For cited: *Aktepe, Z. T. & Yıldız, A. (2020). An Investigation of the Effects of Writing to Learn Activities on Academic Achievement in the Fourth Grade Introduction to Matter Unit. Journal of Current Researches on Social Sciences, 10 (1), 73-88.*

Journal of Current Researches on Social Sciences (JoCReSS)
www.stracademy.org/jocress
ISSN: 2547-9644

Year: 2020
Volume: 10
Issue: 1

Research Article/Araştırma Makalesi

Crossref doi: 10.26579/jocress.348

An Investigation of the Effects of Writing to Learn Activities on Academic Achievement in the Fourth Grade Introduction to Matter Unit*

Zeynep Tuba AKTEPE[1] & Ali YILDIZ[2]

Keywords
Writing to Learn, The Fourth Grade Students, Introduction to Matter Unit, Academic Achievement.

Abstract
The purpose of the study is to explore the effect of writing to learn activities including letter, summary, and poster on academic achievement in the fourth grade science course called introduction to matter unit. The study was carried out via pre-test post-test control group design, one of the quasi experimental research designs. The achievement test developed by the researchers about the unit of introduction to matter was used as data collection tool in the study. The achievement test about the unit of introduction to matter was administered to three experimental groups and one control group chosen randomly among the 4th grades as a pre-test. Then, the first experimental group students were asked to write a letter, the second experimental group was asked to write a summary and the third group was asked to prepare a poster as a writing to learn activity for each part of the unit. The control group students solved questions about the subjects learnt in this process. At the end of the implementation, the achievement test was administered as a post-test and then as a retention test three weeks later to all groups. The paired sample t-test (or the dependent t-test for paired samples) and one-way analysis of variance (one-way ANOVA) were used for data analysis. The findings of the study reveal that the fourth graders' post-test and retention test results for the introduction to matter unit in science course is statistically in favour of the experimental group students. As a result of the study, it was found that the academic achievement of the students who used writing to learn activities was higher and what they have learnt was more permanent than the students who learned the unit with current methods.

Article History
Received
14 Feb, 2020
Accepted
30 Mar, 2020

1. Introduction

The opinion about writing has changed dramatically for the last twenty-five years because writing to learn activities, as a very important learning strategy, included both the process and the products (Emig, 1977). The main result that is revealed by the studies carried out about writing as a cognitive process in the domains of linguistics, literature, and psychology is that writing is a learning process. As a

* This paper was based on a doctoral dissertation by Zeynep Tuba Aktepe which is still continuing in Institute of Educational Sciences in Ataturk University.

[1] Corresponding Author. ORCID: 0000-0003-2884-9412. zeyno_2585@hotmail.com
[2] ORCID: 0000-0001-6241-2316. ayildiz@atauni.edu.tr

learning tool, writing is included in curricula by many disciplines in the USA and in some of the European Union countries (Günel, Kabataş Memiş & Büyükkasap, 2010). Because teachers perceive writing only as taking notes and writing is considered to be waste of time as it is time consuming for the individuals, very little time is spared for writing to learn activities in Turkey. As writing to learn is a new study field which takes shape gradually, it is considered that the studies carried out about it has not reached the desired levels yet (Uzoğlu, 2014).

Showing the differences between the language learning processes, Emig (1977) asserted that writing to learn was a unique and an extraordinary way of learning. Writing is considered to be very important among the language processes. When the national and international literatures are examined, there are many studies revealing the effect of writing to learn activities on learning. The dominant result revealed by the studies is that writing has positive effects on learning. In writing activities, after learning the subject, the students express it in their own words. That is, they produce a product because they internalize the subject. As they think over and evaluate the subject, an effective learning occurs. Thus, students' thinking and evaluation skills as well as critical thinking points of view develop (Uluğ, 2004).

Writing to learn activities encourage students to reach scientific journals and give them an opportunity for reasoning in addition to learning scientific concepts (Günel, Atila & Büyükkasap, 2009). Writing to learn, an unconventional kind of writing style, has some benefits such as developing recollection, interpretation, consolidation, and communication skills as stated by Günel, Uzoğlu & Büyükkasap (2009). This above mentioned way of writing is not writing the explanations made by the teacher or citing a text (Yıldız, 2012) but it is an activity that facilitates students' conceptual changes (Mason & Boscolo, 2000). Writing to learn offers students opportunities to explain their opinions about scientific and natural phenomenon and serves as a learning tool for them to reflect their prior knowledge and explain the new concepts. At the same time, it promotes the understanding of new subjects that require conceptual changes (Mason & Boscolo, 2000). Yıldız and Büyükkasap (2011a) stated that writing to learn activities not only help students to become individuals who communicate better but also they prepare them for different academic disciplines and writing genres. Especially language experts who adopted the ideas of Piaget, Bruner, Chomsky and Vygotsky accepted that writing to learn was a type of learning (Martin, 1992, as cited in Koçak & Seven, 2016).

