

Effect of Online Science Course Supported with Web 2.0 Tools on the Academic Achievement of Fifth Grade Students and Student Opinions

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ABSTRACT

This study aimed to investigate the effect of an online science course on the academic achievement of a fifth grade “World of Living” unit, which was carried out using the materials created with web 2.0 tools, as well as to determine the students’ opinions about the application. This study consisted of a total of 120 fifth grade students studying in state schools in Istanbul during the academic year of 2020–2021. In determining the study group, purposeful sampling methods were used. In the experimental group (n = 60), the course was taught with web 2.0 supported materials; in the control group (n = 60), instruction was made by adhering to the activities in the textbook. The research was carried out by making use of mixed method research. A quantitative quasi-experimental model with pre- and post-test control groups was used. In the qualitative dimension, opinions were obtained from the students after the application. In the study, semi-structured interview form and academic achievement test prepared for the unit of the world of living things were used as data collection tools. While the data obtained from the students to the achievement test before and after the application was transferred to a statistical package program and analyzed; the data obtained from the interview form were analyzed using content analysis. When the post-test academic achievement score data obtained from the students were compared as a result of the study, it was found that there was a significant difference in favor of the experimental group. In addition, result from the interviews, revealed that students found science teaching with web-supported materials fun and enjoyable and that they wanted these to be used in science lessons. As a result of this study, it is recommended that web 2.0 tools be used by educators in science education.

KEY WORDS: Academic achievement; distance education; fifth grade students; online education; science education; web 2.0 tools

INTRODUCTION

The COVID-19 outbreak emerged as a new type of coronavirus in China in December 2019 and affected countries around the world in a very short time. It has been declared a pandemic by the World Health Organization due to the increasing number of cases and death rates (WHO, 2020). The COVID-19 outbreak reached Turkey with the detection of our first case in March 2020. The coronavirus danger that the world faces has significantly affected health, economy, psychology, social life, and education services by creating a crisis in many areas (Yamamoto and Altun, 2020). This pandemic has also affected the education and training process and practices in many areas resulting in changes in educational activities.

Distance education was initiated in primary and secondary education institutions (MEB, 2020) and higher education institutions (YÖK, 2020) as a measure taken against this pandemic. Distance learning can be described as an interdisciplinary field that aims to ensure communication between educators, students, and learning resources using available technologies (Bozkurt, 2017). The approach to

education and interpretation style has also changed during the COVID-19 pandemic (Bozkurt and Sharma, 2020). As a result of the changes in the digital world and learning environments with the coronavirus pandemic, differences have emerged in education and its practices (Kırmızıgül, 2020). Distance education has forced students and teachers to leap forward in digitizing their educational processes and teaching practices, respectively. Suddenly, teaching has transformed from face-to-face classrooms into an online classroom. At this point, students and parents were required to turn to digital tools to continue their education (Livari et al., 2020).

In this pandemic period, it is important to design and develop digital teaching materials to make the education process efficient, attractive, and effective. Effective digital materials should be developed aiming to eliminate the decreasing interaction between students and teachers in distance education and to eliminate any possible deficiencies (Yalman and Başaran, 2018). It could be argued that a positive outcome of the current COVID-19 pandemic has been the catalyst for the effective use of digital devices, online resources, and e-learning activities (Mulenga and Marban, 2020). In support of this view, Angoletto and Queiroz (2020) emphasized the emergence

of technology in teaching in emergencies by stating that the digitization process is difficult. Because distance education is based on major information technologies, developments in the field of technology affect distance education (Öztürk, 2014). The careful and planned integration of technology, which continues to gain value in education and training, into learning environments creates an opportunity to enrich and motivate the learning environment.

Utilizing technology in education, facilitates understanding, enables concretization of concepts and easy access to information (Timur et al., 2020). During quarantine periods, students' access to activities that make their educational processes fun or enriching may affect students' psychology (Stewart et al., 2018). Therefore, there may be a very important benefit from different technologies in terms of making learning environments meaningful during the pandemic process. At this point, web 2.0 technologies are among the technologies that have high potential in providing the expected opportunities in the aforementioned learning environment (Aytan and Başal, 2015). Gürleroğlu (2019) emphasizes that web 2.0 tools are an innovation that adapts to the digital age in which students are present and allows the student to participate actively in the education process and emphasizes that they can shed light on the education process.

Web 2.0 tools, which have started to show themselves as modern course tools and materials, include many programs that are widely used. Horzum (2010) defines the concept of web 2.0 as an umbrella that contains tools that develop many applications. It is stated that web 2.0 applications are technology applications that keep up with the change and development in education, and they are encouraged to be used in education and training environments (Elmas and Geban, 2012). Magnuson (2012) states that web 2.0 tools can help students understand the concepts. Web 2.0 technologies provide students and teachers with many more opportunities such as organizing content, establishing access, communicating, creating a discussion environment, making presentations, structuring, shaping, and sharing information (Kocaman-Karoğlu, 2015; Smeda et al., 2012). Web 2.0 tools are expressed as user-friendly programs with easy-to-use features and they mediate students to become active individuals who can produce and question information (Elmas and Geban, 2012).

