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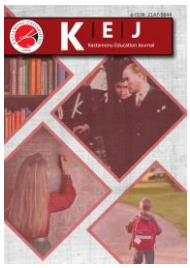

| Research Article / Araştırma Makalesi |

The Effects of Writing to Learn Activities on the 10th Grade on Teaching of Ecosystem Ecology

10. Sınıf Ekosistem Ekolojisi Konusunun Öğretiminde Öğrenme Amaçlı Yazma Aktivitelerinin Etkisi[1]

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Keywords
1.Writing to learn
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Abstract

Purpose: The aim of this study is to determine the effect of Writing to Learning (WTL) activities on learning in teaching the subject of Ecosystem Ecology, which is taught in the biology courses in the 10th grade of high school and to examine the course process carried out with WTL activities in terms of student views.

Design/Methodology/Approach: In the research, explanatory mixed research design, one of the mixed method research designs, was used. The study group of the research consists of 87 students studying in the 10th grade of a high school in the center of Bayburt in the spring term of the 2021-2022 academic year. As a data collection tool in the research; Preliminary Knowledge Test (PKT), Ecosystem Ecology Achievement Test (EEAT) and Interview Form (IF) were used. Shapiro-Wilk Test, one of the normality tests, was used in the analysis of quantitative data. Since the data obtained from both tests used in the study did not meet the normal distribution conditions, Mann-Whitney U and Kruskal-Wallis H tests were applied as non-parametric tests. On the other hand, content analysis method was used to analyze qualitative data.

Findings: As a result of the analysis of the data obtained from the EEAT, it was determined that the letter and the diary from the activities of WTL increased the success of the 10th grade students in Ecosystem Ecology. Considering the letter and diary from these activities, it was determined that the letter writing activity contributed more to academic success than the diary writing activity. According to the analysis of the data obtained from the IF, it was determined that the students' views on the WTL activities were positive.

Highlights: As a result of the results obtained from the findings, it is thought that it is important to support the use of WTL activities in secondary level biology courses to increase student outcomes.

Öz

Çalışmanın amacı: Bu araştırmanın amacı, ortaöğretim 10. sınıf biyoloji dersi içerisinde yer alan Ekosistem Ekolojisi konusunun öğretiminde Öğrenme Amaçlı Yazma (ÖAY) aktivitelerinin öğrenmeye etkisinin belirlenmesi ve ÖAY aktiviteleri ile yürütülen ders sürecinin öğrenci görüşleri açısından incelenmesidir.

Materyal ve Yöntem: Araştırmada karma yöntem araştırma desenlerinden açıklayıcı karma araştırma deseni kullanılmıştır. Araştırmanın çalışma grubu 2021-2022 eğitim-öğretim yılı bahar yarıyılında Bayburt Merkezde yer alan bir lisenin 10. sınıfında öğrenim gören 87 öğrenciden oluşmaktadır. Araştırmada veri toplama aracı olarak Ön Bilgi Testi (ÖBT), Ekosistem Ekolojisi Başarı Testi (EEBT) ve Görüşme Formu (GF) kullanılmıştır. Nicel verilerin analizinde normallik testlerinden Shapiro-Wilk Testi kullanılmıştır. Araştırmada kullanılan her iki testten elde edilen verilerin normal dağılım şartını taşımamasına bağlı olarak testlere non-parametrik testlerden Mann-Whitney U ve Kruskal-Wallis H testi yapılmıştır. Diğer taraftan nitel verilerin analizinde içerik analizi yönteminden faydalanılmıştır.

Bulgular: EEBT'den elde edilen verilerin analizi neticesinde ÖAY aktivitelerinden mektubun ve günlüğün 10. sınıf öğrencilerinin Ekosistem Ekolojisi konusundaki başarılarını arttırdığı belirlenmiştir. Bu aktivitelerden mektup ve günlük dikkate alındığında mektup yazma aktivitesinin günlük yazma aktivitesine oranla akademik başarıya katkısının daha fazla olduğu tespit edilmiştir. GF'den elde edilen verilerin analizine göre öğrencilerin ÖAY aktivitelerine ilişkin görüşlerinin olumlu olduğu belirlenmiştir.

Önemli Vurgular: Bulgulardan elde edilen sonuçlar neticesinde öğrenci çıktılarını arttırmak amacıyla, ortaöğretim seviyesi biyoloji derslerinde ÖAY aktivitelerinin kullanımının desteklenmesinin önemli olduğu düşünülmektedir.

[1] This study is based on the second author's thesis.

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INTRODUCTION

The age we live in is seen as an age in which individuals who can learn scientific knowledge, reconstruct what they have learned, develop scientific knowledge and skills, and accordingly use these skills when necessary, direct life and are considered as the age of science. Science can be defined as the ability to think correctly, to search for the right information, to use scientific methods to obtain systematic knowledge, to make the acquired knowledge usable and to make efforts to understand the universe objectively. The fact that individuals interested in science have developed observation skills, problem solving skills, critical thinking, ability to look at events objectively and decision-making skills, have characteristics such as learning, producing and reconstructing what they have learned throughout their lives, and maintaining their sense of curiosity throughout their lives is because science is not static, but rather changing and always open to change. Science starts with curiosity and continues with new discoveries. With the developments in our age, science and scientific studies have gained importance. Thus, learning science, eliminating the sense of curiosity and increasing the predisposition of school-age children to science, and ensuring the permanence of what is learned have led to an increase in the importance of different learning strategies. In these learning strategies, it is important for students to participate and be active in their learning. Writing, which is one of the most important learning strategies that have an important place in students' learning, is important in terms of evaluating products and processes (Emig, 1977). In this direction, the student's willing participation in learning in the process and his/her awareness of responsibility for the result obtained is an important result of writing. Yaman (2008) defines writing as transferring one's feelings, thoughts, experiences and many information that one has learned to others through a number of methods. Other important features of writing are changing one's ideas, organizing information and making it coherent (Rivard & Straw, 2000). Writing is a behavior learned by individuals (Emig, 1977). Moreover, writing involves a slow, simple and artificial process. Students' ability to apply their knowledge more easily is directly proportional to the development of their writing skills. As writing skills develop, thinking skills are controlled and learning becomes more meaningful and effective for minds that are active in this process. As a result, individuals succeed academically and in many other ways throughout their lives. Writing is a metacognitive activity that requires the individual to gain skills in many subjects and to have the ability to coordinate these skills (Can, İşleyen & Küçük-Demir, 2017; Walker, Shippen, Alberto, Houchins & Cihak, 2005). Moreover, writing is a learning tool that allows us to be aware of our thoughts and dreams about a subject we want to write about, and to synthesize our dreams (Graham, 2008). In this direction, recent studies have shown that writing and learning can be considered as a whole.

