromagnets Activity' diary of student A.

In the activity called "The Transformation of Motion Energy into Electric Energy", in the student's journal, there were expresions as "Today, we produced energy in school without batteries." was written. First, the teacher brought a 600-coil bobbin to the class and presented it. We connected the positive and negative poles of the bobin to the positive and negative poles of the ammeter (as in the figure below). Then, by moving the magnet back and forth in the bobin, we observed that the needle of the ammeter moved. We obtained electricity without the battery in the circuit. ".

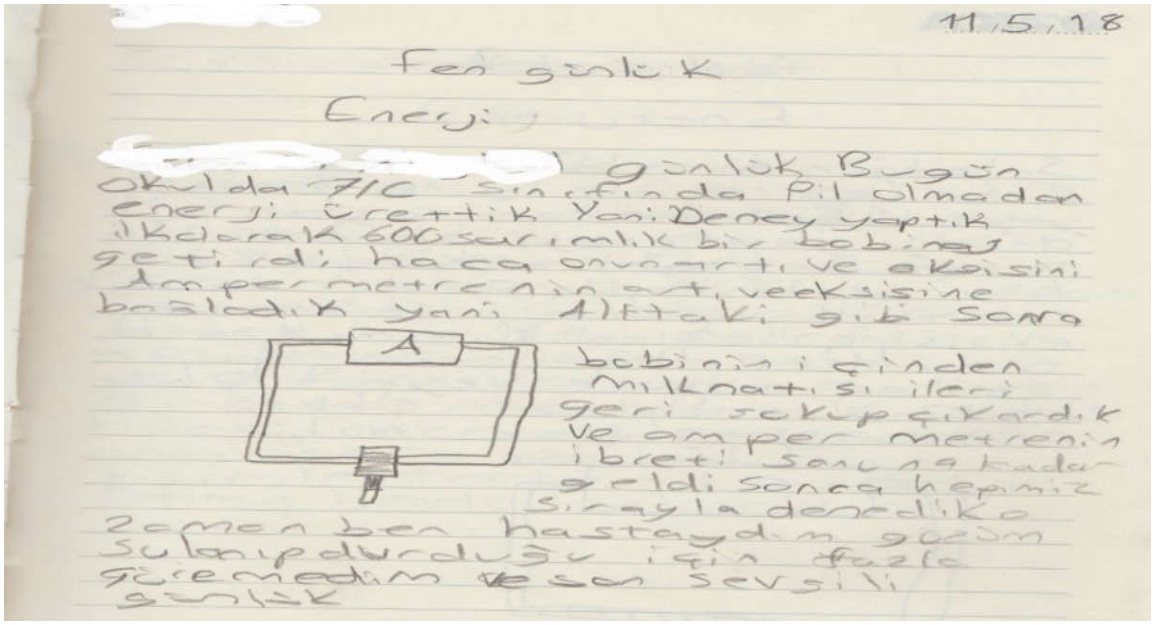

Figure 2: The diary about "From Energy of Motion to Electrical Energy"

When the indication table was examined, 20 and 21 numbered questions asked to evaluate the achievemet " He/she comprehends that The electric energy is converted into the energy of motion, the energy of motion becomes electrical energy." As the "A" student emphasized in his diary, He answered the questions related to this achievement correctly in EUAT. On the other hand in EUAT, He could not answer question 27 correctly related to the achievement of ' Relates the reason for the difference in brightness, in cases where the bulbs are connected in series and parallel with the electrical resistance.' When the student's diary was examined, there was no expression for this achievement. As a result, student A paid more attention to his diary

especially on the days when the experiment was performed, and this situation also appeared in the student's EUAT results. In addition, It's detected that In the unstructured observations made by the researcher during the course, The student is more willing and active in the days of the experiment. This situation also reflected in the journals written on the days of the experiment.

Findings Related to Student B

When the diary of student "B" was examined, a more colorful diary was encountered. The student chose a colored notebook for her diary and used different color pens for writing. She showed the important points for herself, with different color pencils and different color papers. Moreover, unlike other students, she included examples of questions in her diary. In addition, in order to relate the subject matter of the day to the current life, she cut and put newspaper clippings in her diary.