It is possible to say that the science course's emphasis on experimentation, observation, and visuality creates the need to integrate technology in science lessons to be held remotely. Efforts should be made to enrich science classes in terms of technology (Koç-Ünal and Şeker, 2020). Through the technology used in science education, it has been demonstrated with many studies that existing misconceptions have been eliminated and academic achievement has increased (Keleş et al., 2017; Kırınkaya and Şentürk, 2018; Koç-Ünal and Şeker, 2020; Ünal, 2017). Therefore, in this process where face-to-face education is interrupted, technology-supported education that will ensure the active participation of students should be

integrated into science teaching. For this reason, it is thought that it may be important to revise science education and create new curriculums when it comes to gaining the acquisitions included in the science course content in the suddenly changing educational conditions during the pandemic period. Supporting science teaching with web 2.0 tools and integrating it into science teaching programs will greatly benefit students' learning skills (Barak and Dori, 2011). With web 2.0 tools, digital stories, concept maps, concept cartoons, educational games, animations, educational videos, and evaluation tools can be created. In this context, it is evident that using web 2.0 tools in line with the objectives determined in science teaching can greatly contribute to the teaching process for both students and teachers. In the current study, digital story and digital educational game were created with the help of web 2.0 tools.

Digital Stories

One of the materials that can be designed from web 2.0 tools are digital stories, which are thought to have an important place in science teaching. Digital stories are known as teaching practices that contribute to students' learning with new teaching methods and can involve students in the process (Hung et al., 2012; Lowenthal and Dunlap, 2010). Many studies in the literature reveal that digital stories are an effective approach that can be utilized by educators in the teaching process (Baim, 2015; Kalogiannakis et al., 2017; Sancar-Tokmak et al., 2014; Gömleksiz and Pullu, 2017; Ulum and Yalman, 2018; Korucu, 2020). It is stated that digital stories are suitable for teaching material because they appeal to more than one sense and activate many skills (Kurudayıoğlu and Bal, 2014). As can be understood from the literature, use of digital stories is an effective teaching method. Programs using web 2.0 tools to create digital stories include: Pixton, story-bird, story-board that, tondo, etc., using existing web 2.0 tools, digital stories can be easily created during the education process. With Pixton, story-board that, and tondo programs, both teachers and stories can be prepared in the online environment in the way they want and within the framework of their purposes. Story-bird was used in this study as it is a simple and easy program that allows users to write their own stories (Karadağ, 2018).

Digital Games

Another of the educational materials that can be designed with web 2.0 tools are games. Educational digital games can be described as games that include cognitive, social, behavioral, and emotional areas and are prepared with technological tools for the desired goals (Çetin, 2013). Many studies show that digital games have contributed to the teaching process (Sabırlı, 2018; Majuri et al., 2018; Şahin, 2019; Dönmez Usta and Turan Güntepe, 2019). Korkusuz (2012) determined that educational games designed online are effective in understanding the concept of simple electrical circuits and were found to be fun by students. Dinçer (2019) revealed that digital educational games that contain analogies positively affect academic achievement in science. Programs utilized for creating digital educational games can be listed as Adobe Flash, Kodu game lab, Elektrogame, Scratch, etc. Scratch was used in the study

as it was created for the age range of 8–16. Scratch is a block-based programming language designed by the Massachusetts Institute of Technology Media Lab. (Kışla et al., 2019) and has been shown to affect positively the academic confidence of individuals (Demirer and Sak, 2016).

Science can be defined as a course with a wide range of topics in terms of its content and achievements. It includes the branches of biology, physics, and chemistry. This study focuses on the branch of biology included in the science course. In the field of biology, Duman and Avcı (2014) reported that secondary school students had misconceptions and lack of knowledge about the unit “World of the Living” in the science course content. It has been revealed that there are misconceptions regarding the classification of fungi, plants, vertebrate-invertebrate creatures, mammals and animals in other groups, and some students have difficulty learning this unit (Çetinkaya, 2010; Özdemir and Çalışkan, 2018; Aymen-Peker and Taş, 2020). In the science curriculum implemented in our country since the 2018–2019 academic years, it has included the “World of the Living” unit within the subject area “Creatures and Life” for the fifth grade (MEB, 2018). In this context, the aim to be gained by students is for them to be able to give examples of living things and classify them according to their similarities and differences. Along with the updated 2018 science curriculum, many changes have been made with the arrangement and enrichment studies made in the content of the “World of the Living” unit. Therefore, it would not be wrong to say that there are a limited number of studies on this subject in the literature. In a study, the effect of the biodiversity museum, which is an out-of-school learning environment in the 5th-grade “World of the Living” unit, on student achievement was investigated (Bolat et al., 2020). The effect of classification activities carried out by Kara (2020) using labels on students’ knowledge of classifying living things was determined similarly, Karamustafaoglu and Aksoy (2020) aimed to identify teachers’ views on educational games developed on the classification of living things. In a study where the effect of model-based learning was investigated, it was tried to determine the effect of microscopic creatures on students’ mental model development (Bozdemir-Yüzbaşıoğlu and Sarıkaya, 2018). In addition, Aymen-Peker and Taş (2020) aimed to reveal misconceptions about the “World of the Living” unit. Teaching materials designed with web 2.0 tools within the scope of the “World of the Living” is an area not included in the literature.