Writing provides permanent learning because it requires brain functions that involve activities that require the use of many parts of the brain together (Emig, 1977). The aim of ensuring permanence in science education has made it necessary to turn to activities in which the learner is active, aware of the process of receiving information, and can reshape the information rather than the traditional activities used in the education process. Hand, Prain, Lawrence, and Yore (1999) emphasized that writing activities to be used in science education should be writing activities in which students can combine their readiness with new knowledge, make different inferences when necessary, and develop their own learning skills in the light of new concepts. Writing activities can provide retention in science only in such cases. Because traditional approaches to writing in science involve practices in which teachers are active, teachers' lectures on the subjects in the textbooks, teachers' evaluations using the available resources, and students remain in the background and do not actively participate. This process is the process of copying information and does not attract the interest of students who have gained the ability to synthesize information (Yore, Bisanz & Hand, 2003). The aim of education is to enable students to use their cognitive functions at a high level, to participate actively in the process and to take responsibility for the products of the process. In this direction, WTL activities in which students can question and reconstruct their own learning in the process are one of the new approaches used in science education. In contrast to traditional writing practices, using WTL activities enables students to interpret information rather than receive it directly. In the related literature review, it is possible to acquire reading and writing skills in science education and many other disciplines through the implementation of WTL activities (Doğan & İlhan, 2016). This is supported by the fact that teachers in schools create learning environments suitable for WTL activities and ensure students' participation in these activities and that students form positive attitudes in the process. In order for teachers to be able to use the WTL activities, it is important that they have a good knowledge of the activities and therefore a good ability to implement them.

WTL activities, which ensure that students' learning is deep (Thompson, Pilgrim & Oliver, 2005), is a process in which students progress by exploring their own ideas and learning styles about the subject matter studied. Thus, in the learning process, students acquire the ability to identify problems and obtain new information (Beyer, 1982), problem solving skills and the ability to synthesize information. These activities make the student mentally free as the student who uses IWL activities will find the freedom to use their own thoughts and their own words (Yıldız, 2014). A student who feels free is not afraid of making mistakes and is always in search of innovation in an effort to find the truth. They work harder, learn more permanently and their self-confidence increases. Thus, the student's communication skills and determination to work increase (Tynjala, 1998). Nowadays, WTL activities are used in learning processes (Gunel, Hand & Gunduz, 2006). Considering the characteristics of WTL activities, it is thought that writing activities provide meaningful learning in the learning environment and long-term memory of the information learned (Bozat & Yıldız, 2015). WTL ensures that the ideas that people have are more grounded and more organized (Rivard & Straw, 2000). WTL ensures the continuity of knowledge (Klein, 2000; Rivard & Straw, 2000) and enables learners to learn new concepts without misconceptions. WTL facilitates the retention of knowledge (Karadağ & Öztürk, 2022; Öztürk, 2023; Öztürk, Öztürk & Işık, 2016a) by enabling people to examine knowledge in depth (Hand & Prain, 2002). When national and international

publications are examined, it is seen that WTL is widely used as a learning tool in learning environments where students personally participate in the learning process. Many studies have shown that WTL activities have an important role in students' retention and utilization of knowledge (Klein, 2000). It is seen that the learning of students who use WTL activities in lessons is positively affected and their imagination and creativity increase. Realizing that one has learned, realizing that one has the ability to learn creates a sense of perseverance and ensures continuity for the work one wants to accomplish. Thus, students' self-confidence and self-recognition skills improve (Biber, 2012). Considering the characteristics of writing, the writing mentioned in education is not the direct writing of what the student hears in the lesson, but the originality of the products formed as a result of writing. The content of writing that has been used since ancient times includes activities such as transferring exactly what is written on the board to the notebook, taking notes, summarizing what is explained, and unlike these, non-traditional writing activities are learning tools such as poems, songs, concept maps, letters, diaries, and posters (Biber, 2012). These writing activities are learning processes that provide students with permanent learning and allow students to freely express their ideas. When these features are taken into account, it is understood why writing is preferred by all disciplines. In all disciplines, the aim is for students to actively participate in learning processes and for what is learned to be permanent. Undoubtedly, science, which is one of these disciplines, is divided into three disciplines at the secondary education level, each of which is basically common but different in particular. Biology, one of these three science disciplines, is a discipline that studies living things as a science. Therefore, all changes and developments in biology also affect human life. It is very important to learn biology well, to retain and structure what is learned. Since biology is a verbal and Latin-oriented course, ensuring retention in biology lessons, reinforcing the information learned, adapting it to new situations and eliminating misconceptions depend on the quality of teaching activities and activities used in classroom environments. Apart from classical teaching models, learning models in which students actively participate in the process, experience excitement in learning and are able to restructure their knowledge attract attention. Accordingly, teaching is a process in which the student is an active recipient of knowledge and interacts with teachers, peers and experts in this process. Such a process requires the student to be at the center of learning experiences (Whitsed, 2004). The concepts that students use in biology lessons or the meanings that are embedded in their minds may be different from the meaning that the concept actually has in biology. It is important for the biology course that these misconceptions in students' minds are replaced with correct concepts and that their concept learning is correct and permanent. It is also important for students to be active in learning biology and to feel responsible for this learning process in terms of their self-confidence. This study was planned considering the importance of using writing activities, which is one of the new learning methods, in teaching the Ecosystem Ecology subject in the biology course curriculum and learning the concepts related to the subject correctly. Because the subject of Ecosystem Ecology is a subject that should be learned well because it is a subject that describes living things, living things and their environment, the nutrition of living things, the interaction of living things with each other in their nutrition, and the material cycles that are important for our nature and the world. The reason for the use of writing in this context is that writing is a different form of learning in that it allows students to reshape the information they learn through their mind filters. In addition, the active participation of students in the learning process and their cognitive and sensory development in this process make learning WTL activities important.

Experimental studies have shown that WTL facilitates students in learning knowledge, helps students to increase their self-confidence and contributes to their communication skills (Günel, Uzoğlu & Büyükkasap, 2009; Hohenshell, Hand & Staker, 2004). In addition, WTL enables students to actively participate in the learning process and to transfer the information learned not directly but structurally. Learned knowledge needs to be structured, used and transferred appropriately. In other words, knowledge is not to be used exactly as it is, but to be shaped and structured (Perkins, 1999). The most important feature that constructivism adds to education is that the learner does not directly use the information he/she receives, but reinterprets and restructures it in a new way. In constructivism, the individual is not a passive recipient, but a participant in the work, analyzing the information, reinterpreting the information and taking an active role in the process of reconstructing the information. It is emphasized that constructivist learning environments are open to innovations, teachers are guides, students do the work and are effective in giving shape and meaning to knowledge (Evrekli, İnal, Balım & Kesercioğlu, 2009). WTL activities are student-centered activities based on constructivism and are important activities in increasing the retention of learning and supporting meaningful learning.

