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How Teaching Fraction Word Problems with Digital Storytelling Affects Sixth Grade Students' Academic Achievement and Motivation

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Abstract

Digital storytelling also offers the benefit of being an easy and economical way to create real life scenarios. This advantage might be useful to visualize and materialize fraction word problems in everyday situations. Moreover, digital storytelling might help students understand complex ideas, concepts, or information. Therefore, it might be beneficial for overcoming the difficulties that students encounter while learning fractions. The purpose of the study: considering the effective role of digital storytelling in creating daily life situations and making difficult subjects interesting and easy to learn, we aimed to examine how teaching fraction word problems with digital storytelling affects sixth grade students' academic performance and motivation.This study is a survey study with quantitative data collection tools and 43 sixth graders from a public school in the Central Anatolia Region constitute the study group for this study.According to findings, digital story-based instruction affected positively the academic achievement of the experimental group. Furthermore, there is a statistical difference between the posttest scores of the experimental andcontrol group (U=122,500; p=0,310>0,05).Thus, it can be deduced that digital story based instruction have a positive effect on academic achievement.

Introduction

Individuals need to have basic skills like counting, addition, and subtraction to live comfortably in society. Because of that, it is important to know natural numbers and to use them in daily life situations. However, natural numbers might be inefficient when solving some of the problems in daily life. For instance, if we want to distribute four apples among five children, natural numbers will not help us because the answer is $\frac{4}{5}$.

A half-liter of milk, one and a half kilograms of tomatoes, and quarter past six are some examples of the usage of fractions in daily life (Bingölbali&Özmantar, 2014). Fractions are given right after the natural numbers in the elementary mathematics curriculum because they are used often in daily life (MEB, 2018). These statements about fractions that students encounter constitute the basis of systematic fraction instruction (Erol, 2021; Olkun&Toluk-Uçar, 2014). Effective fraction instruction might help students understand fractions, infer about them, and calculate with them.

Children's knowledge of fractions predicts their future mathematics achievement (Siegler et al., 2012). Fractions constitute the basis of decimals, rational numbers, ratios, proportions, and percentages (Booker, 1996). For this reason, it is important to build a strong foundation in fractions in the sixth grade so that students can understand the fractions-related issues that they will encounter in mathematics lessons in the coming years (Erol, 2021). Also, success in fractions helps students specialize in professions that include STEM (science, technology, engineering, and mathematics) (National Mathematics Advisory Panel (NMAP), 2008; Siegler et al., 2012).

Students learn fractions from the first grade to the sixth grade (MEB, 2018), and studies show that students struggle with some points of fractions in all these grades (Aksu, 1997;Bailey, Siegler, & Geary, 2014; Leinhardt& Smith, 1984; Zhang, Yu, Xiao, Liu, & Jiang, 2022). There are some issues that students have encountered when studying fractions. One of these issues is that fractions can have several meanings (such as part-whole, division, proportion)(Behr, Harel, Post, & Lesh, 1992;Hansen, Jordan, & Rodrigues,2017), and another issue is that students calculate fraction questions using the rules of natural numbers (for example to solve as 1/2 + 3/4 = 4/6) (Newstead & Murray, 1998; Vamvakoussi&Vosniadou, 2010; Xu vd., 2022). Moreover, students who can calculate arithmetical questions easily have had trouble if the same computation is given in a verbal question (Aksu, 1997). This issue shows that students have had difficulties with fraction word problems.

According to the researchers, there are a few causes of these challenges, including the emphasis on memorization in the educational system, the teaching of arithmetic before the fractional meaning, and the lack of focus on the conceptual significance of fractions (Chan, Leu & Chen, 2007; Hansen et. al., 2017; Lortie-Forgues, Tian & Siegler, 2015). If these issues are not resolved in the sixth grade, it might affect the success of the following grade. Because the elementary mathematics curriculum follows a spiral approach (MEB, 2018), which means that one subject serves as the foundation for another. All of these arguments show that we need to use new instruction strategies that avoid memorization without conceptual comprehension, simplify complex topics, and include real-life examples in them.