If the individuals can effectively use writing, one of the most effective communication tools, they can get along with the society they live in (Ungan, 2007). Writing not only serves as a mediator for the explanation of opinions about a subject but also it also serves to develop a kind of new understanding about the subject by actualizing the conceptual change. Writing is not only a tool of recording. What makes writing valuable is that it is a meaningful activity which offers opportunities such as reading more information, revising, editing, explanation, reflection of learning experiences, revealing cause and effect relations, and reasoning. Mason and Boscolo (2000) in their studies aimed at having students use writing as a tool of expressing and comparing their ideas, reasoning

and reflection. In addition, their aim was to view the effects of writing to learn activities on understanding the new subject via conceptual change and on conceptualizing itself. The study revealed that students understood the subject they wrote conceptually much better and also students reached an advanced level of awareness of concepts about the changes in their own knowledge structure. Moreover, writing changed the opinions about the conceptualization of writing.

While carrying out different writing activities make writing more interesting for children, they can change their ways of perceiving the differences between written and oral expressions. Using different writing genres cause children to give importance to these activities at varying degrees. Attaching more importance to writing activities used more frequently or used by teachers with the intention of assessment can cause the others to be perceived as if they are less effective. Writing is a tool which offers students an opportunity to experience a new perceptual process which they tend towards by reflecting their prior knowledge and integrating with the new one. Thus, students have an opportunity to think via considering their current understanding and actualize the conceptual change required for the understanding of the new subject more easily. Moreover, students who write to learn see more clearly what makes them confused and raises doubts and thus eliminating misconceptions. Writing to learn proves that the conceptual awareness about the changes that occur in students' conceptual structures develops due to this and this awareness is very important. Students' consciousness of the differences between their initial and acquired perceptions is related to the quality of what they have written (Mason & Boscolo, 2000).

Rivard and Straw (2000) in their studies which examined the effects of speaking, writing and using writing and speaking together on learning and remembering simple and complex knowledge revealed that speaking was important for creativity, clarity, sharing and expansion of knowledge and writing was a strong tool to construct knowledge. However, while speaking is a social activity for learning, writing requires personal construction of knowledge. Students must have specific prior knowledge for writing to be effective. Writing can have a positive effect on learning only in this way. Writing to learn activities are effective in the transformation of unripe opinions into more consistent and more structured knowledge and remembering in time; however, they usually require premises like speaking or peer discussion. While speaking is a social activity, writing is an activity which requires more individual effort, is reflective and organizing.

In order to have students use writing to learn, they must be encouraged to object to copying what the teacher says and given an opportunity to think and compare so that they can make up their own learning (Mason & Boscolo, 2000). Writing to learn not only provides reflection related to the development of students' understanding of knowledge but also it is an important tool that offers an opportunity for teachers to develop new strategies (Mason, 1998; İnaltekin, Özyurt & Akçay, 2012). Yıldız (2016) asserts that while carrying out writing to learn activities, students are on their own to think and to solve the existing problem, start to use their abilities and cognition they have without any explanations or

instructions and this will become behaviour with the process. According to Palamut (2008), students go to primary school having a natural writing skill. However, when a student encounters a setting in which he cannot develop his creativity and express himself very well, he forgets having that skill and pays attention to the writing style more than the content. Thus, this decreases students' motivation to write and thus causing them to develop negative attitudes towards writing. Another mistake that is made with writing applications is that students are given a topic and asked to write about it.

Skills and values gained with primary education are the values and skills that will form the basis of future education. Student achievement and retention of learned information which have become a requirement today change the traditional perspective in education and enable the emergence of new method and techniques. Writing activities are categorized into two groups in literature: traditional and non-traditional writing activities (Erduran Avcı & Akçay, 2013; Günel, Atila & Büyükkasap, 2009). Especially the use of non-traditional writing activities is encouraged in literature (Uzoğlu, 2014). Retention of learned information is possible when a person has access to information and uses it (Eker & Coşkun, 2012). As non-traditional writing activities, writing to learn activities are one of the up-to-date methods which enable students to synthesize their prior knowledge and the newly learned information (Rivard & Straw, 2000), express their opinions, make comparison and deduction and reflect. It could be difficult to expect primary students to regard writing as a tool of reflection. However, changing students' opinions and attitudes about writing, enabling them to regard writing not only as a recording tool but also a meaningful activity to express their opinions could be possible by creating a classroom environment where writing is used as an effective tool during the process of development of understanding (Mason & Boscolo, 2000).