When the national literature was examined, it was found that there were many studies in which WTL activities were used especially at the secondary school level. However, it is seen that there are a limited number of studies conducted in biology course, which is one of the high school disciplines. It is noteworthy that although the WTL activities are very effective, these activities are not given much space in our schools (Uzoğlu, 2014). It is foreseen that the use of WTL activities in the biology course is important in terms of students' learning and good management of the learning process in terms of having a student-centered structure and supporting meaningful learning. For this reason, it is thought that this study will contribute to the literature in terms of determining whether the WTL activities have a significant effect on students' learning about Ecosystem Ecology in biology course and revealing students' opinions about these activities. In addition, it is foreseen that the study will contribute to the literature and provide a different perspective since the WTL activities have been used very little in biology courses. In line with the results of the study, it is aimed to provide new information in addition to the studies conducted on letters and diary activities from the WTL activities. In addition, it is aimed to clarify what students think about these activities by taking the opinions of students who write letters and diaries for learning purposes. In this context, the study was planned to determine the effect of letter and diary activities, which are among the WTL activities, on learning in the teaching of Ecosystem Ecology subject in high school 10th grade biology course and to examine the lessons carried out with WTL activities in terms of students' opinions. In this direction, the research investigates the answers to the following two questions:

1. Do WTL activities have a significant effect on students' academic achievement?
2. What are the opinions of the students about WTL activities?

METHOD/MATERIALS

Research Design

In this study, explanatory mixed research design from mixed method approaches was used. The explanatory mixed research design is a research design in which quantitative data obtained in the first phase of the study are processed and then qualitative data are collected to analyze the data in depth based on these data (Creswell, 2016; Creswell & Plano-Clark, 2014). In this study, since it was aimed to determine the effect of conducting the 10th grade biology course "Ecosystem Ecology" subject with IWL activities on students' academic achievement and to evaluate the course conducted with IWL activities according to students' opinions, explanatory mixed research design was adopted because it was thought to serve the purpose better.

Research Group

The study group of the research consists of 87 students studying in the 10th grade of a high school in Bayburt Center in the spring semester of the 2021-2022 academic year. In the selection of the study group, the convenience sampling method, one of the non-random sampling methods, was used. In convenience sampling method, the researcher selects the sample group in the most accessible situation and in a way to provide maximum savings (Cohen & Manion, 1998; Ravid, 1994). Since this study was conducted in the school where one of the researchers was working and in the classrooms where he was conducting the biology course, the convenience sampling method was preferred in accordance with the nature of the study. Two of the study groups, consisting of 3 classes in total, were determined as the letter experimental group (LEG) in which the letter was applied and the diary experimental group (DEG) in which the diary was applied. The last group was determined as the control group (CG) in which the current program was carried out, i.e. no WTL activities were implemented. Table 1 shows the demographic information of the students in the experimental and control groups.

Table 1. Demographic characteristics of the experimental and control groups

Groups	Female	Male	Total
LEG	12	17	29
DEG	10	18	28
CG	13	17	30

In addition, in order to realize the qualitative dimension of the research, interviews were conducted with a total of 14 students, 7 from the MDG and 7 from the GDG, taking into account that their gender and achievement status were different from the experimental groups.

Data Collection Tools

Preliminary Knowledge Test (PKT), Ecosystem Ecology Achievement Test (EEAT) and Interview Form (IF) were used in the study. The processes related to the development of the data collection tools are detailed below.

Preliminary Knowledge Test (PKT)

The PKT, which was developed to determine the prior knowledge of the students in the study group and whether the achievement levels of the study groups were equivalent, was created by the researchers by taking the 9th grade curriculum into consideration. In the first stage, the PKT was composed of 30 multiple-choice questions with five options in the form of four distractors and one correct answer. The prepared questions were checked by three experts, two biology educators and one science educator. According to the feedback from the experts, it was determined that the questions were appropriate and in the last stage, the PKT was checked by a language expert and finalized. The pilot application of the PKT was conducted with 63 students enrolled in 10th grade who had previously studied the 9th grade curriculum and were independent from the study group. As a result of the pilot application, 10 questions with low item difficulty were removed from the test and the number of questions was reduced to 20. Finally, the KR-20 reliability coefficient of the PKT was found to be .724. This reliability coefficient indicates that the reliability of the PKT is high (Gürbüz & Şahin, 2014). Each question in the PKT has a score value of 5 and the maximum score that can be obtained from the test is 100.

Ecosystem Ecology Achievement Test (EEAT)

At the end of the implementation process, the EEAT, which was used to control the academic achievement of the students in both experimental and control groups, was created by the researchers by considering the 10th grade Ecosystem Ecology acquisitions. In the first stage, the EEAT was composed of 30 multiple-choice questions with five options in the form of four distractors and one correct answer. The prepared questions were checked by three experts, two biology educators and one science educator. According to the feedback from the experts, it was determined that the questions were appropriate and in the last

stage, the EEAT was checked by a language expert and finalized. The pilot application of the EEAT was applied to 65 students enrolled in 11th and 12th grades who had previously studied 10th grade Ecosystem Ecology. As a result of the pilot application, 5 questions with low item difficulty were removed from the test and the number of questions was reduced to 25. Finally, the KR-20 reliability coefficient of the EEAT was found to be .789. This reliability coefficient shows that the reliability of the EEBT is high (Johnson & Christensen, 2014). Each question in the EEBT has a point value of 4 and the maximum score that can be obtained from this test is 100. This reliability coefficient shows that the reliability of the EEAT is high (Johnson & Christensen, 2014). Each question in the EEAT has a point value of 4 and the maximum score that can be obtained from this test is 100.

Interview Form (IF)

After the implementation was completed, the IF, which was created to obtain the opinions of the experimental group students about the WTL activities, was a semi-structured interview and consisted of six questions. While preparing the IF, studies in the literature were utilized and the developed IF was presented to two researchers who are experts in WTL and their expert opinions were sought. As a result of the feedback from the experts, it was concluded that the questions in the IF served the purpose of the study. In the IF, before the interview questions, there is an instruction to provide information to the students who will participate in the interview about the purpose of the form. Before starting the interviews, the researcher read the instructions to the students participating in the interviews. The interviews were conducted in the school environment in order to utilize a voice recorder to record the interviews and for the students to participate in the interviews in a comfortable environment. Before the interview, the students were told that the transcripts obtained from the voice recordings would be kept confidential and that their names would not be mentioned in the study in any way. The names of the students were coded as L1, L2, ... and D1, D2...