Technology has been developing in recent years. These developing technologies are used in all areas of life. There has also been some progress in educational technologies. All students should have access to technology, according to the National Council of Teachers of Mathematics (NCTM), because it is essential and significant for enhancing students' understanding, developing their mathematical skills, and fostering a love of learning.NCTM focuses on three benefits of providing students access to technology: technology deepening mathematics teaching, contributing effectively to the teaching of mathematics subjects, and increasing the quality of mathematics teaching (NCTM, 2000).

Digital storytelling is a technological practice that has gained popularity in recent years. It enables teachers to use technology in their classrooms efficiently, and it is a powerful teaching material that combines traditional storytelling with digital content. (Robin, 2008). Digital stories are made with computer applications by incorporating the telling of stories with current multimedia tools (e.g., graphics, animations, pictures, videos, and records) (Mellon, 1999).

Van Gils (2005) states the advantages of digital storytelling. For instance, it provides more variety than traditional teaching methods, personalizes the learning experience, makes the explanation of the taught subject more interesting, and increases the participation of students in the learning process. Therefore, digital storytelling is a method that provides information and enables students to learn while having fun with visual, audible, and written elements (Demirbaş ve Şahin, 2020). Today's students have grown up with digital technologies and have learned to transform data into information (Bilici & Yılmaz, 2021). Therefore, since digital storytelling is similar to the interests of the technology generation, it may increase their motivation.

Digital storytelling also offers the benefit of being an easy and economical way to create real life scenarios (Van Gils, 2005). This advantage might be useful to visualize and materialize fraction word problems in everyday situations. Moreover, digital storytelling might help students understand complex ideas, concepts, or information (Sadik, 2008; Xu, Park & Baek, 2011). Therefore, it might be beneficial for overcoming the difficulties that students encounter while learning fractions.

The purpose of the study: considering the effective role of digital storytelling in creating daily life situations and making difficult subjects interesting and easy to learn, we aimed to examine how teaching fraction word problems with digital storytelling affects sixth grade students' academic performance and motivation. The research questions of this paper are:

1. Is there a significant difference between the pretest scores of the experimental group and the control group students?

2. Is there a significant difference between the pre-test and the post-test scores of the experimental group students?

3. Is there a significant difference between the pre-test and the post-test scores of the control group students?

4. Is there a significant difference between the post-test scores of the experimental group and the control group students?

5. Is there a significant difference between the motivation scores of experimental group students and control group students after the experimental instruction?

Theoretical Framework

Digital storytelling is a creative, meaningful, and functional tool for the rising generation (Bozdoğan, 2012). There are many definitions of digital storytelling. For instance, according to Sadik (2008), digital storytelling is a modern expression of the ancient art of storytelling. From the campfire to the television and, now, to the computer screen, storytelling has evolved.

Digital storytelling, according to Mellon (1999), is the use of multimedia software tools in traditional storytelling. In this respect, digital storytelling can be seen as the revival of oral cultural heritage because it creates a connection between the narrator and the listener. Stories come alive and evolve as the narrator responds to an audience's emotions. Commonly used types of digital storytelling can be divided into three categories. These are personal stories that tell about important events in the lives of individuals, historical stories that tell about important events in

the past; and finally, instructive stories that contain information about a subject (Robin 2008).There are 10 steps to preparing a digital story. Table 1 displays these phases.

Table 1. Steps to preparing a digital story

Steps	Phases
1st step:	Deciding the story
2nd step:	Gathering content to use (pictures, music, photographs etc.)
3rd step:	Creating the script
4th step:	Preparing the equipment (a computer, an application etc.)
5th step:	Creating a storyboard
6th step:	Editing and digitizing the content
7th step:	Made voice records
8th step:	Adding music
9th step:	Editing the story
10th step:	Sharing the story
	(Büyükkarcı&Müldür, 2022; Lasica, 2006)

There are seven components in digital story types. Point of view includes the author's personal point of view and the central issue of the story. The compelling question grabs people's attention and is answered at the end of the story. Emotional content is strong and serious situations about life that connect the audience to the story. *Audio* is crucial for personalizing the story and improving the audience's comprehension. The power of *music* supports and beautifies the story with the sound recordings. Avoid exhausting the viewer with excessive amounts of content in order to maintain the element of *economy.The rhythm of the story* changes to be quick or slow, depending on the subject, by increasing or decreasing the progress speed. (İncikabı&Kepçeoğlu, 2019; Lambert, 2003).