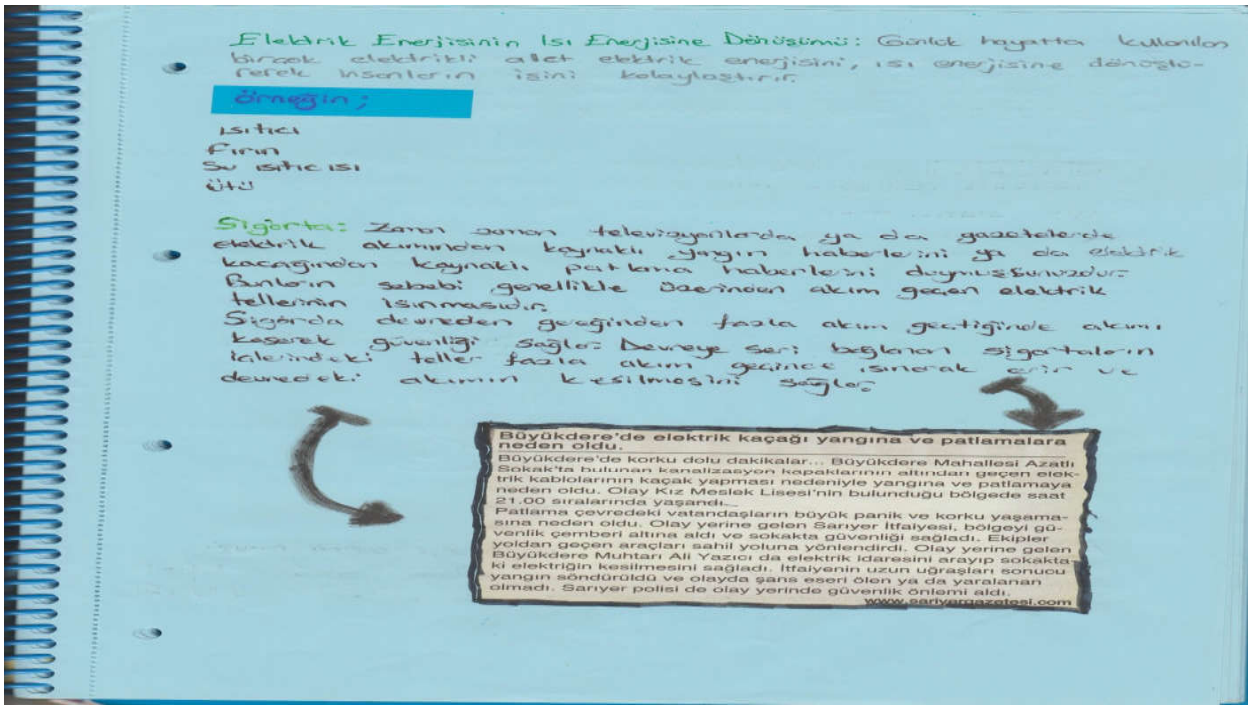

Figure 3. The student B's diary that she supported it with the newspaper clippings.

In her diary B student used ' I think I understand this topic better by writing a diary. It was harder. I just don't understand the breaker. That's why I'm giving myself 97 points from this unit.' expressions in the section where she evaluated the unit in general. The same student requested help from her teacher about the "fuse", which she thought she did not understand the following day.