Data Analysis

The quantitative data obtained from the PKT and EEAT were analyzed using the SPSS-22 program. In order to decide which test to use in the analysis of the data, it was first checked whether the data showed a normal distribution. Accordingly, necessary normality tests were performed on the data. Since the number of students in LEG, DEG and CG was less than 50, the results of Shapiro-Wilk test (Büyüköztürk, 2016) were taken into consideration for normality analysis. The process of analyzing all data collection tools is explained in detail below.

Analysis of the data obtained from the PKT

As a result of the normality test of the data obtained from the PKT, p=.042 for LEG, p=.207 for DEG and p=.025 for CG. Since p<.05 for two of the groups, it was determined that the data distributions of the groups were not suitable for normal distribution according to .05 significance level. Therefore, Kruskal-Wallis H Test was used to compare the experimental and control groups. The relevant results are presented in the form of tables in the findings section and interpreted.

Analysis of the data obtained from the EEAT

As a result of the normality test of the data obtained from the EEAT, p= .001 for LEG, p=.001 for DEG and p=.115 for CG. Since p<.05 for two of the groups, it was seen that the data distributions of the groups were not suitable for normal distribution according to the .05 significance level. Therefore, Kruskal-Wallis H Test / Mann-Whitney U Test was conducted and the relevant results were presented in the form of tables in the findings section and interpreted.

Analysis of the data obtained from the IF

The audio recordings of the interviews were digitized at the end of the interviews and then transcribed with a detailed analysis. The content analysis method was used in the analysis. In this analysis method, data are first collected and codes and categories are created, the data obtained are synthesized and interpreted by the researchers, the similarities among the data are grouped under similar codes and categories so that the interlocutor can read, understand and interpret them (McMillan & Schumacher, 2010). With the analysis of the data obtained in this direction, codes were first extracted, and then similar codes (if any) were brought together to form categories. The researchers repeated this process several times. Then, the consistency between the researchers in the codes and categories created was examined with Miles and Huberman's (1994) inter-rater consistency formula. Using Miles and Huberman's (1994) formula, the consistency between raters was calculated as 86%. The structured categories and codes are presented and explained in the findings section in the form of tables.

Implementation Process

The study was conducted with 10th grade students in a high school in the center of Bayburt in the spring semester of the 2021-2022 academic year. There were three groups in the study, one control group and two experimental groups. Before starting the implementation, all groups were administered the PKT. In addition, the experimental groups were informed about the WTL activities. The subject of Ecosystem Ecology was taught two hours a week for 6 weeks with the same teaching method in the study groups. While the lectures were conducted with the help of slide presentations, this process was supported by question-answer,

lecture and test-solving techniques. Unlike the control group, one of the experimental groups was asked to write letters to the 9th grade students at the end of each lesson in line with the WTL activities. In the other experimental group, a diary was kept at the end of each lesson in line with the WTL activities. At the end of the teaching process, the EEAT was administered to all groups as a post-test in order to see the effect of WTL activities on student achievement. In addition, semi-structured interviews were conducted with 14 of the experimental group students (7 students from the LEG and 7 students from the DEG).

FINDINGS

In order to answer the research problem, this section presents the results of the analysis of the data obtained from PKT, EEAT and IF. While explaining the findings, the findings obtained from the data collection tools were presented under separate headings and interpretation of the findings was tried to be made.

Findings obtained from the PKT

The Kruskal-Wallis H Test results of the data obtained from the PKT scores of the research groups are presented in Table 2.

Table 2. Kruskal-Wallis H test analysis results of PKT scores of the research groups

Groups	N	Main Rank	df	X^2	p
LEG	27	49.72			
DEG	27	34.76	2	5.214	0.074
CG	30	42.97			

As seen in Table 2, since the calculated significance value was p>0.05, there was no significant difference between the SCT scores of the research groups (X^2(2, N=84)=5.214; p=0.074).

Findings obtained from the EEAT

The Kruskal-Wallis H Test results of the data obtained from the EEAT scores of the research groups are presented in Table 3.

Table 3. Kruskal-Wallis H test analysis results of EEAT scores of the research groups

Groups	N	Main Rank	df	X^2	p	significant difference
LEG	27	63.56				*DEG-CG
DEG	27	37.07	2	31.675	0.001	*LEG-DEG
CG	30	28.43				*LEG-CG

Table 3 shows that there is a significant difference between the EEAT scores of the research groups since the calculated significance value is p<0.05 (X^2(2, N=84)=31.675; p=0.001). Mann-Whitney U Test was used to determine which of the research groups this significant difference was between. In this direction, it was determined that there was a significant difference between LEG and CG in favor of LEG (p=0.001), between DEG and CG in favor of DEG (p=0.03) and between LEG and DEG in favor of LEG (p=0.001).

Findings obtained from the IF

In the post-implementation interviews with the sample groups who wrote letters and diaries and whose opinions were obtained about the activities of WLM, the students were first asked the question "What comes to your mind when you think of writing activities?". The codes obtained from the students' responses are given in Table 4.

Table 4. Students' perceptions of writing activities

Groups	Code	Student	Frequency
LED	Activity that provides permanency	L_1, L_2, L_3	3
	Transferring information to paper	L_1, L_6	2
	Transferring ideas and thoughts to writing	L_3, L_5	2
	Activity that provides repetition	L_2	1
	Writing letters and diaries	L_3	1
	Literary genre	L_4	1
	Doing homework (summarizing)	L_7	1
DEG	Writing diaries, poems and letters	D_2, D_3, D_6, D_7	4
	Activity that provides permanency	D_3, D_5	2
	Activity that provides repetition	D_1	1
	Activity that provides reinforcement	D_4	1
	Learning by writing	D_5	1

Table 4 shows that students' perceptions of the writing activity were represented by seven different codes in LEG and five different codes in DEG. It was determined that 3 students perceived writing as an activity that provides permanency, 2 students perceived it as transferring information to paper, 2 students perceived it as transferring ideas and thoughts to writing, and 1 student each perceived it as an activity that ensures repetition, letter and diary writing, literary genre and doing homework (summarizing) in LEG. In the DEG, it was determined that 4 students perceived the writing activity as writing diaries, poems and letters, 2 students perceived it as an activity providing permanency, 1 student each perceived it as providing repetition, providing reinforcement and learning by writing. When the table is analyzed, it is seen that among students at LEG, students coded L_1 and L_2 have 2 different opinions, student coded L_3 has 3 different opinions and students coded L_4, L_5, L_6 and L_7 have one opinion when it comes to writing activity. When it comes to writing activity, it is seen that among students at DEG, students coded D_1, D_2, D_4, D_6 and D_7 have 1 opinion, while students coded D_3 and D_5 have 2 different opinions. Some of the codes expressed by the students are given below:

The student coded L_2 stated that writing is to transfer information permanently and to keep it in mind by repeating it with the following sentences:

When I think of writing activities, I think of transferring the information that I have learned permanently and keeping it in my mind by repeating it, in other words, not forgetting it. I think it is very true what they say that words fly and writing remains (L_2).