The man learns his mother tongue best in a very short time. Children first learn by imitating and after they become successful with trial and error, they repeat systematically. But in that period no matter what their social status and races are, they can learn and speak the native language without needing a teacher (Rancière, 2015). Because primary students are very close to that period, they can be more willing to learn and they can be motivated more easily. While carrying out writing to learn activities, considering that they could focus much better on the process, they are expected to learn the concepts more permanently. Learning the concepts permanently can increase academic achievement (Yıldız, 2016).

Considering the effect of writing on conceptual change and the fact that more studies about how different writing to learn activities change the conceptual framework related to students' writing are needed, this study in which different writing genres are actualized by primary school students is important on behalf of literature.

2. Purpose of the Study

The purpose of the study is to investigate the effect of writing to learn activities including letter, summary, and poster on academic achievement in the fourth grade science course called introduction to matter unit.

In line with the purpose of this study, the following questions are sought to be answered:

- Is there a statistically significant difference between the experimental groups and control group's academic achievement pre-test scores?
- Is there a statistically significant difference between the experimental groups and control group's academic achievement post-test scores?
- Is there a statistically significant difference between the experimental group and control group teachers' in terms of retention?
- Is there a statistically significant difference with the changes that occurred before the study within experimental groups and control group?

3. Method

3.1. Research Design

The study was carried out via pre-test post-test control group design, one of the quasi experimental research designs (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2013, s. 208).

3.2. Study Groups

The research was carried out in a state school located in Yakutiye district of Erzurum in 2017-2018 education year. Among the 12 4^{th} grades in the primary school where the study was carried out, three experimental groups and one control group were randomly chosen. A total of 102 students, 26 students in letter writing experimental group, 25 students in summary writing experimental group, 26 students in poster activity experimental group, and 25 students in control group participated in the study.

3.3. Data Collection Tools

The test prepared about the fourth grade introduction to matter unit in science course and consisting of question types such as multiple choice, true-false, filling in gaps, and matching as a data collection tool was administered as pre-test- post-test and retention test. The test was developed as a result of scanning text books, supplementary books, item banks, and previous exam questions in the examinations carried out by Ministry of National Education. It is found that such achievement tests are developed using similar techniques (Özsevgeç, 2006). 20 questions considered appropriate for the fourth grade students' level were included in the test. Out of these 20 questions, 15 of them are multiple choice, 3 of them are matching type of questions, 1 question is filling in gaps with sub-items and 1 question is true-false question with sub-items. Each question is 5 point and the test is graded over 100.

3.4. Research Process

During the research process, the researcher informed the experimental and control group students about the process. Then, the activity samples were shown to the control group students and they examined them. After the achievement test

about introduction to matter was administered to all groups as pre-test, the first experimental group students were asked to write a letter, the second experimental group students were asked to write a summary and the third experimental group students were asked to prepare a poster about each section of the unit as a writing to learn activity. The control group students solved questions related to the subjects taught during this process. Because the implementation lasted until all the sections of the unit were finished, it was completed in 8 weeks. At the end of the implementation, the achievement test was administered as post-test and then three weeks later, it was administered as a retention test to all groups.

3.5. Data Analysis

The data obtained after the administration of data collections tools to the experimental groups and the control group, the data obtained were analyzed by using SPSS 20 software package and the data were analyzed. During the interpretation of the results, 0.05 was accepted as significance level. Dependent paired-samples t-test was used in order to do analysis on the same sampling group in the study. The dependent paired-samples t-test compares the means of two related groups. However, there are not two different sampling groups. In this study, the experimental groups and the control group's achievements within themselves in different time periods were measured. ANOVA, one-way analysis of variance, was used to determine whether or not there were statistically significant differences between the pre-test post-test and retentions test scores of the experimental group students who wrote a letter, a summary, and prepared a poster and the control group students. One-way analysis of variance is a technique that can be used to compare whether or not there were significant differences between the means of two or more samples.

4. Findings and Interpretation

1. Is there a statistically significant difference between the experimental groups and control group's academic achievement pre-test scores?