We found research assessing the outcomes of useing traditional storytelling in mathematics teaching when we searched the literature. These studies demonstrate the advantages of utilizing stories in mathematics instruction. For instance, Lemonidis andKaiafa (2019) looked into the results of employing storytelling to teach third-grade pupils about fractions. The goals of the fraction teaching curriculum were taken into consideration when they were writing the stories they utilized in the study. The experimental group outperformed the control group by a significant amount as a result of the experimental study using these stories. In other words, the findings showed that the use of storytelling improved students' proficiency with fractions.Moreover, it was discovered that children with middling, and particularly low, performance, profited the most from the use of narrative. The researchers also stressed how storytelling might help students improve their ability to compare fractions, locate equivalent fractions, create and manipulate representations, and solve problems.

Similar to this, Albool (2013) examined how adopting a storytelling technique in mathematics instruction affected students' capacity to tackle challenging mathematical problems and word problems in mathematics. He used a quasi-experimental methodology to analyze fourth graders, and after finishing the fractions lesson, he administered a math test to both groups. According to the findings, there was a statistically significant difference between students in the experimental and control groups in terms of their success in mathematics and desire to learn the subject, and the students' capacity for solving word problems and complex mathematical problems also improved. He strongly urged the use of storytelling in curriculum development and programs for teacher professional development in light of these findings.

Digital storytelling has been used in mathematics instruction in addition to traditional storytelling. But few studies on digital storytelling have been conducted in the area of mathematics education (Bilici & Yılmaz, 2021; Chang & Chu, 2022). Pre-service teachers have been employed in the majority of studies on mathematics education. In their study with 30 prospective classroom teachers, Büyükkarcı and Müldür (2022), for instance, sought to assess the quality of the digital stories created by prospective classroom teachers for the teaching of mathematics in primary schools as well as their experiences with the production of digital storytelling. The investigation led to the conclusion that the candidates' digital stories were typically of poor quality. The actions and strategies used by the pre-service teachers in the digital story creation process were quite limited, and the process did not fully comply with the digital story production steps.

Özpınar (2017) investigated how pre-service mathematics instructors thought about the integration of digital storytelling into the classroom. In this case study that was created, 54 pre-service teachers who were enrolled in the third year of the mathematics teaching program took part. The study's objective is to look at pre-service teachers' perceptions of what happened during a pre-service training in which they learned about digital storytelling, produced their own digital stories, saw how the stories were used in actual classrooms, and talked about how effective the applications were. Data were gathered using written survey questionnaires. The study's findings showed that pre-service instructors struggled with story creation and ran into technological issues while producing digital stories.In addition, the majority of pre-service teachers claimed that incorporating digital storytelling into the classroom had beneficial effects on learning in a number of areas, including active involvement, success, motivation, and creativity.

However, there haven't been many studies on digital storytelling that involved students. For instance, in order to discover kids' mistakes and misconceptions regarding fractions and to eliminate these errors and misconceptions using digital storytelling, Karaoğlan-Yılmaz, Gökkurt-Özdemir, and Yaşar (2017) did action research with the involvement of 25 fourth grade children. Semi-structured interviews were done as part of the study to get feedback from teachers and students on the activities created using digital storytelling.The study's findings showed that employing digital storytelling in the classroom helped pupils understand fractions correctly and to avoid common mistakes and misunderstandings. The majority of students showed support for the usage of digital stories in the courses and thought that they were enjoyable, educational, and helpful when the researchers looked at the opinions regarding the activities created with digital stories.

Additionally, in the context of the history of mathematics, Küçükolu and İncikabı (2020) did a case study on digital stories created by secondary school pupils. 12 7th graders who participated in the study created digital stories. The researchers examined the students' opinions on creating digital stories and how the storytelling process affected their perceptions of how mathematical knowledge is formed. They gathered information via semi-structured interviews and an opinion survey. As a consequence of the study, the students said that they loved the digital storytelling procedure, found the digital storytelling tool to be extremely comfortable and simple to use, and

that the digital storytelling activities they created helped them learn about the lives of mathematicians.