The student coded L_3 stated that writing is an activity that provides permanence, transferring ideas and thoughts to writing, and writing letters and diaries with the following sentences:

The activity of writing allows us to convey our ideas, opinions or curiosities about any subject by researching and transferring them through certain methods, such as letters or diaries, in other words, through different methods and ensures permanence (L_3).

The student coded D_3 stated that writing is transferring information permanently and writing diaries and letters with the following words:

When I think of writing activities, I think of activities such as letters, diaries, etc. that ensure permanence (D_3).

The student coded D_5 stated that writing is an activity that provides permanence and learning by writing with the following words:

When I think of writing activities, I think of retention and learning through writing (D_5).

The second question asked to the students in the interviews was; "What are the writing activities you use in biology lessons? What are your thoughts about these activities?". The codes extracted from the students' responses to this question are presented in Table 5 and Table 6.

Table 5. Students' views on the types of writing that they use in biology courses

Groups	Code	Student	Frequency
LEG	Letter	L_1, L_2, L_3, L_4, L_5, L_6, L_7	7
	Poem	L_2, L_3, L_5, L_6	4
	Diary	L_3, L_4	2
	Note-taking	L_1	1
DEG	Diary	D_1, D_2, D_3, D_4, D_5, D_6, D_7	7
	Poem	D_5, D_7	2

When Table 5 is taken into consideration, it is seen that students' views on the types of writing they use in biology lessons are gathered in 4 different codes in LEG and 2 different codes in DEG**.** All 7 students in LEG expressed letter writing; students coded L_2, L_3, L_5 and L_6 expressed poem writing; students coded L_3 and L_4 expressed diary writing; and student coded L_1 expressed note-taking. All 7 students in the DEG expressed diary writing, and students coded D_5 and D_7 expressed poetry writing in terms of the types of writing they used in biology lessons. Some of the codes expressed by the students for this question are given below.

The student coded L_2 expressed his/her views that the types of writing they used in biology lessons were writing letters and poems with the following sentences:

We wrote letters and poems in the second semester. We wrote letters to the 9th graders in the first semester and it was good. It was quite fun and we transferred our knowledge (L_2).

The student coded L_4, who stated that they used both letter and diary as a type of writing in biology lessons, expressed her opinion in the following sentences:

We had activities such as letter writing and diary writing. These activities made our learning more permanent (L_4).

The student coded D_2 expressed his/her views that the type of writing they use in biology lessons is diary writing as follows:

In biology lessons, we wrote a diary and in this diary we covered the topic of ecosystem ecology and I benefited from this writing activity, my writing skills improved (D_2).

The student coded D_7 stated that he did poem and diary activities as follows:

In the first semester, we wrote a poem about a topic, and in the second semester, we did a diary writing activity after each lesson (D_7).

Table 6. Students' views on the writing activities they use in biology courses

Groups	Code	Student	Frequency
LEG	Preparing for exams	L_2, L_6	2
	Fun activity	L_2, L_7	2
	Providing permanency	L_4, L_6	2
	Eliminating misconceptions	L_3	1
	Enabling learning	L_1	1
	Activating visual memory	L_4	1
	Way to obtain knowledge	L_5	1
	Facilitating learning	L_6	1
DEG	Providing permanency	D_3, D_5	2
	Eliminating misconceptions	D_1, D_3	2
	Improving writing	D_2	1
	Meaningful learning way	D_3	1
	Providing concept change	D_1	1
	Providing repetition	D_4	1
	Way to obtain knowledge	D_6	1
	Eliminating knowledge deficiencies	D_7	1

When Table 6 is examined, it is seen that the students' opinions about the letter, one of the writing activities they use in biology lessons, are represented by 8 different codes. 2 students from the LEG stated that letter writing helped them prepare for exams. While 2 students stated that letter writing is a fun activity, 2 students stated that it provides permanency, 1 student each stated that letter writing helps to eliminate misconceptions, enables learning, activates visual memory, is a way of obtaining knowledge and facilitates learning. On the other hand, it is seen that the opinions of the students in the DEG about the diary, one of the writing activities they use in biology lessons, are represented by 8 different codes. It is seen from the table that 2 students each stated that the diary provides permanency and eliminates misconceptions, 1 student each stated that the diary improves writing, that the diary is a way of meaningful learning, that it provides concept change and repetition, that it is a way of acquiring knowledge and that it is a way of eliminating knowledge deficiencies. Some of the codes expressed by the students for this question are given below.

The student coded L_3 stated that the letter writing activity helped to eliminate misconceptions as follows:

Through these activities, we actually cleared our misconceptions and learned the real meanings of the terms we knew wrongly (L_3).

The student coded L_4 stated that writing letters increased retention with the following sentences:

I think I achieved more permanent learning through the letter writing activity. Because writing activates visual memory and writing is a more effective learning method than verbal memory (L_4).

The student coded D_1 explained that journal writing provides concept change and is a way to eliminate misconceptions as follows:

We kept a diary in biology lessons. After the lesson, we write a summary of the subject, we can both change our thoughts on this subject and we can eliminate misconceptions. This is healthier for us (D_1).

The student coded D_2 stated that daily writing improves writing with the following sentences:

In the diary we wrote in biology class, we did a study on ecosystem ecology. This study improved my writing skills (D_2).

The third question asked to the students in the interviews was; “Have you ever used the letter and diary writing activity used during the Ecosystem Ecology subject in any lesson before?”. The codes extracted from the students' responses to this question is presented in Table 7.

Table 7. Students' views on whether they have used the letter/diary writing activity before

Groups	Code	Student	Frequency
LEG	No, not used	L_1, L_2, L_3, L_4, L_5, L_6, L_7	7
DEG	No, not used	D_1, D_2, D_3, D_4, D_5, D_6, D_7	7

When Table 7 is analyzed, it is noteworthy that all 14 students interviewed stated that they had not used the letter and diary writing activity in any lesson before.

The student coded L_3 expressed his views that they had not used the letter writing activity in any lesson before with the following sentences:

We had not used it in any lesson before and it was useful for us to use it in the biology lesson. We did this activity before the exams, so it helped us understand our subjects. Since we wrote by narrating, it was more permanent in our brains and it was useful (L_3).