In the process of distance education, it will be important to maintain the productivity of individuals as in face-to-face education and to make online education more effective. At this point, online education may have to highlight the use of technology and indirectly, technology tools, and course materials that can be used by educators during the pandemic may need to be differentiated. The research outputs are expected to be a guide to science educators who aim to increase the quality of teaching by supporting science teaching to be carried out remotely and to use web 2.0 tools. It is also to

create a pedagogical framework for science educators aiming to improve the online education process and to encourage the meaningful use of web 2.0 technologies. Considering the misconceptions and lack of information in the “World of the Living” unit on the one hand, and the effect of creating it with web 2.0 tools in the online education process, the purpose of the study is shaped. Considering that the “World of the Living” unit could contribute to distance education in terms of being understood by students, it was decided to prepare web 2.0 tools using digital stories and games during the teaching of the unit. For this purpose, the study aimed to investigate the effects of digital stories and games created with web 2.0 supported tools on the academic achievement of the “World of the Living” unit at the fifth grade and to determine student views about the implementation.

Research Problem

For the study, the question “What is the effect of online science course supported by web 2.0 tools on the academic achievement and views of 5th grade students?” was determined as the main research question. The following sub-questions aimed to further investigate the context of the study:

1. What is the effect of online science course supported by web 2.0 tools on the academic achievement of 5th grade students?”
2. What are the opinions of the experimental group students about the materials developed with web 2.0 tools?”

METHODS

Research Design

In the study, quantitative and qualitative data were used together in a mixed-method design. The opportunity to examine the research questions from all sides is seen as one of the most important contributions of mixed-methods (Creswell and Clark, 2017). Mixed-methods design can be used to solve research problems that qualitative or quantitative studies cannot answer alone. In this study, students’ opinions were received to reveal the achievement scores quantitatively on one hand and to support the quantitative data on the other. In the literature, there are mixed-method patterns that can be used in different ways. In the present study, it was decided to use a descriptive sequential design, Figure 1.

When Figure 1 is examined, the research process regarding the descriptive sequential pattern used to reveal the reasons for the data obtained can be seen. In the study, first, quantitative data were collected using the achievement test determined within the scope of the research, and then the quantitative data obtained were analyzed. In the next process, qualitative data were collected through an interview, which is a qualitative data collection method, and data analysis was completed. The interpretation step was started by bringing together the findings obtained from both quantitative and qualitative data. After the interpretation process, the research results were presented.

Within the scope of mixed design, a quasi-experimental design with a pre- and post-test control group was used to determine

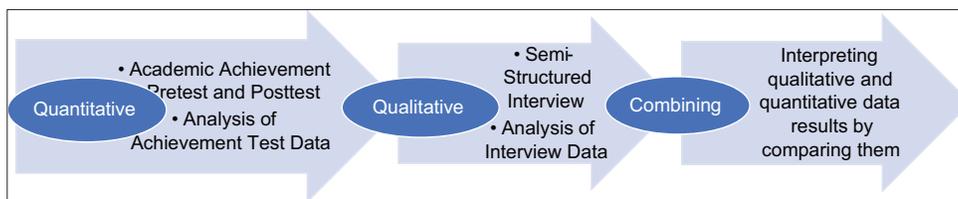


Figure 1: Descriptive sequential pattern used in the study

the effects of web 2.0-based materials. While the experimental group was conducted by subjecting to a different application process, the control group was carried out with the usual practices. The academic achievement test was applied to the experimental group and the control group before and after the lesson application. While explaining the “World of the Living” unit in the experimental group, while applying the story and game approaches created with web 2.0 tools; in the control group, direct expression, question, and answer approaches were used. Afterward, qualitative data were collected by conducting semi-structured interviews to support quantitative data. Besides, through the interviews with the experimental group students, students’ thoughts about the applications were taken about web 2.0 tools.

The participants in this research consisted of 120 fifth grade students of whom 56 were girls and 64 were boys studying at a public school in Istanbul in the 2020–2021 academic year (Table 1). Easily accessible sampling, which is one of the purposeful sampling types, was preferred in the study. Easily accessible sampling method brings speed and practice to the research (Yıldırım and Şimşek, 2013). The main goal of this sampling method is that the researcher can easily access the sample and collect data. While determining the students to be included in the study within the scope of this research, it has been taken into consideration that they will study the unit “World of the Living.” Half of the participants included in the study were in the experiment group, and the other half in the control group.

Instruments

Academic achievement test

In the study, the academic achievement test developed by Kasım (2018) for the unit “World of the Living” was used which includes 26 multiple-choice questions. Difficulties of achievement test items used in the research process vary between 0.32 and 0.86, while the average item difficulty is 0.65. The Cronbach alpha reliability coefficient value of the academic achievement test was 0.85. In addition, the average discriminatory effect of the test was 0.47, the discrimination of the test was high and it was effective in distinguishing between the knowing student and the unknowing student. Figure 2 for examples of questions in this test.