Table 1. ANOVA Results Related to the Experimental Group and Control Group Students' Introduction to Matter Unit Pre-test Scores

Pre-test	**N**	**X**	**Std. Deviation**	**Std. Error**	**95% Mean reliability range**			
					Threshold	Upper Limit	Minimum	Maximum
Letter	26	56.5000	11.64903	2.28456	51.7949	61.2051	22.00	73.00
Summary	25	52.4000	13.11805	2.62361	46.9851	57.8149	18.00	70.00
Poster	26	64.5769	6.65837	1.30581	61.8876	67.2663	44.00	71.00
Control	25	54.2800	14.92068	2.98414	48.1210	60.4390	25.00	85.00
Total	102	57.0098	12.65967	1.25349	54.5232	59.4964	18.00	85.00

ANOVA

		Sum of Squares	Degree of Freedom	Mean Squares	F	p
Pre-test	Inter groups	2213.104	3	737.701	5.174	.002
	Intra group	13973.886	98	142.591		
	Total	16186.990	101			

The pre-test mean scores are found to be 56.50 in letter writing group, 52.40 in summary writing group, and 64.57 in poster group and 54.28 in the control group. It is found that according to the results of one-way analysis of variance, there is statistically a significant difference at a significance level of 0.05 between the experimental groups and control group pre-test mean scores ($p=0.002$; $p<0.05$). The table for Duncan's multiple range test must be checked to view the present differences between the groups' means.

Table 2. Duncan's Multiple Range Test Results Related to the Experimental Group and Control Group Students' Introduction to Matter Unit Pre-test Scores

Groups	**Pre-test**
Poster	64.57 ± 6.65^{a}
Letter	56.50 ± 11.65^{b}
Summary	52.40 ± 13.12^{b}
Control	54.28 ± 14.92^{b}

$p<0.05$

Analysing the Duncan's multiple range test results related to the experimental group and control group students' introduction to matter unit pre-test scores; it is found that the pre-test mean scores of the experimental group who prepared a poster were higher than the other groups. Two different sub-groups were composed with the experimental groups and control group's introduction to matter unit pre-test scores. The experimental group preparing a poster with their 64.57 pre-test achievement formed one group and the experimental groups who wrote a summary and prepared a poster, and the control group with their means of 56.50; 52.40 and 54.28, respectively, formed the other groups. The experimental group students who wrote a letter and a summary and the control group students reveal similar qualities while answering the introduction to matter unit pre-test. The experimental group students who prepared a poster are different from these three groups with their higher mean scores. This situation is due to random assignment of study groups.

2. Is there a statistically significant difference between the experimental groups and control group's academic achievement post-test scores?

Table 3. ANOVA Results Related to the Experimental Group and Control Group Students' Introduction to Matter Unit Post-test Scores

Post-test	N	X	Std. Deviation	Std. Error	95% Mean reliability range			
					Threshold	Upper Limit	Minimum	Maximum
Letter	26	74.7308	13.25008	2.59855	69.3789	80.0826	49.00	94.00
Summary	25	76.1200	18.09770	3.61954	68.6496	83.5904	14.00	100.00
Poster	26	84.1154	10.78394	2.11538	79.7587	88.4721	60.00	100.00
Control	25	61.2000	13.85039	2.77008	55.4828	66.9172	32.00	83.00
Total	102	74.1471	16.24161	1.60816	70.9569	77.3372	14.00	100.00

ANOVA

		Sum of Squares	Degree of Freedom	Mean Squares	F	p
Post-test	Inter groups	6880.385	3	2293.62	11.373	.000
	Intra group	19762.409	98	201.657		
	Total	26642.794	101			

The post-test mean scores are found to be 74.73 in letter writing group, 76.12 in summary writing group, and 84.11 in poster group and 61.20 in the control group. It is found that according to the results of one-way analysis of variance, there is statistically a significant difference between the experimental groups and control group's post-test mean scores ($p=0.000$; $p<0.05$). It can be stated that writing to learn activities increased the academic achievement of the experimental group students who wrote a letter, a summary, and prepared a poster. The table for Duncan's multiple range tests must be checked to view the present differences between the experimental groups and control group.