The student coded D_7 expressed his views on this issue as follows:

No, we didn't. Since biology is a detailed course that sometimes requires memorization, the activities helped us a lot (D_7).

The fourth question asked to the students in the interviews was; “What do you think about the writing activities done while studying Ecosystem Ecology? What do you think about the contribution of letter and diary writing activities to your learning? Do you think these activities can be a learning tool for you? Why?”. The findings obtained from the analysis of the students' responses to these questions are presented as codes in Table 8 and Table 9 and as categories and codes in Table 10.

Table 8. Students' views about the letter/diary writing activity on ecosystem ecology

Groups	Code	Student	Frequency
LEG	Mind-developing activity	L_1, L_4	2
	Providing permanency	L_1, L_2	2
	Increasing work efficiency	L_5, L_6	2
	Adding our own interpretation	L_1	1
	Refreshing information	L_2	1
	Ensuring regular repetition	L_7	1
	Learning to write a letter	L_3	1
	Multiple working method	L_4	1
DEG	Providing permanency	D_1, D_3, D_5	3
	Increasing academic achievement	D_3, D_5, D_7	3
	Providing repetition	D_4, D_7	2
	Increasing knowledge acquisition	D_6, D_7	2
	A way to learn new subjects	D_1	1
	Ensuring good self-expression	D_2	1
	Improving writing skills	D_2	1

When Table 8 is examined, it is seen that 2 students each in LEG stated that letter writing is a mind-developing activity and that it helps to increase permanency and study efficiency, and 1 student each stated that adding their own interpretation, refreshing information, regular repetition and letter writing support learning. Again, 1 student evaluated the letter writing activity as a studying method. When the table is examined, it is seen that students' opinions about the diary writing activity they did on Ecosystem Ecology are represented by 7 different codes. Three students each participating in the interviews stated that the diary was an activity that increased permanency and academic achievement. Two of the students stated the diary as an activity that provides repetition and two of them stated it as a method to increase knowledge acquisition. 1 student each evaluated the diary as a way of learning new subjects, a way of expressing oneself well and a method of improving writing skills. Some of the codes expressed by the students for this question are given below.

The student coded L_1 stated that the letter writing activity was a mind-developing activity, ensuring permanency and adding our own interpretation as follows:

It is very useful, it develops one's mind. It also makes what we learn permanent, and if we repeat it once, we don't need to study because it is permanent. Since we write it down, it becomes more permanent (L_1).

The student coded L_2 stated that the letter writing activity provided permanency and refreshing information with the following sentences:

We refreshed our knowledge every week by writing letters. Our knowledge became permanent because of the repetition we did every week. Since we started studying for the exams 4 to 5 weeks in advance instead of one day in advance, the grades we got were high. We also received very productive feedback from the activities we did (L_2).

The student coded D_3 stated that the daily writing activity provided permanency and increased academic achievement as follows:

It was a very good learning method. We got higher grades in the exams and the meanings of the words we learned stayed in our minds more. Since we combined learning by writing with diaries, we described the events or topics in our own words as if we had lived them. This helped us learn better (D_3).

The student coded D_6 stated that the daily writing activity increased knowledge acquisition with the following sentence:

This activity helped me to gain more knowledge in my learning process (D_6).

Table 9. Students' views on the contribution of letter/diary writing activity to their learning

Groups	Code	Student	Frequency
LEG	Providing permanency	L_1, L_2, L_6	3
	Supporting exam grades	L_1, L_5	2
	Providing repetition	L_2, L_5	2
	Enabling homework	L_7	1
	Enabling concept learning	L_6	1
	Reinforcing learning	L_5	1
	Supporting understanding of subjects	L_3	1
	Supporting the use of audio-visual and writing skills	L_4	1
DEG	Providing permanency	D_2, D_5	2
	Ensuring good self-expression	D_2, D_3	2
	Supporting understanding of subjects	D_1	1
	Improving writing skills	D_2	1
	Ensuring understanding of what is written	D_4	1
	Eliminating knowledge deficiencies	D_7	1
	Prompting to think	D_6	1

Table 9 shows that students' opinions about the contribution of letter writing activity to their learning are represented by 8 codes. It is noteworthy that 3 students who participated in the interviews in LEG stated that the letter supported learning by providing permanency, 2 students by supporting the increase of exam grades, 2 students by repeating, 1 student by doing homework, 1 student by enabling concept learning, 1 student by reinforcing learning, 1 student by supporting understanding of subjects and finally 1 student by supporting the use of audio-visual and writing skills. It is also seen in Table 9 that the views of the students in the DEG are represented by 7 codes. It is seen that 2 students each who participated in the interviews in the DEG stated that diary writing supported their learning by providing permanency and better self-expression and 1 student each stated that it supported their learning by enabling them to understand the subject, improve their writing skills, understand what is written, eliminate their knowledge deficiencies and encourage them to think. Some of the codes expressed by the students for this question are given below.

The student coded L_1 stated that the letter writing activity provided permanence and supported the exam grades as follows:

Letter writing activity ensures receptivity, makes our learning realistic and helps us to get high grades in exams (L_1).

The student coded L_3 stated that the letter writing activity helped to understand the subjects as follows:

With the letter writing activity, we learned how to write a letter. It also made great contributions to our understanding of our subjects. Therefore, it was a very good experience for me (L_3).

The student coded D_2 stated that the diary writing activity improved his/her writing ability and enabled him/her to express himself/herself well as follows:

Diary writing activity improved my writing skills. Thus, it enabled me to express myself better in the literature course and in other courses where I use writing (D_2).

The student coded D_4 stated that the diary writing activity enabled her to understand what was written as follows:

The diary writing activity obviously made a positive contribution to me in terms of understanding what I wrote. Because what is usually written stays in my mind when I rewrite it. In addition, since this writing was in the form of reconstruction, I benefited much more (D_4).

Table 10. Students' views on whether the letter/diary writing activity is a learning tool

Groups	Category	Student	Frequency	Code	Student	Frequency
LEG	Yes, it is a learning tool	L_1, L_2, L_3, L_4, L_5, L_6, L_7	7	Non-classical way of learning	L_3, L_4	2
				Providing permanency	L_1, L_6	2
				Providing activism	L_3	1
				Providing repetition	L_2	1
				Providing summarization	L_7	1
				Providing reinforcement	L_5	1
DEG	Yes, it is a learning tool	D_1, D_2, D_3, D_4, D_5, D_6, D_7	7	Providing permanency	D_1, D_3, D_4, D_6, D_7	5
				Ensuring learning-comprehension by writing	D_4, D_5	2
				Using your own sentences	D_3	1
				A way to express yourself well	D_2	1
				Providing repetition	D_1	1

When Table 10 is analyzed, it is seen that the students' views on the question “Do you think this activity can be a learning tool for you?” are gathered in 1 category in LEG and DEG. Moreover, students' views are represented by 6 different codes in LEG and 5 different codes in DEG. It was determined that 2 students each in LEG stated that the letter was a learning tool because it provided non-classical learning and permanency. It is seen that 1 student each in LEG indicated that the letter can be a learning tool because it provides activity, repetition, summarizing and reinforcement. On the other hand, it is seen that 5 of the students in the DEG evaluate the diary as a learning tool because it provides permanence. Two students in DEG evaluated the diary as a learning tool because it enables learning-comprehension through writing. One student each in the GDG evaluated the diary as a learning tool because it enabled them to use their own sentences, to express themselves better and to repeat. Some of the codes expressed by the students for this question are given below.