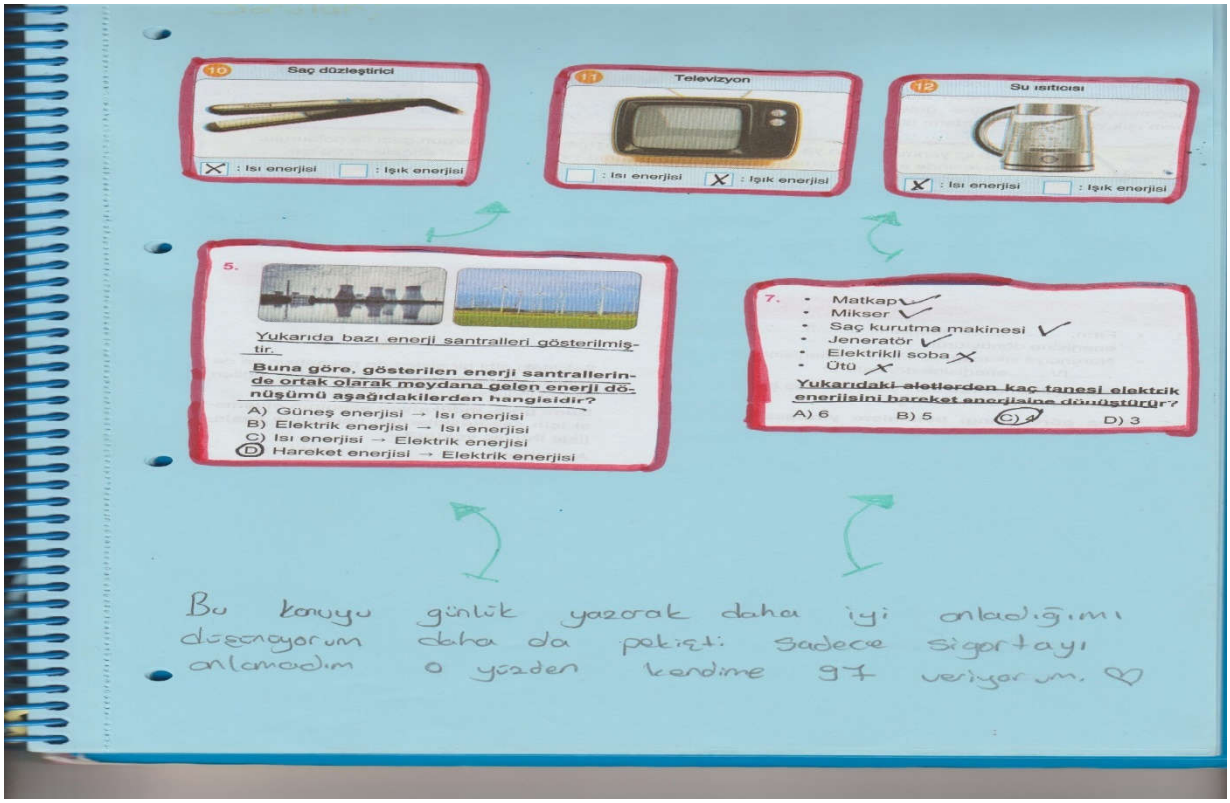

Figure 4. The diary that the student 'B' evaluate herself about the subject

When the indication table (Table4) was examined, in EUAT, 23 and 24 numbered questions were about 'fuse',and It was intended to provide the achievement of "given examples of 'The transformation of electrical energy into heat and light energy' based technological applications in terms of safety, the importance of electrical fuse is emphasized." The student has answered these questions correctly in the EUAT.

As a result, student B received help from her teacher for a topic that she did not understand in her diary. First, she reviewed her own learning process, made a general evaluation and found that she could understand the subjects better. The student who expressed this situation in his diary thought about what to do to understand the subject and asked her teacher for help. The student's EUAT results support this situation.

Findings Related to Student C

When the student's diary was reviewed, it was seen that the student focused on the issues she deems more important in her diary. She wrote the important points on colored sticky papers and pasted them in her diary. She also emphasized, in particular, the formulas and circuit diagrams, and wrote the subjects that she had difficulty to understand, by itemizing. In the unstructured observations made during the lesson by the researcher, it was observed that the student was also enthusiastic during the course and took an active role in the classroom.

Figure5. "C" Student's diary showing the diagrams in series and parallel circuits