Table 4. Duncan's Multiple Range Test Results Related to the Experimental Group and Control Group Students' Introduction to Matter Unit Post-test Scores

Groups	**Post-test**
Poster	84.12 ± 10.79^{a}
Letter	74.73 ± 13.25^{b}
Summary	76.12 ± 18.10^{b}
Control	61.20 ± 13.85^{c}

$p<0.05$

Analysing the Duncan's multiple range test results related to the experimental group and control group students' introduction to matter unit post-test scores; it is found that the post-test mean scores of the experimental group who prepared a poster were higher than the other groups. Three different sub-groups were composed with the experimental groups and control group's introduction to matter unit pre-test scores. The experimental group who prepared a poster formed a group with their 84.11 post-test score; the experimental groups (writing a letter) and (preparing a poster) formed a group with their 74.73 and 76.12 mean scores and the control group formed the other group with their mean scores of 61.20. The experimental group students who wrote a letter and a summary reveal similar qualities while answering the introduction to matter unit post-test questions. While the experimental group students who prepared a poster are different from these three groups with their higher mean scores, the control group students reveal rather lower scores.

3. Is there a statistically significant difference between the experimental group and control group teachers' in terms of retention?

Table 5. ANOVA Results Related to the Experimental Group and Control Group Students' Introduction to Matter Unit Retention Test Scores

Retention	N	X	Std. Deviation	Std. Error	95% Mean reliability range			
					Threshold	Upper Limit	Minimum	Maximum
Letter	26	77.0000	13.62938	2.67294	71.4950	82.5050	50.00	99.00
Summary	25	77.4400	15.24270	3.04854	71.1481	83.7319	47.00	100.00
Poster	26	83.1154	8.58523	1.68370	79.6477	86.5830	62.00	95.00
Control	25	61.5200	14.82992	2.96598	55.3985	67.6415	35.00	90.00
Total	102	74.8725	15.36595	1.52146	71.8544	77.8907	35.00	100.00

ANOVA

		Sum of Squares	Degree of Freedom	Mean Squares	F	p
Retention	Inter groups	6506.289	3	2168.763	12.256	.000
	Intra group	17341.054	98	176.950		
	Total	23847.343	101			

The retention test mean scores are found to be 77.00 in letter writing group, 77.44 in summary writing group, and 83.11 in poster group and 61.52 in the control group. It is found that according to the results of one-way analysis of variance administered to reveal whether or not there is a statistically significant difference between the experimental groups and control group's retention test mean scores, there is a statistically significant difference between the implementation groups ($p=0.000$; $p<0.05$). It can be stated that writing to learn activities increased retention in students' learning. The table for Duncan's multiple range tests must be checked to learn the differences between the experimental groups and control group.

Table 6. Duncan's Multiple Range Test Results Related to the Experimental Group and Control Group Students' Introduction to Matter Unit Retention Test Scores

Groups	Post-test
Poster	83.11±8.59[a]
Letter	77.00±13.63[a]
Summary	77.44±15.24[a]
Control	61.52±14.83[b]

$p<0.05$

Analysing the Duncan's multiple range test results related to the experimental group and control group students' introduction to matter unit retention test scores; it is found that the retention test mean scores of the experimental group who prepared a poster were higher than the other groups. Two different sub-groups were composed with the experimental groups and control group's introduction to matter unit post-test scores. The experimental groups who prepared a poster, wrote a letter and a summary formed a group with the following mean scores of 83.11; 77.44; 77.00 and the control group formed the other group with the mean score of 61.52. The experimental group students who

wrote a letter, a summary and prepared a poster reveal similar qualities while answering the introduction to matter unit retention test questions. The control group students who learned the unit with existing methods reveal lower means when compared to other groups. It can be stated that writing to learn activities are effective on students' retention of learned information.

4. Is there a statistically significant difference with the changes that occurred before the study within experimental groups and control group?

Table 7. Dependent Paired-samples t-test Results for the Comparison of Pre-test-Post-test Letter Writing Experimental Group

	X	N	Std. Deviation	Std. Error Mean
Pre-test	56.5000	26	11.64903	2.28456
Post-test	74.7308	26	13.25008	2.59855

	Paired Differences							
				95% Confidence Interval of Difference				
	X	Std. Deviation	Std.Error mean	Lower	Upper	t	Degree of freedom	p (2-tailed)
Pre-test Posttest	-18.23077	8.61769	1.69007	-21.71153	- 14.75001	-10.787	25	.000

Letter writing experimental group students' mean pre-test scores that they got from the achievement test administered at the beginning of the introduction to matter unit was found to be 56.50 and their mean post-test scores administered after the activities were found to be 74.73. The results of the dependent paired-samples t-test applied to this group revealed that the pre-test-post-test scores belonging to this group were statistically different. The analysis results are statistically important at significance level of 0.05 ($p=0.000$; $p<0.05$). That is, it can be stated that it made positive contributions to the academic achievement of experimental group that wrote letters as a writing to learn activity.