The student coded L_4 stated that such activities are different from the classical learning method as follows:

Of course it's a learning tool. It is not easy to learn and understand a lesson so well. We could have used normal classical learning methods, but our learning was better because we used this non-classical method (L_4).

The student coded D_3 states that such activities ensure permanence and the use of their own sentences as follows:

It is definitely a learning tool. In fact, it should be used in every lesson, because we can learn better when we write. The topics and the information we learn become more permanent. Since we use our own sentences, we restructure and learn (D_3).

On the other hand, the student coded D_5 stated that these activities provided learning and understanding through writing as follows:

Yes, it can be a learning tool. Because with this activity, we realized better learning and understanding through writing (D_5).

The fifth question asked to the students in the interviews was; “Would you like activities such as letter/diary writing activities to be included in other biology courses? Why?”. The findings obtained from the analysis of the students' responses to this question are presented as category and codes in Table 11.

Table 11. Students' views on whether they would like to use activities such as letter/diary writing activity in other biology courses

Groups	Category	Student	Frequency	Code	Student	Frequency
LEG	Yes, I would.	L_1, L_2, L_3, L_4, L_5, L_6, L_7	7	Providing reinforcement	L_4, L_7	2
				The way to understand subjects	L_3, L_6	2
				Enabling concept learning	L_1	1
				Preparation for exams	L_2	1
				Providing permanency	L_1	1
				Providing visualization	L_4	1
				Learning by doing and experiencing	L_5	1

Groups	Category	Student	Frequency	Code	Student	Frequency
DEG	Yes, I would.	D_1, D_2, D_3, D_4, D_5, D_6, D_7	7	Providing permanency	D_1, D_2, D_3, D_4, D_5, D_6	6
				Providing repetition	D_1	1
				Facilitating learning	D_4	1
				Strengthening memorization	D_7	1

When Table 11 is examined, it is seen that the opinions of the students about whether they would like to use activities such as letter/diary writing activities in other biology courses were collected in a single category in both groups and represented by 7 different codes in LEG and 4 different codes in DEG. Two students each from LEG stated that they would like to use this activity because it provides reinforcement and is a way of understanding the subjects. In addition, 1 student expressed their desire to use the letter writing activity in other biology courses because it provides concept learning, retention of concepts, preparation for exams, visuality and learning by doing and experiencing. On the other hand, 6 students from DEG stated that they wanted to use diary writing because it ensures the retention of concepts. One student each from DEG justified their desire to use the diary writing activity in other biology courses because it supports repetition, facilitates learning and reinforces memorization. Some of the codes expressed by the students for this question are given below.

The student coded L1 stated that he/she wanted to use activities such as letter writing activities in other biology courses, based on the fact that these activities provide concept learning and increase the permanency of concepts as follows:

Of course I would like to. Because in some courses there are really too many concepts, too many subjects, too much information. I would like to use it in order to learn this information and concepts more fully and for the subjects to stay in our minds more (L_1).

The student coded L_3 expressed his/her desire to use such activities on the basis that they helped to understand the subjects as follows:

I definitely want it. Because it is a really useful way of learning. We both write letters and learn the subjects in a good way. If we want to increase our efficiency in other biology lessons, letter writing activities should be done (L_3).

On the other hand, the student coded D_3 expressed his/her desire to use the daily writing activity based on the fact that this activity provides permanency as follows:

I would definitely like to. Because it was more effective in our learning. This way we do not forget what we have learned (D_3).

The student coded D_7 stated that these activities reinforced memorization with the following sentences:

Yes, I do. Because it is a lesson that requires memorization, we strengthen our memorization by writing (D_7).

DISCUSSION AND CONCLUSION

In this study, the effect of these activities on students' academic achievement and students' views about the activities were examined as a result of teaching the 10th grade biology course subject “Ecosystem Ecology” with WTL activities. As a result of the research, it was determined that the implementation of the Ecosystem Ecology subject with WTL activities affected the retention of the subject compared to teaching it as specified in the curriculum. Therefore, it was determined that WTL activities have a positive effect on students' academic achievement and are an activity that improves self-confidence. When Table 2 is examined, there was no difference between the pre-test scores of the students in the groups participating in the study before starting the study. The reason why there was no significant difference between the groups in the pre-test scores is that the students acquired the acquisitions related to the items in the PKT in the 9th grade and the courses were conducted with the same curriculum. When Table 3 is examined, it is seen that while there is a significant difference in favor of the experimental groups in the post-test scores, the difference is especially high in favor of LEG. First of all, it can be said that this difference in the experimental and control groups is due to the activities implemented during the process. It can be said that the reason for the difference between the experimental groups in favor of the LEG students is that the students who wrote letters made an effort to write in a more explanatory way to the students in the lower group (younger), paid more attention for the students in the lower group to learn, chose the concepts they used more carefully in order not to make misconceptions, did research and tried to write by structuring the subject. In addition, the fact that MDG students felt themselves in the position of teachers and made efforts with this awareness had significant effects on both increasing students' self-confidence and permanency of the information learned. It can be said that the achievement scores of the students in the DEG were slightly lower than the students in the LEG because they talked about their own experiences while writing diaries and did not worry about teaching. One of the important situations in WTL activities is that students are active in the writing process, they reconstruct the concepts they have learned in their own minds and thus ensure permanency. Since the restructuring of knowledge in students' minds enables students to transform knowledge into new situations, internalize the subject matter, make their own evaluations and participate in the plot themselves, students can realize