Student interview form

A semi-structured interview, developed by the researchers, was used as a qualitative measurement method. The interviews make it easier for the participants to explain their thoughts on the specified topic in their own words (Patton, 2018). The interview form used in the study was aimed to determine the

Which of the information given about the classification of living things is correct?

- A) Living things; We can classify them as plants, animals, bacteria and humans.
 - B) Classification of living things makes studies about living things difficult.
 - C) Gathering living things with similar characteristics into a group makes it easier to study living things.
 - D) Living things are classified according to their external appearance.
20. “Microscopic creatures; They play a role in turning milk into cheese, pickling, fermenting dough. In addition, it is known that they also cause diseases such as tuberculosis and cholera. “

According to the information given above, what can be said about microscopic creatures?

- A) Microscopic creatures can live in extremely hot or cold temperatures.
- B) Microscopic creatures can be beneficial or harmful.
- C) Microscopic creatures can only be seen under a microscope.
- D) Microscopic creatures can produce food using solar energy.

Figure 2: Sample questions on academic achievement test

Table 1: Information regarding students participating in the study

Groups	Gender		Education Level	Total
	Girls	Boys	Secondary School	
Control	25	35	5	60
Experiment	31	29	5	60

opinions of participating students about the materials prepared with web 2.0 tools applied during the lesson. In the interview form, there were four basic questions prepared to determine the students’ views on the applied materials. Interviews were held with some students in the experimental group. The scores of the students in the achievement test were ranked from low to high. At this point, the participant students to be interviewed were decided which included 10 students with low academic achievement points and 10 students with high academic achievement points. Within this scope, interviews were made with 20 students selected from the experimental group students. Figure 3 for some sample interview questions.

Implementation Process

The implementation process took 10 lesson hours. In the first stage, the “World of the Living” academic achievement test

1. What do you think are the positive aspects of the story and game course materials created with the web 2.0 tools applied in the science course?
2. What do you think are the negative aspects of the story and game course materials created with the web 2.0 tools applied in the science course?
3. What do you think are the contributions of the story and game course materials created with the web 2.0 tools applied in the science course to you in the course flow?
4. Would you like the story and game course materials created with web 2.0 tools applied in your science lesson to be used in a science lesson or other lessons? What lessons would these be if you wanted to?

Figure 3: Sample questions related to the questions in the interview form

was offered to the students in both the experimental and control groups as a pre-test. While lecturing to the control group in line with the textbook under the current education program, a lecture was given to the experimental group supported by games prepared with a scratch from materials designed with web 2.0 tools and stories prepared with story-bird. Story-bird and game program scratch were introduced to the students by the teacher and explained how to enter and use them. An exemplary story-bird story was created by the teacher, and a clear understanding of the story-making process was provided. The application process was conducted online. During the lesson, a lecture was given on the unit. The concepts related to the content of the subject in the unit were given to students to facilitate the process of preparing a story. Stories were created with the students, following the teacher, based on the concepts determined during the lesson. During the post-lesson process, it was ensured that each of the students created a story with the story-bird tool in line with the concepts given by the teacher. Some of the stories created by the students were read and studied in the next lesson. The story was discussed and analyzed by the students. Efforts were made to find answers to the questions given at the end of the story by creating a discussion environment for the students. By giving correct answers, the lesson time allocated for the story reached an end.

The story-based teaching process was completed in 6 lesson hours. Next, the game designed based on scratch, another web 2.0 tool, was played. The teaching process realized with the game based on the scratch application was completed in 1 lesson hour. The program introduced to the students at the beginning of the lesson was downloaded and a game design was made with the students for 2 lesson hours. In the next stage, the academic achievement test was applied to the students for the 2nd time as a post-test. After the final test, interviews were held with 20 students determined in the experimental group and it to ascertain their thoughts about the application process.

The game designed based on the scratch program, which is a web 2.0 tool used in the teaching process, is given in Figure 1. On the other hand, the digital story materials used by the students during the application phase are given in Figure 2.

Data Analysis

The data obtained in line with the answers given by the students to the achievement test prepared for the unit was analyzed by transferring it to a SPSS statistics package program version 22.0. While scoring the achievement test, the questions that the students answered correctly were coded as 1 point, and the questions that were given incorrectly and left blank were coded as 0 points. The highest score that can be obtained from the knowledge test is 26 and the lowest score is 0. Before analyzing the achievement test, it was checked whether the data showed normal distribution. When the sample size is 50 or more, it is recommended to look at the Kolmogorov–Smirnov test (Seçer, 2015). Considering the result of the Kolmogorov–Smirnov test, parametric analyses were applied to the data set, which was understood to show a normal distribution. The mean values and standard deviation values of the experimental and control groups were calculated. Independent samples t-test was used to compare the pre- and post-test achievement scores of the experimental and control groups. The dependent samples t-test was used to compare the pre- and post-test of the experimental and control groups. Content analysis was used in the analysis of the data obtained from the interviews. In content analysis, it is to combine similar data into concepts and categories that we have determined and to interpret them in an order that they can be understood (Özmen and Karamustafaoğlu, 2019). For this purpose, the views of each participant were examined, similar opinions were brought together, codes generalizing similar features were created, and categories were determined by linking the determined codes to each other. In the last stage, the frequency values of the codes that emerged in the coding process were written and tabulated. While calculating the frequency values of the created tables, the case of a student giving more than one answer was also considered. Because the students were able to provide more than one answer, the frequency values are higher than the number of participants.