Similar to this, Albano and Pierri (2017) asked students about the benefits and drawbacks of digital storytelling after doing an online training on PISA problems using digital stories for students aged 13 to 15. The majority of the students' remarks about digital storytelling were favorable. One student, for instance, commented that the digital storytelling's use of images made the lecture more entertaining. Another student claimed that using digital tools to learn allows him to learn while listening as well as reading, which boosts his participation in class. Only a few pupils voiced criticism on technological elements like connectivity or video improvement.

Considering the theoretical framework explained above, it is seen that storytelling has positive effects on subjects such as teaching fractions, solving high-level mathematics questions and solving mathematical word problems. Digital storytelling is the technological form of storytelling. In the studies on digital storytelling, it was seen that the views of pre-service teachers and students about digital storytelling were mostly positive. We therefore hypothesized that teaching fraction issues using digital storytelling would improve students' academic performance and motivation. Due to these factors, we looked into how digital storytelling affected the teaching of fraction word problems in this study.

Method

Research Design

This study is a survey study with quantitative data collection and analysis methods to increase the reliability and validity of the research.

Study Group

43 sixth graders from a public school in the Central Anatolia Region constitute the study group for this study.

Table 2. Number of Students in the Research Group and Distribution of Students by Gender

	Girls	Boys	Total
ExperimentalGroup	9	13	22
Control Group	10	11	21
Total	19	24	43

Data Collection Tools

Fraction Word ProblemsTest

In this study, we measured academic achievement using an achievement test. The researchers developed the achievement test, which was used as both a pre-test and a post-test. To prevent memorizing, we rearranged the options and questions in the second application. The test was developed in accordance with the learning objective of "solving word problems that require operations with fractions". We made sure to include scenarios from everyday life in the test while developing the questions. The accomplishment test's initial version consists of 15 multiple-choice questions with four answer choices.

After the test was created, we sought the opinions of two professors who had earned doctorates in mathematical education as well as a secondary school mathematics instructor. We enhanced the test in light of these revelations. The achievement test was then piloted with 47 7th grade

students from two separate schools, and the results were examined in order to determine the validity and reliability of the test. We calculated item statistics using the Henryson approach and examined all 47 students' responses during the item analysis procedure.

While analyzing the achievement test, first of all, the item difficulty values of each question were calculated (see Table 3). According to the values in Table 4, the item difficulties were; classified as difficult, medium, easy and very easy. Since the item difficulty of the prepared achievement test analysis is between 0.51 and 0.77, we can say that the items in the test are easy and very easy. In other words, 10 of the 15 questions were determined as easy and 5 of them as very easy.

Table 3. The item difficulty values of the questions in the academic achievement test

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
0,51	0,85	0,53	0,64	0,72	0,74	0,77	0,55	0,68	0,57	0,72	0,66	0,60	0,64	0,64

Table 4. Categories according to the item difficulty values of the questions

ItemDifficultyValues	Categories
0,29 orless	Hard
0,30 – 0,49	Medium
0,50 – 0,69	Easy
0,70 – 1	Veryeasy

For each question, we first calculated the item difficulty and then the item discrimination index. We displayed the calculated item discrimination values in Table 5 and compared them to the values in Table 6 for analysis. Following the tests, 13 of the accomplishment test's items were taken to be "very good items." while 1 was classified as "quite good but could be improved." We did not alter these items because the amount of discrimination against them was above what was considered acceptable. On the other hand, the first question's item discrimination index was 0.15, which was below 0.19 in accordance with Table 6 and qualified it as one of the items that needed to be eliminated. Therefore, we removed the first question from the achievement test.