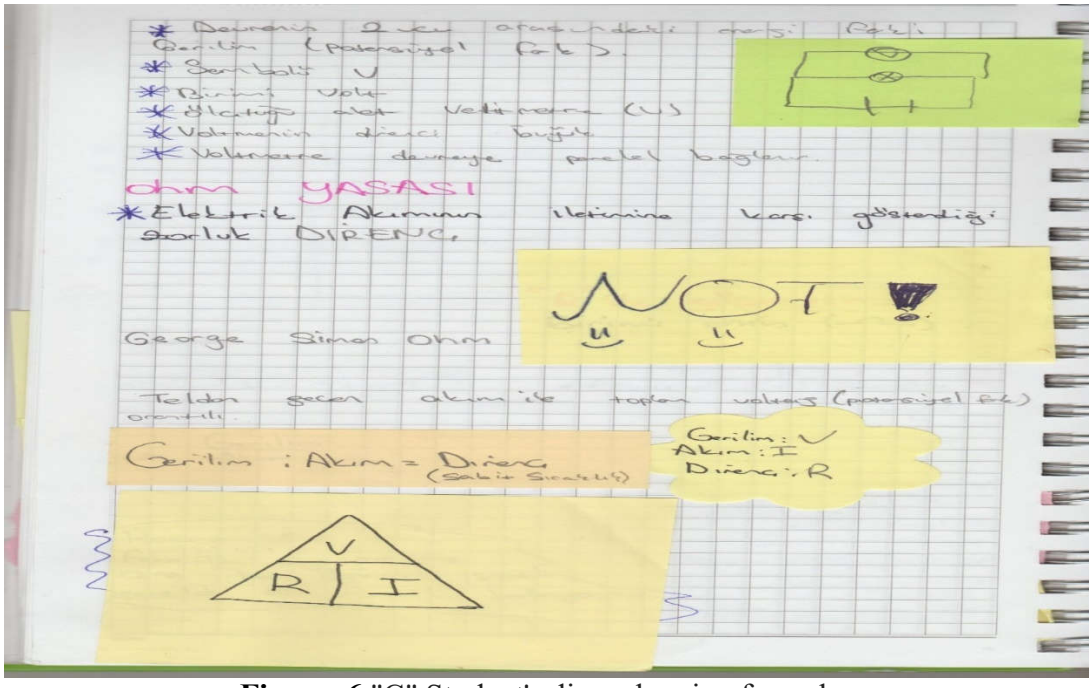

Figure 6."C" Student's diary showing formulas

When the indication table (Table4) was examined, in EUAT, 17 and 18 numbered questions were related to ' She discovers the relationship between the voltage between the ends of a circuit element and the current passing through it by experiment.' achievement. In addition, the 7,8 and 27 numbered questions were related to achievement of ' Relates the reason for the difference in brightness in cases where the bulbs are connected in series and parallel with the electrical resistance.' Both achievements are related to "Ohm's Law" and are questions that require formulas and processes. In the diary of the student 'C', the topics she most emphasized were the topics of formula and circuit diagrams. It has been determined that the student has correctly answered the questions about these issues in EUAT.

As a result, student C has developed different methods to better understand the most challenging subjects in her diary. She used different color pencils and different color sticky papers to realize them.

The answers given by the student to the questions about these subjects in the EUAT support these articles in her diary.

Dıscussion and Conclusion

The aim of this study was to investigate the effect of the use of science journals on the academic achievement of students in the 7th grade ' Electrical Energy Unit'. In addition to the Science Teaching Curriculum, it was concluded that there was a difference of 0.05 significance between the academic achievement of the experimental group students who used science journals before and after the experimental process. Finding this difference in terms of academic achievement shows that the use of science journals by the students in the experimental group is effective. In the literature, supporting the results of the study in the groups where journals are used, studies have been achieved supporting the changes in academic achievement level (Çardak 2010; Keskinkılıç 2010; Moon, 2010; Akkuzulu 2011; Çavuş 2015; Du ve Wagner, 2005).

The reason for this increase in the academic achievement of the students in the experimental group is that they keep the learning process and their progress in this process under constant observation with the science journals. After each block classes, students in the experimental group holding the science diary kept the process and their learning stages in the process continuously recorded. They planned the learning processes by means of the journals, followed the process, intervened in the process if there was a party in which they were wrong, changed their methods in a timely manner, and evaluated themselves at the end of the process and graded them.

In line with the information they have acquired in the lesson, students can write their own words without restricting their feelings and thoughts to their course diaries and enable them to face their thoughts. With journal writing, the student also has the opportunity to see his own progress and what he learned and how (Crawford ve diğerleri, 2005).

The researcher examined the journals of three randomly selected students from the experimental group, and examined the relationship between the students' journals and their responses to the questions of EUAT they achieved. In addition, unstructured observations showed the performance of the students during the course. As a result, It's seen that there was a positive parallel between the students' journals and their responses to the EUAT. Keeping the diary provided an increase in students' academic achievement. Tuncel ve Ayva (2009) günlük tutmanın, dersi tekrar etme imkânı vermesi nedeniyle öğrencilerin başarısını etkilediğini belirtmiştir. Benzer bir araştırmada Atilla, Günel ve Büyükkasap (2009) konuyu tekrar etmenin öğrenci başarısını arttırdığı sonucunu bulmuştur. Aynı zamanda Derslerde günlük yazma hem anında hem de daha sonraki süreçlerde hatırlama gücünü geliştirmektedir (Weiland ve Kingsburg, 2001). Günlük yazmanın kalıcı öğrenme üzerindeki etkisini ortaya koyan (Du ve Wegner, 2005; Avcı, 2008; Uslu, 2009) araştırma sonuçları bu araştırmanın bulguları ile paralellik göstermektedir.

In the light of the findings and results of the research, suggestions can be made are given below as items.

- ✓ This study was conducted in only one school with a very narrow sample. Therefore, the impact of the geography and the demographic and socio-economic conditions of the family has been ignored.

- ✓ In the education processes applied in our schools, mostly teachers make their students to be taken notes. Instead of noting students in their notebooks exactly as their teachers say, students can write notes to their own student journals. Thus, when the journals of students who remain quieter and more shy in the lesson are read by the teacher later, the teacher may have more knowledge about the student's thoughts and the learning process.
- ✓ In the study, science journals were used as a factor increasing the success. Science journals can also be used as an alternative evaluation tool.

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