Findings

Within the scope of the study, the data obtained from the students were analyzed, and the results of the analysis are presented in this section based on the determined research questions.

Findings regarding the quantitative data

The first sub-problem of the study, “What is the effect of online science course supported by web 2.0 tools on the academic achievement of 5th grade students?” the answer to the research problem was sought. In the first stage of the research, normality distributions were examined in order to analyze the data collected from the experimental and control groups. For this purpose, the data were subjected to a normality test. The values obtained from the normality distribution test results applied to the academic achievement test scores are presented in Table 2.

When Table 2 is examined, the results of the normality distribution test of the applied academic achievement test are seen. Considering the distribution results of the normality test,

it is seen that the academic achievement test score data obtained in the context of the study show a normal distribution, and therefore, it is appropriate to evaluate the data using parametric tests. The pre-test scores obtained from the experimental and control groups were analyzed using the independent t-test. The values obtained from the applied independent t-test results are presented in Table 3.

When Table 3 is examined, the academic achievement pre-test mean score of the control group students was found to be $X = 10.11$ and the standard deviation as 4.75. The academic achievement pre-test mean score of the experimental group students was $X = 11.68$, and the standard deviation was 4.58. When the pre-test achievement score values are examined, it is understood that there is no significant difference between the experimental and control groups scores ($t = -1.838$; $p > 0.05$). Therefore, it can be said that the achievement levels of the experimental and control group students are quite close to each other.

The pre- and post-test scores obtained from the control group students were analyzed using the dependent t-test. The values obtained from the applied dependent t-test results are presented in Table 4.

When Table 4 is examined, the pre-test mean score of the students in the control group is $X = 10.11$, the standard deviation is 4.75; the post-test mean score was $X = 11.61$, the

standard deviation was 4.58. When the achievement score values of the control group are examined, it is understood that there is a significant difference between the pre- and post-test scores ($t = -4.044$; $p < 0.05$).

The pre- and post-test scores obtained from the experimental group students were analyzed using the dependent t-test. The values obtained from the applied dependent t-test results are presented in Table 5.

When Table 5 is examined, the academic achievement pre-test mean score of the students in the experimental group is $X = 11.68$, the standard deviation is 4.58; the post-test mean score was $X = 18.10$, the standard deviation was 3.89. When the achievement score values of the control group are examined, it is understood that there is a significant difference between the pre- and post-test scores ($t = -16.962$; $p < 0.05$).

The post-test scores obtained from the experimental and control groups were analyzed using the independent t-test. The values obtained from the applied independent t-test results are presented in Table 6.

When Table 6 is examined, it was found that the academic achievement pretest mean score of the control group students was $X = 11.61$, and the standard deviation was 3.895. The academic achievement pre-test mean score of the experimental group students was $X = 18.10$, and the standard deviation was found to be 4.584. When the post-test achievement score values are examined, it is understood that there is a significant difference between the experimental and control groups scores ($t = -8.347$; $p < 0.05$), and this significant difference is in favor of the experimental group.

Findings regarding qualitative data

Within the scope of the research, the findings obtained based on the analysis of the interviews with 20 students selected from the experimental group students through the ZOOM program are included under this heading. An answer was sought for the third sub-problem of the study, "What are the opinions of the experimental group students about the materials developed with web 2.0 tools?" In this context, the data obtained from the experimental and control groups were analyzed using content analysis.

Opinions on the positive aspects of the applied web 2.0 tools

The findings obtained from the students regarding the positive aspects of the web 2.0 tools applied in science lessons are presented in Table 7.

When Table 7 is examined, it is seen that the students' positive opinions about the web 2.0 applications used in the

Table 2: Normality distribution test results related to academic achievement test

Achievement Score	Groups	Kolmogorov-Smirnov		
		Statistics	SD	ρ
Pre-test	Control	0.105	60	0.200*
	Experiment	0.099	60	0.095
Post-test	Control	0.100	60	0.200*
	Experiment	0.108	60	0.079

Table 3: Independent t-test results related to academic achievement pre-test scores

	Groups	N	X	SS	SD	t	ρ
Achievement Score	Control	60	10.1167	4.75178	118	-1.838	0.069
	Experiment	60	11.6833	4.58624			

Table 4: Dependent t-test results for the control group academic achievement pretest and posttest scores

	Achievement Score	N	X	SS	SD	t	ρ
Control Group	Pretest	60	10.1167	4.75178	59	-4.044	0.000
	Posttest	60	11.6167	4.58476			

Table 5: Dependent t-test results for the experimental group academic achievement pretest and posttest scores

	Achievement Score	N	X	SS	SD	t	ρ
Experiment Group	Pre-test	60	11.6833	4.58624	59	-16.962	0.000
	Post-test	60	18.1000	3.89567			

science course. It is understood that the students stated that they wanted to use the practices used in the lessons as they were fun, enjoyable, interesting, exciting, and increased their participation in the lesson and wanted to use them more often. Student coded Ö25 said, *“We have not used such applications in any other lesson. It is very beautiful; I had a lot of fun.”* While expressing his opinion, Student coded Ö42 said, *“Scratch game was very exciting. I liked it more than previous learning method. I wish my teacher would use it in future lessons. Answering before my friends was like a contest.”*

Opinions on the negative aspects of the applied web 2.0 tools

The findings obtained from the students regarding the negative aspects of the web 2.0 tools applied in science lessons are presented in Table 8.