Table 5. Item discrimination indexes of the questions in the achievement test

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
0,15	0,38	0,46	0,69	0,54	0,46	0,54	0,69	0,62	0,62	0,54	0,62	0,77	0,69	0,62

Table 6. Categories according to item discrimination indexes of the questions

ItemDiscriminationIndexes	Categories
0,40 ormore	Verygooditems
0,30 – 0,39	Quitegood but could be improved
0,20 – 0,29	Needsto be fixedandimproved
0,19 orless	Veryweak, must be removedfromthe test

After removing the first question, we calculated the reliability coefficient and correlation values of the remaining 14-question achievement test. We have shown these values in Table 7. We found the Cronbach Alpha (KR20) coefficient of the achievement test to be 0.768. In the correlation calculation, we saw that the corrected item correlation values ranged from 0.312 to 0.538. According to Cristobal, Flavian, and Guinaliu (2007), items with this correlation value below 0.3 should be removed from the scale; however, there is no item in the test that is suitable for this situation. At the same time, since there was no item that increased the reliability coefficient when the questions were removed, it was decided that the achievement test would consist of 14 questions.

Motivation Scale

We did a literature analysis to assess how using digital storytelling in the classroom affected students' motivation. We determined that the Turkish translation of Aktan and Tezci's (2013) mathematics lesson motivation scale was appropriate for use in this investigation. The Motivational Strategies Scale developed by Pintrich et al. (1991) was used as the basis for the scale the researchers used, which was composed of items related to motivation. Internal goal orientation, external goal orientation, subject value, control of learning beliefs, self-efficacy, and test anxiety are the sub-dimensions of the scale, which consists of 27 questions.The scale was graded on a five-point Likert scale as strongly disagree, disagree, undecided, agree, and completely agree. The validity and reliability studies of the scale were conducted with 210 fifth-grade students. The internal consistency coefficient of the created scale ranged from 0.85 to 0.94, and the item-total correlation values ranged between 0.62 and 0.89. Considering these results, we can say that the scale can be used to measure the motivation of 6th grade students.

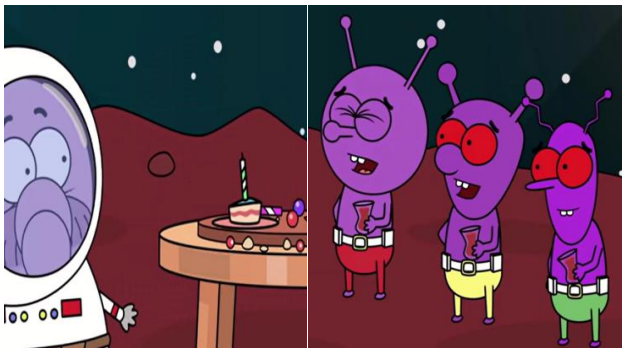
Digital Story Preparation Process

Except for the kids that participated in the research, we initially asked the sixth graders about the stories and cartoons they like before beginning to create the digital stories. Thus, we identified the cartoons and stories that might catch the pupils' attention more(Keloğlan, Kral Şakir, Masha and the Bear, RafadanTayfa, etc.) Then, we decided on the tales we would tell after selecting stories from these cartoons and picture books that had the right kind of information to make fraction problems. After choosing the background music and sound effects to go with the flow of the story, we captured pictures and video recordings of the cartoons and books we selected.Therefore, we gathered the materials for use.We then developed the story possibilities and turned them into narrative. The researchers added one or two fraction problems to each digital story to fit the story's flow. We then set up the necessary software and hardware. After that, we used Windows Movie Maker to edit the collected materials into a storyboard and add music. One of the researchers recorded audio recordings above it. Finally, by setting up the stories, we made them ready to be shared with the students. Nine digital stories were produced in the above way by the researchers. While preparing digital stories based on cartoons, we mostly used videos. And the digital stories we create using storybooks consist of photographs.

Two experts were consulted to determine whether the generated digital tales followed the steps of digital storytelling, contained the elements that should be present in a digital narrative, and contained questions that were appropriate for inclusion in the research.With the feedback from the experts, we rearranged the digital stories and made them suitable for use in the research.Figures 1 and 2 are examples of the digital stories we used.

Question: The children distributed the tomato paste to their neighbors, and there was only one bowl of paste left.They gave half of the tomato paste in the last bowl to Hayri because Hayri loved it very much. Akın, Kamil, Mert, Sevim and Hale shared the remaining tomato paste equally. What fraction of tomato paste is given to each of these five children?