Table 8. Dependent Paired-samples t-test Results for the Comparison of Pre-test-Post-test Summary Writing Experimental Group

	X	N	Std. Deviation	Std. Mean Error
Pre-test	52.000	25	13.11805	2.62361
Post-test	76.1200	25	18.09770	3.61954

	Paired Differences							
				95% Confidence Interval of Difference				
	X	Std. Deviation	Std.Error mean	Lower	Upper	t	Degree of freedom	p(2-tailed)
Pre-test Posttest	-23.72000	11.86564	2.37313	-28.61789	-18.82211	-9.995	24	.000

Summary writing experimental group students' mean pre-test scores that they got from the achievement test administered at the beginning of the introduction to matter unit was found to be 56.40 and the mean post-test scores administered after the activities were found to be 76.12. The results of the dependent paired-samples t-test applied to this group revealed that the pre-test-post-test scores belonging to this group were statistically different. The statistical analysis results are statistically important ($p=0.000$; $p<0.05$). It was found that the academic

achievement of the experimental group that wrote summary as a writing to learn activity increased positively.

Table 9. Dependent Paired-samples t-test Results for the Comparison of Pre-test-Post-test Poster Preparing Experimental Group

	X	N	Std. Deviation	Std. Error Mean
Pre-test	64.5769	26	6.65837	1.30581
Post-test	84.1154	26	10.78639	2.11538

	Paired Differences							
				95% Confidence Interval of Difference				
	X	Std. Deviation	Std. Error Mean	Low	Upper	t	Degree of freedom	p (2-tailed)
Pre-test Post-test	-19.53846	7.89040	1.54744	-22.72546	-16.35146	-12.626	25	.000

Poster preparing experimental group students' mean pre-test scores that they got from the achievement test administered at the beginning of the introduction to matter unit was found to be 64.57 and the mean post-test scores administered after the activities were found to be 84.11. The results of the dependent paired-samples t-test applied to this group revealed that the pre-test-post-test scores belonging to this group were statistically different. The analysis results are statistically important ($p=0.000$; $p<0.05$). It can be stated that the experimental group students' academic achievement who prepared a poster as a writing to learn activity increased positively.

Table 10. Dependent Paired-samples t-test Results for the Comparison of Pre-test-Post-test Control Group

	X	N	Std. Deviation	Std. Error Mean
Pre-test	54.2800	25	14.92068	2.98414
Post-test	61.2000	25	13.85039	2.77008

	Paired Differences							
				95% Confidence Interval of Difference				
	X	Std. Deviation	Std.Error Mean	Low	Low	t	Degree of freedom	p (2-tailed)
Pre-test Post-test	-6.92000	9.69072	1.93814	-10.92013	-2.91987	-3.570	24	0.002

Control group students' mean pre-test scores that they got from the achievement test administered at the beginning of the introduction to matter unit was found to be 54.28 and the mean post-test scores administered after the activities were found to be 61.20. The results of the dependent paired-samples t-test administered for the control group revealed that the pre-test-post-test scores belonging to this group were statistically different. The analysis results are statistically important ($p=0.002$; $p<0.05$). In other words, the control group's academic achievement is proportionately (%) not at the same level as the experimental groups who actualized writing to learn activities.

5. Conclusion

The effect of writing to learn activities (letter, summary, and poster) in introduction to matter unit, a science course in the fourth grade, on academic achievement was explored in this study. The experimental groups and the control group's ANOVA results related to the post test revealed a significant difference in favour of experimental groups ($p=0.000$; $p< 0.05$). It was found in the experimental groups who performed writing to learn activities that these writing activities made positive contributions to learning and the introduction to matter unit was learnt much better than the control group.

ANOVA results exhibited significant differences for retention in favour of experimental group ($p=0.000$; $p<0.05$). This result means that writing to learn activities provides retention of learned information.

When the experimental groups and control group's pre-tests and post-tests were compared, independent paired sample t-test results revealed that there were significant differences in all groups. The difference between the pre-test and post-test mean scores of the letter writing experimental group was found to be $p=0.000$; $p<0.05$. Considering the result obtained, it could be concluded that letter as a writing to learn activity increased the achievement in learning the introduction to matter unit. The difference between the summary writing experimental group's mean pre-test and post-test scores ($p=0.000$; $p<0.05$) exhibited that summary as a writing to learn activity had positive effects on students' learning. The difference between the poster preparing experimental group's mean pre-test and post-test scores ($p=0.000$; $p<0.05$) revealed that the students who prepared a poster as a writing to learn activity were academically more successful.