When Table 8 is examined, the negative opinions of the students about the web 2.0 applications used in the science course are seen. It is understood that the students stated that the practices used in the lesson were very time consuming, boring, unappealing, and difficult to do. Student coded S18 said, *“I got bored while I was doing the activities in the lesson. The lesson was not enjoyable at all. Let’s not do it again.”* While expressing his opinion, Student coded Ö32 said, *“Scratch game was considered good. But it is better to take a test.”*

Table 6: Independent t-test results for academic achievement post-test scores

	Groups	N	X	SS	SD	t	p
Achievement Score	Control	60	11.6167	3.89567	118	-8.347	0.000
	Experiment	60	18.1000	4.58476			

Table 7: Positive opinions regarding applied web 2.0 tools

Category	Code	Frequency
Web 2.0 Applications	Enjoyable	15
	Very enjoyable	11
Positive Aspects	Interesting	10
	Excited	9
	Not boring	7
	Very good	5
	Increase their participation	5
	Want to use them continuously	2
	Like solving puzzles	2

Table 8: Negative opinions about web 2.0 tools applied

Category	Code	Frequency
Web 2.0 Applications	Time-consuming	5
	Boring	3
Negative Aspects	Tasteless	3
	Difficult	3
	Slow activity	2
	No Test	2

Views regarding the contribution of the applied web 2.0 tools

The findings obtained from the students regarding the contributions of the web 2.0 tools applied in science lessons to them are presented in Table 9.

When Table 9 is examined, students’ opinions about the contributions of web 2.0 applications used in science lessons are seen. It is understood that it contributes to the students’ achievement and their desire to participate in the lesson, to use technology better with applications, to love science lesson, to do the homework enthusiastic. Student coded Ö35 said, *“It helped me understand the subject better and my achievement increased. I did the homework my teacher gave at home more enthusiastically.”* While expressing his opinion, Student coded S48 said, *“I learned to use the programs taught by my teacher. I can do it like my teacher at home.”*

Views regarding the use of applied web 2.0 tools in science lessons and other lessons

The findings obtained from the students regarding the use of web 2.0 tools applied in science lessons in science lessons and other lessons are presented in Table 10.

When Table 10 is examined, it is seen that students’ opinions about the use of web 2.0 tools used in a science lesson in science and other lessons. It is understood that almost all of the students wanted to use web 2.0 tools in their science lessons. It was seen that the majority of students who wanted to use web 2.0 technologies from other courses, especially in Turkish lessons. Ö9 coded student said, *“I want my teacher to use it continuously in the Science course. I think my teacher should teach every subject like this. I wish we could do about the Sun and the Earth that we covered last week.”* While expressing his opinion, Ö22 coded student said, *“My teacher should always*

Table 9: Opinions regarding the contribution of applied web 2.0 tools to individuals

Category	Code	Frequency
Contributions of Web 2.0 Applications	Increase in achievement	12
	Increased enthusiasm to attend the lesson	9
	Using technology	6
	Loving science	4
	Enthusiasm to study	2
	Do homework	1

Table 10: Regarding the use of applied web 2.0 tools in science and other lessons

Category	Code	Frequency
Use of Web 2.0 Applications	Continuous use in science classes	25
	Not using in science lesson	5
	Turkish lesson	11
	English lesson	8
	Computer lesson	6

use it in a science lesson. It should even teach our Turkish and English teachers. I would be very happy if they also used it in our lesson.”

DISCUSSION

In the research, it was aimed to investigate the effect of the fifth grade “World of Living” unit on the academic achievement of the students and to determine their opinions about the applications used in the course using the digital story and game materials created with web 2.0 supported tools in the distance education process.

When the findings of the analysis were examined, it was understood that both study groups were similar to each other in terms of achievement ($\rho > 0.05$). In this sense, it can be argued that the desired result in terms of clearly demonstrating the effect of web 2.0 tools on students. It can be stated that the students have almost the same level of knowledge about the “World of the Living” unit and that the groups have a very close level in terms of achievement.

Analysis findings indicate that both experimental and control groups have different levels of achievement in terms of

pre- and post-tests ($\rho < 0.05$). It is understood that the average achievement of both groups increased. It is possible to say that this situation was expected since both groups had been learning science for the unit determined by different methods.