Figu... An image from the story of Paste Time



Question: Necati ate a quarter of the cake and gave $\frac{2}{3}$of the remaining cake to the aliens. What fraction of the whole cake did Necati give to the aliens?

Figure 2. An image from the story of Lost Cake

Implementation Process

A pilot study was first carried out in a group separate from the experimental and control groups. In this way, we determined the possible problems and gained experience and ideas about the implementation process. Following the pilot application, we administered the pre-test to the experimental and control groups. For the pre-test application, we allowed the students 40 minutes. After that, we got began on the practice, which would endure for five lessons (or one week), as prescribed by the primary education mathematics curriculum (MEB, 2018).

In the experimental group,we provided the students with a worksheet that contained the questions from the stories. Afterward, students began to watch the digital stories.Thus, we enabled students to follow the questions more easily and write their solutions in the spaces below the questions. Then, we had the students watch the digital stories by ordering them from easy to difficult according to the difficulty level of the questions. When the question in the story arose while watching the digital stories, we paused the video and gave the students time to solve the question. Then we solved the problem with the students and watched the continuation of the digital story. After the digital story was finished, the students answered the question “What are your views about this story?” in the first part of the reflection report and wrote their opinions about that digital story.In this way, nine digital stories were watched during five lesson hours, and 11 questions in the stories were solved. After watching all of the digital stories, the students answered the questions, “What are your thoughts on teaching with digital stories in math class?” and “What was your favorite digital story? Why?" in the second part of the reflection report.

For the application in the control group, we took the same fraction word problems as in the experimental group, but we changed the names of the characters in the problems. So instead of cartoon characters, we used random human names in the problems. We gave the problems to the students as a worksheet. In the application in the control group, we did not make the students watch the digital stories and solved the problems with the usual method of the lesson.

After both applications ended, we applied the post-test and motivation scales to the experimental and control groups.

Analysis of Data

The second and third questions of this research aim to compare the data of the same group before and after the procedure. Therefore, in order to answer these questions, it is necessary to refer to the tests developed for paired samples for the analysis of the data obtained. For this reason, one of these tests, the paired samples t-test, is for cases where the data is normally distributed; the Wilcoxon paired signed rank test was used for cases where the data were not normally distributed.In the first, fourth, and fifth questions of the research, it was aimed at making a comparison between the experimental and control groups. For this reason, tests developed for independent samples were used to answer these questions. Independent samples t-test from these tests in cases where the data are normally distributed; the Mann-Whitney U test was used when the data are not normally distributed.

Findings

In this section, the findings of the study will be presented in the order of the research problems.

Findings for the first research problem

The first research problem of the study is about the statistical difference between the pretest scores of the experimental group and the control group students. In order to choose appropriate statistical analysis, first thing to do is to control the normality distribution of the pre-test scores of the experimental group and the control group by Kolmogorov-Smirnov and Shapiro-Wilk tests. The test results are given in the following table.

Table 7. The normality of the pre-test scores of the experimental group and the control group

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	0,137	35	0,092	0,933	35	0,035

The Kolmogorov-Smirnov test results yield that pre-test scores of two groups are distributed normally (p=0,092>0,05); in contrast Shapiro-Wilk test results yield that pre-test scores of two groups are not distributed normally (p=0,035<0,05). As a result, it can be concluded that the pre-test scores of the experimental group and the control group are not distributed normally, and so non-parametric tests have to be used in order to analyze between the pre-test scores of two groups. Therefore, Mann-Whitney U test is chosen and the results are given in the Table 8.

According to the Mann-Whitney U test results, there is no statistical difference between the pretest scores of the experimental group and the control group students (U=153,000; p=0,954>0,05).Thus, it can be deduced that both groups have same mean for pre-test scores.

Table 8.The Mann-Whitney U test result is based on the pretest scores of the experimental group and the control group students

Test Statistics		
	Mean	Std. Dev.
Experimental Group	4,2353	2,488
Control Group	4,3889	3,146
Mann-Whitney U	153,000	
Asymp. Sig. (2-tailed)	0,954	

Findings for the second research problem

The second research problem of the study is about the statistical difference between the pre-test and the post-test scores of the experimental group students. Since the Kolmogorov-Smirnov and Shapiro-Wilk test results yield that pre-test scores of experimental groupare not distributed normally, Wilcoxon W test is chosen and the results are given in the Table 9.