According to the dependent paired samples t-test results, the control group's mean pre-test scores were 54.28 and the mean post-test scores were 61.20 ($p=0.002$; $p<0.05$). Taking into consideration the control group students' mean pre-test and post test scores, it can be stated that the existing methods caused lower impacts on academic achievement when compared to the experimental groups who used writing to learn activities.

Moreover, the findings of this study which stated that writing to learn activities had positive effects in favour of experimental groups in terms of increasing academic achievement and providing retention reveal similarities with the results of the previous studies (Rivard & Straw, 1999; Mason & Boscolo, 2000; Günel, Uzoğlu & Büyükkasap, 2009; Yıldız, 2009; Özturan Sağırlı, 2010; Uzoğlu, 2010; Duymaz, 2011; Yıldız & Büyükkasap 2011a, 2011b, 2011c; Çontay, 2012; Koçak & Seven 2016; Uzun & Alev, 2013; Bozat & Yıldız, 2015; Karaçağıl & Kiriş Avaroğulları, 2017; Yıldız, 2014; Ünlü & Soylu, 2017; Tekin Aytaş & Uğurel, 2016; Yıldırım, 2016; Yıldız, 2016; Akçay & Baltacı, 2017; Yeşildağ Hasançebi, Koçak, Köksal & Seven, 2017; Ay, 2018).

References

Akçay, H. & Baltacı, A. (2017). Evaluation of writing to learn activities for teaching astronomy. *Mersin University Journal of the Faculty of Education*, 13(1), 138-151.

Ay, A. (2018). *Sosyal bilgiler öğretim programında öğrenme amaçlı yazma etkinliklerinden mektup ve şiir kullanımının öğrenci başarısına etkisi (Doctoral thesis)*. Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir (Tez No. 486539).

Bozat, Ö. & Yıldız, A. (2015). The Impact of letter as one of the writing to learn activities on achievement at fifth grade electricity in our life unit. *NWSA-Education Science*, 10 (4), 291-304. doi:10.12739/NWSA.2015.10.4.1C0648

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2013). *Scientific research methods*. Ankara: Pegem Yayıncılık.

Çontay, E. G. (2012). *The effect of journal writing in surface area and volume of geometric solids on achievement and geometry self-efficacy of 8th grade students (Master's thesis)*. Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir (Tez No. 469523).

Duymaz, N. (2011). *Hücre konusunun öğrenilmesinde öğrenme amaçlı yazma etkinliklerinin kullanımı ve analoji üretme (Master's thesis)*. Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir (Tez No. 290591).

Eker, C. & Coşkun, İ. (2012). The effect of writing course diaries on academic achievement of elementary school fourth grade students. *Journal of Social Sciences and Humanities Researches*, (29), 111-122.

Emig, J. (1977). Writing as a mode of learning. *College Composition and Communication*, 28(2), 122-128. doi: 10.2307/356095

Erduran Avcı, D. & Akçay, T. (2013) Teachers' views on writing activities in science and technology course. Journal of Turkish Science Education, 10 (2), 48-65.

Günel, M., Atila, M. E. & Büyükkasap, E. (2009). The impact of using multi modal representations within writing to learn activities on learning electricity unit at 6th grade. *Elementary Education Online.* 8(1), 183-199.

Günel, M., Uzoğlu, M., & Büyükkasap, E. (2009). Effects of using writing to learn activities on learning force unit in the primary education level. *Gazi University Journal of Gazi Education Faculty*, 29 (1), 379-399.

Günel, M., Kabataş Memiş, E., & Büyükkasap, E. (2010). Effects of the science writing heuristic approach on primary school students' science achievement and attitude toward science course. *Education and Science*, *35* (155), 49-62.

İnaltekin, T., Özyurt, B. & Akçay, H. (2012). Analysis of activities in elementary 6th, 7th and 8th grade science and technology textbooks. *Trakya University Journal of Education, 2*(2), 63-73.

Karaçağıl, C. & Kiriş Avaroğulları, A., (2017). The effect of using writing to learn activities in social studies on students' academic achievement. *International Journal of Innovative Research in Education*, 4(2), 54-59.

Koçak, G. & Seven, S. (2016). Prospective science teachers' opinions about writing to learn: the case of one-dimension motion. *Ekev Akademi Dergisi, 20* (65), 253-268.