meaningful learning. Considering such effects of WTL activities, it is natural that there is a difference in favor of the students in the experimental group. Considering the literature related to the research topic, it has been revealed in many studies that WTL activities used in science teaching have positive effects on students' academic achievement in science courses (Akçay & Baltacı, 2017; Bozat & Yıldız, 2015; Graham, Kiuhara & MacKay, 2020; Küçük-Demir & İşleyen, 2019; Hand, Hohenshell & Prain, 2007; Koçak & Seven, 2016; Öztürk, Kaymakoğlu & Demiroğlu-Çiçek, 2022; Pınar, 2019; Sinaga & Feranie, 2017; Wright et al., 2019; Villalon & Mateos, 2009). For example, in a meta-analysis study on WTL activities, Graham et al. (2020) point out that writing reliably enhances learning and facilitates learning. Again, when the literature is examined, the importance of the use of WTL activities in biology education, which is a science field, has been emphasized many times. For example, Hand et al. (2007) found in their study that 10th grade students' writing activities on cells and molecular biology topics increased learning outcomes in teaching difficult and complex topics that are new to students and require interest. Duymaz (2011), in his study aiming to determine the effect of using WTL activities for different interlocutors and creating analogies with WTL activities on the teaching of the cell topic, stated that WTL activities were effective in teaching the 9th grade cell topic. In addition, students who used WTL activities stated that they had a positive opinion on the use of these activities. In her study, Pınar (2019) investigated the effect of the diary, one of the WTL activities, on achievement and science attitude. As a result of the study, the researcher determined that students who used these activities were more successful than those who did not use them. On the other hand, Ödün-Başkıran (2022) found that the effect of the diary on students' learning outcomes was not significant in biology lessons supported by the diary, which is one of the WTL activities. However, the study emphasizes that lessons supported by diaries increase students' motivation, interest in the lesson, self-evaluation and teamwork skills. In this study, although it was seen that diary writing increased academic achievement compared to the classical method, it was determined that the diary was behind in increasing academic achievement compared to the letter. It can be said that the biggest factor in this situation is the nature of diary and letter writing. Because students who write diaries transfer their own feelings and thoughts to the diary within the framework of their own potential, while those who write letters tend to take more care to be more efficient because they write to their friends at a lower level. As a result of the literature review, the results in the study overlap with many studies. 10th grade Ecosystem Ecology subject by supporting it with WTL activities, especially contributing to the literature in order to compare the effects of the letter and daily activities used in the study on academic achievement reveals the importance of the study.

It is noteworthy that although all of the students who participated in the interviews stated that they had never used activities such as letter/diary writing before (Table 7), they gave positive feedback about WTL activities with this study. It was determined that students' perceptions of writing activities are repetition of writing, activities that provide permanence and reinforcement, and transferring thoughts to writing (Table 4). The knowledge gained during the implementation process and their own participation in the learning process may be effective in the students' perceptions towards the WTL activities. Because in this process, the knowledge acquired by the students is internalized, reshaped and presented by the students through their mind filters. Therefore, this situation caused the students to gain a positive perspective towards writing activities in the study. All of the students who participated in the interviews emphasized that the writing activities they use (letter and diary writing) can be used as learning tools (Table 10). The students base this emphasis on the fact that the activities used provide permanency, repetition, reinforcement and activity, and that they are a way of using their own sentences and expressing themselves. Moreover, when the students' views on the writing activities used and their contribution to their learning are considered (Table 8-Table 9), it is seen that important points are pointed out. At this point, students state that writing supports concept learning, helps them to understand the subjects, reinforces their learning, provides repetition, encourages them to think, helps them overcome their knowledge deficiencies, increases their academic success, develops their minds and increases their study efficiency. On the other hand, when the students' views on the types of writing used in biology lessons are considered, it is seen that they generally focus on the letter and diary used by the researchers in this study (Table 5). In addition, it is also seen that the students mentioned the poetry writing activity in which the researchers tried to ensure the participation of the students in order to make small practices for writing before starting this study. It is noteworthy that note-taking, one of the traditional writing practices, was also mentioned by a student. The results obtained in this section are important in terms of indicating that the practices created an awareness in students. Because when the relevant literature is examined, the first thing that comes to mind when it comes to writing activities are traditional writing practices such as note-taking, preparing an experiment report, and summarizing. When evaluated within the scope of this study, it is pleasing for researchers that students mainly expressed non-traditional writing practices as opposed to traditional writing practices. When the students' views on the writing activities they used in the biology course are taken into consideration, it is seen that they list the features of writing such as eliminating misconceptions, making learning permanent, meaningful and easier, and being a way of obtaining information (Table 6). It is noteworthy that all the students who participated in the interviews stated that the WTL activities contributed to their learning and expressed positive opinions about the activities. In addition, the students explained that they would like to use the WTL activities in other biology courses by mentioning the contributions of writing to their learning and the learning process (Table 11). There are many studies showing that the positive views of the students participating in the study regarding the SCM activities overlap with the relevant literature (Ay, 2018; Fry & Villagomez, 2012; Hand et al., 2007; İncirci & Parmaksız, 2016; Köksal, 2019; Öztürk et al., 2022; Öztürk, Öztürk & Işık, 2016b; Prain & Hand, 2016). For example, Ay (2018) emphasized that in his study with 5th grade students in which they carried out poetry and letter writing processes, which are among the WTL activities, students stated that they realized more meaningful and permanent learning through these activities. Similarly, İncirci and Parmaksız (2016), in their study on 11th grade students' views on letters

from WTL activities, pointed out that students found WTL activities important and thought that these activities contributed to their positive attitudes towards the course and thus to their success. In this sense, it can be said that the results of the study support the literature.

Ecosystem Ecology is an important topic in terms of conceptual knowledge in the 10th grade Biology course. However, Ecosystem Ecology is a subject which misconception may exist and learning outcomes may affect all grade levels. Therefore, it is important for biology teaching that learning in ecosystem ecology is permanent and without misconceptions. In this study, it was determined that in the teaching of Ecosystem Ecology subject, WTL activities supported students' meaningful learning and increased their academic achievement. Therefore, it is thought that it is necessary to expand the use of WTL activities in order to prevent students from making mistakes in teaching basic subjects such as Ecosystem Ecology and to increase learning outcomes.

RECOMMENDATIONS

Considering the results of the research, the following recommendations can be made:

- Since this study was limited to the topic "Ecosystem Ecology" in the 10th grade biology course and the activities of writing letters and keeping a diary, similar studies can be conducted at other grade levels, on different topics and using different WTL activities.

- Studies can be carried out in multiple experimental groups in order to make comparisons in order to compare the effects of WTL activities on academic achievement.

- Since WTL activities are student-centered, classroom environments can be created where classroom management is good and the course operation is well planned.

- Since the activities of WTL are based on writing, it is possible to work with branches related to writing in a more instructive way.

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The authors declare that there is no conflict of interest with any institution or person within the scope of the study.

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Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The authors contributed equally to all processes of the article. The authors have read and approved the final version of the article.

Ethics Committee Approval Information

The ethics committee document of this study was approved by the ethics committee decision of Bayburt University Rectorate dated 23.05.2022 and numbered 70389.

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