The achievement average of both groups increased. In this sense, it is possible to say that the teaching realized with traditional teaching methods and materials prepared with web 2.0 tools increased the science teaching levels. However, when both groups are compared, it is seen that the significant difference is in favor of the experimental group. Analysis findings indicate that the experimental group differed from the control group in terms of achievement ($\rho < 0.05$). At this point, it can be said that the experimental group had greater achievement than the control group. It can be argued that the reason for this difference was due to the story and game materials created with web 2.0 tools. In other words, it can be inferred that the teaching applied with the materials prepared with web 2.0 tools had more effect on the academic achievement of science compared to the teaching with traditional methods. Teaching with game and story materials based on web 2.0 tools reveals that the “World of the Living” unit has greatly increased the achievement of the students.

There are studies in the literature that are similar to many studies on web 2.0 tools. In this context, it may be inevitable to state that the scratch application, which is the web 2.0 tool used in the study, is a factor that increased the achievement of the students in these science lessons. It was determined that the activities that Keçeci (2018) carried out with 6th-grade students with the support of the scratch program on the subject of “Circulatory System” increased their academic achievement in science. Similarly, another study conducted with the scratch application for 8th graders, shows that the courses made with the scratch application increased the academic achievement of the students in science (Ekici, 2020). In his study, Alp (2019) observed an increase in the level of understanding and perception of the science lesson of 5th-grade students in collaborative teaching with scratch software. Studies show that it coincides with the results obtained in the literature of the current study about the positive effect that science teaching designed with the scratch application will have on academic achievement.

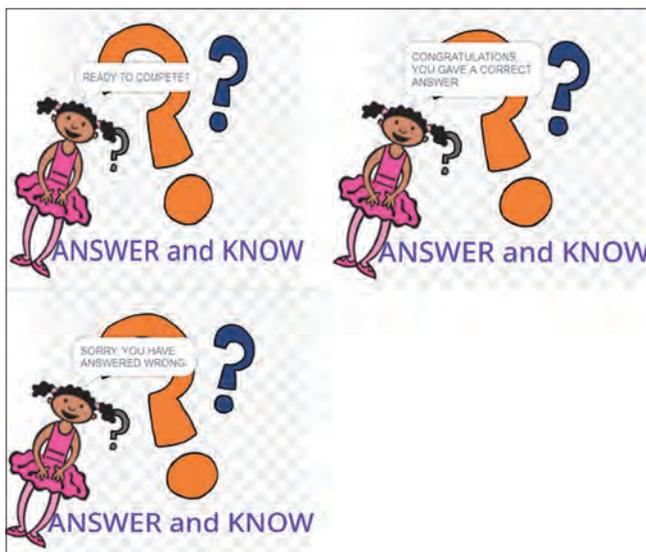


Figure 4: Images of the scratch program designed in the study

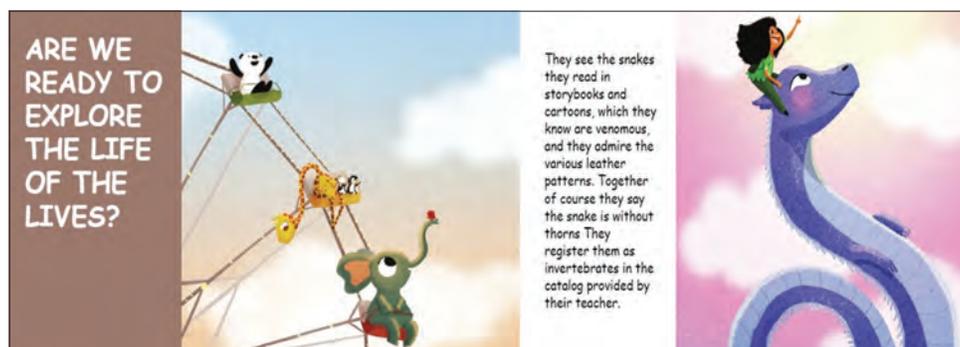


Figure 5: Images of the story-bird program designed in the study

In a study where Baytak and Land (2011) examined the game design process with scratch on the subject of environmental sciences, it was revealed that students learned more about environmental sciences in the context of the data they obtained. It was seen in the studies where the scratch program was applied to the teaching of mathematics for middle school students that the use of scratch is effective on mathematics learning, mathematical achievement, thinking, understanding operations, and conceptual learning (Brown et al., 2008; Calao et al., 2015; Calder, 2010; Wang et al., 2014). It is possible to say that the teaching based on scratch application from international studies is effective.

In a study conducted by Mladenović et al., (2016) using scratch and another programming language, it was revealed that teaching with scratch increased the achievement scores of fifth-grade students more than the other program. The results of the research conducted by Dinçer (2018) show that the achievement of sixth-grade students who are taught with scratch has increased significantly compared to the education done with the other program. Kobsiripat (2015) stated as a result of his study that the scratch program can be used as an educational tool for primary school students. It is understood that national and international studies in the literature coincide with the result that the scratch application achieved in this study positively affects the teaching process. Therefore, scratch program, which is one of the web 2.0 tools, has shown itself as a powerful tool that can be used to increase students' course achievement.