Mason, L. (1998). Sharing cognition to construct scientific knowledge in school context: The role of oral and written discourse. *Instructional Science*, 26, 359-389. http://dx.doi.org/10.1023/A:1003103213786

Mason, L. & Boscolo, P. (2000). Writing and conceptual change. What changes? *Instructional Science,* 28**,** 199–226.

Özsevgeç, T. (2006). Kuvvet ve hareket ünitesine yönelik 5E modeline göre geliştirilen öğrenci rehber materyalinin etkililiğinin değerlendirilmesi. *Journal of Turkish Science Education, 3*(2), 36-48.

Özturan Sağırlı, M. (2010). The examination of the educational effects of some writing activities in the light of student opinions. *Educational Sciences: Theory & Practice*, 10 (4), 2521-2530.

Palamut, İ. (2008). *Hikâye okumanın ilköğretim öğrencilerinin yaratıcılık düzeylerine ve akademik başarılarına etkisi (Master's thesis)*. Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir (Tez No. 220346).

Rancière, J. (2015). *Le maître ignorant* (S. Kılıç, Trans.). İstanbul: Metis Yayınları.

Rivard, R. & Straw, S. (2000). The effect of talk and writing on learning science: An exploratory study. *Science Education, 84*, 566-593.

Tekin Aytaş, Ç. & Uğurel, I. (2016). The effects of an instruction practice based on the writing activities on students' learnings in a mathematics class. *Journal of Education and Social Sciences,* 211, 113-146.

Uluğ, F. (2004). *Okulda başarı: Etkili öğrenme ve ders çalışma yöntemleri.* İstanbul: Remzi Kitabevi.

Ungan, S. (2007). Development of and importance of writing skills. *Erciyes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 23*, 461-472.

Uzoğlu, M. (2010). *Öğrenme amaçlı yazma aktivitelerinin kullanımının ilköğretim seviyesinde kuvvet ve madde ünitesini öğrenmeye etkisinin araştırılması (Doctoral thesis)*. Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir (Tez No. 269319).

Uzoğlu, M. (2014). The Effects of diverse writing activities in learning on academic achievement, thinking skills, and laboratory attitudes of prospective science teachers: Giresun faculty of education sample. *The black sea journal of social sciences, 6*, 195-209.

Uzun, S. & Alev, N. (2013). The effect of reading and writing to learn activities enriched environments on students achievement. *Journal of Turkish Science Education*, 10(2), 138-154.

Ünlü, V. (2015). & Soylu, D. (2017). The effects of writing activities on students' achievement, attitudes and metacognition in mathematics course. *Gazi University Journal of Gazi Education Faculty*, 37 (1), 345-365.

Yeşildağ Hasançebi, F., Koçak, G., Köksal, A. P., & Seven, S. (2017). The Impact of writing for learning on learning modern physical science subject and students. *Journal of Bayburt Education Faculty, 12* (24), 649-666.

Yıldırım, Z. (2016). *Yazma etkinliklerinin ortaokul öğrencilerinin matematik başarılarına ve tutumlarına etkisi (Master's thesis)*. Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir (Tez No. 423760).

Yıldız, A. (2009). *College Students' Understanding Level of Quantum Physics and The Effect of Using Writing to Learn Activities on Academic Achievement (Doctoral thesis).* Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir (Tez No. 246914).

Yıldız, A. (2012). Letter as a writing to learn activity and the addressee. *Mevlana International Journal of Education (MIJE)*, 2 (2), 1-10.

Yıldız, A. (2014). Letter as a writing to learn activity and its effective use. *Turkish Studies*. 9 (5) Spring, 2097-2104.

Yıldız, A. (2016). Discussion of the effects of writing activities for learning purpose on the academic achievement of students at primary schools. *Turkish Studies*, 11(14), 861-870. http://dx.doi.org/10.7827/TurkishStudies.9665

Yıldız, A. & Büyükkasap, E. (2011a). Prospective teachers' levels of understanding Compton effect and the impact of writing activities for learning purposes on academic success. *Journal of Human Sciences*, 8(1), 1643-1664.

Yıldız, A. & Büyükkasap, E. (2011b). The Level of understanding of the photoelectric phenomenon in prospective teachers and the effects of writing with learning on their success rates. *Educational Sciences: Theory & Practice*, 11(4), 2259-2274.

Yıldız, A. & Büyükkasap, E. (2011c). Prospective teachers' levels of understanding Heisenberg uncertainty principle and the impact of writing activities for learning purposes on academic success. *Journal of Turkish Science Education, 8*(4), 134-148.