In this context, it appears that they story-bird applications increased the achievement of these participating students in their science course. With the web 2.0 story-bird application used in the study, the students were allowed to teach science stories in a digital environment. In the literature, there is no story-bird study that can be compared directly to this study's science course. However, the results of digital story studies for science were examined. In the study conducted for biology teacher candidates through Korucu (2020), it is concluded that the science teacher candidates' science academic achievement increased with the digital story development environment supported by web 2.0 technologies. Even if this result does not exactly match our study, it would be correct to state that both studies show similarities. In the study investigating the effect of the use of drama on achievement in the digital storytelling process, it was determined that the digital story process had a positive effect on 7th-grade students' achievement in science (Akgül, 2018). In another national study where digital storytelling was studied on science teaching, it was found that digital storytelling benefited the scientific achievement of sixth-grade students (Büyükcengiz, 2017). Kahraman (2013) revealed that the digital stories he used in physics lessons increased the academic achievement of students in physics lessons. Demirer (2013) concluded in his study that web-based digital narration has an increasing effect on academic achievement. In the study conducted by Hung et al., (2011), it was determined that science teaching with digital stories

contributed to the learning achievement of fifth-grade students. Based on the results of the study, Wu and Yang (2008) stated that the achievement of students will increase with digital stories. In addition, Shin and Park (2008) demonstrated that digital stories can raise their desire to understand and participate in the lesson in the context of the results of the study. National and international studies coincide with the conclusion that the digital stories obtained in this study are effective in academic achievement.

In the study conducted by Gürleroğlu (2019), it was revealed that web 2.0 applications have a positive effect on the achievement of secondary school students in a science course. The positive effect of web 2.0 tools on academic achievement in science in the present study is an indication that the results are parallel. In addition to all these studies, the meta-analysis study conducted by Ergül-Sönmez and Çakır (2020) reveals that the teaching performed with web 2.0 technologies has a positive and medium effect on academic performance. On the other hand, in another meta-analysis study encountered in the literature, it is seen that the results in favor of the achievement of the web-based science teaching were obtained (Orhan and Men, 2018). Based on the existing studies in the literature, meta-analysis studies and this study, it is clearly revealed that web-based and web 2.0-based teaching has a positive effect on the academic achievement of the science course. The studies in the literature parallel the conclusion reached in our study that the web 2.0 science course increases academic achievement.

To find an answer to the fifth sub-problem of the research, the experimental group students who participated in the study were interviewed, and the data obtained were analyzed using content analysis. They stated that they especially liked that they could get instant feedback with the scratch application. They stated that revealing the hidden misconceptions in the story-bird concept story was such as a puzzle-solving activity, and that they were excited by their discussions with their friends while answering the questions in the story. In support of these views of the students; in his study, Sarı (2019) found that web 2.0 applications increased the collaboration behavior of students. In addition, Clements and Boyle (2018) stated that learning environments using web 2.0 tools enabled them to be collaborative. In this study, these students noted that they had fun throughout the lesson, enjoyed the lesson, the lesson was very good, they looked forward to the next lesson, they came prepared to participate in the lesson more, and they would use these programs at home. In addition, they stated that they wanted to use such applications in other lessons. Bolatlı and Korucu (2018) found out from students' opinions that students have fun and an increase in their desire to participate in the lesson in the teaching processes where web 2.0 tools are used. In another study conducted on web 2.0 tools, it was stated that these tools should be used for students to enjoy the lesson and have fun (Timur et al., 2019). Similarly, in another study, it was revealed that students expressed that the activities designed with web 2.0 tools were fun and enjoyable and that they want to use them (Özenç et al., 2020). Although there are generally

positive opinions about web 2.0 tools, they are asked to be used in other lessons, especially in science. Similarly, the positive approach of the students in the study of Gürleroğlu (2019) makes these two studies interesting. In the present study, the positive perspectives obtained from the students will be supported that many studies in the literature have positive feedbacks from teachers and teacher candidates against web 2.0 tools (Bunul, 2019; Timur et al., 2019; Lim and Newby, 2019). Although positive opinions were obtained from the interviews conducted within the scope of the study in general, contrary to all positive opinions, there were also students who stated that such practices are boring and time-consuming and that it would be better to solve lots of test questions instead. In addition, it was stated that the activities slowed down due to the internet connection that the applications were implemented remotely.

CONCLUSION

In the research, it is revealed that the web 2.0 tools used in the online science teaching process are more effective than the traditional science teaching. With the digital materials created with Web 2.0 tools, it has been determined that the academic achievement of the students in science increased statistically significantly. In addition, it has been determined that students have generally positive opinions about online science teaching supported by web 2.0 tools.

Recommendations

In line with the results of the study, it has been revealed that the materials created with scratch and story-bird from web 2.0 tools have a positive effect on the academic achievements of students compared to traditional methods. It was determined that the positive feedback obtained from the students' opinions supported the quantitative data. Based on these results, it is recommended these be used by teachers who aim to increase student achievement in science lessons. It is recommended to use web 2.0 tools to increase students' desire for a science lesson, to increase their participation in the lesson, and to be more active in their learning. In this study, the living things unit was applied within the subject area and at the fifth-grade level. Educators are expected to benefit from web 2.0 applications in another subject area and at all levels. Teachers can teach by integrating web 2.0 tools with different methods and techniques in the literature. Although these tools were applied to a science course, it is recommended they be used in other learning areas as stated in the students' opinions.

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