According to the Wilcoxon W test results, there is a statistical difference between the pretest and posttest scores of the experimental group (W=-2,605; p=0,009<0,05).Thus, it can be deduced that experimental instruction did affect positively the scores of the experimental group.

Table 9. The Wilcoxon W test result is based on the pretest and posttest scores of the experimental group

Test Statistics		
	Mean	Std. Dev.
Pre-test	4,2353	2,488
Post-test	6,2353	3,326
Wilcoxon W	-2,605	
Asymp. Sig. (2-tailed)	0,009	

Findings for the third research problem

The third research problem of the study is about the statistical difference between the pre-test and the post-test scores of the control group students. Since the Kolmogorov-Smirnov and Shapiro-Wilk test results yield that pre-test scores of control group are not distributed normally, Wilcoxon W test is chosen and the results are given in the Table 10.

According to the Wilcoxon W test results, there is no statistical difference between the pretest and posttest scores of the control group (W=-1,576; p=0,115>0,05).Thus, it can be deduced that the instruction did not affect the scores of the control group.

Table 10. The Wilcoxon W test result is based on the pretest and posttest scores of the control group

Test Statistics		
	Mean	Std. Dev.
Pre-test	4,3889	3,146
Post-test	5,3333	3,710
Wilcoxon W	-1,576	
Asymp. Sig. (2-tailed)	0,115	

Findings for the fourth research problem

The fourth research problem of the study is about the statistical difference between the post-test scores of the experimental group and the control group students. Since the Kolmogorov-Smirnov and Shapiro-Wilk test results yield that post-test scores of experimental and controlgroupare not distributed normally, Mann Whitney U test is chosen and the results are given in the Table 11.

According to the Mann-Whitney U test results, there is a statistical difference between the posttest scores of the experimental andcontrol group (U=122,500; p=0,030<0,05).Thus, it can be deduced that experimental group have higher mean for post-test scores.

Table 11. The Mann-Whitney U test result is based on the posttest scores of the experimental and control group

Test Statistics		
	Mean	Std. Dev.
Experimental Group	6,2353	3,32659
Control Group	5,3333	3,71008
Mann-Whitney U	122,500	
Asymp. Sig. (2-tailed)	0,030	

Findings for the fifth research problem

The fifth research problem of the study is about the statistical between the motivation scores of experimental group students and control group students after the experimental instruction. In order to choose appropriate statistical analysis, first thing to do is to control the normality distribution of the motivation scores of the experimental group and the control group by Kolmogorov-Smirnov and Shapiro-Wilk tests. The test results are given in the Table 12.

Both the Kolmogorov-Smirnov and Shapiro-Wilk test results yield that motivation scores of two groups are distributed normally (p=0,200>0,05; p=0,543>005). So, parametric tests have to be used in order to analyze between the motivation scores of two groups. Two independent samples test is chosen and the results are given in the Table 13.

According to the independent samples t test results, there is no statistical difference between the motivation scores of the experimental andcontrol group (t=-0,584; p=0,563>0,05).Thus, it can be deduced that both groups have same mean for motivation scores.

Table 12. The normality of the motivation scores of the experimental group and the control group

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Motivation	0,072	35	0,200	0,973	35	0,543

Table 13. The Independent Samples test result is based on the motivation scores of experimental group and the control group

Test Statistics						
	Groups	**N**	**Mean**	**Std. Deviation**	**Z**	**p**
Post-test	Experimental	17	98,8824	13,39721	-0,584	0,563
	Control	18	101,4444	12,55211		

Conclusion and Implications

According to findings, digital story-based instruction affected positively the academic achievement of the experimental group. Furthermore, there is a statistical difference between the posttest scores of the experimental andcontrol group (U=122,500; p=0,310>0,05).Thus, it can be deduced that digital story based instruction have a positive effect on academic achievement.

These results show that the teaching environment in both the experimental and control groups has a positive effect on the success of the students, in other words, the digital storytelling method is effective in increasing the success of the students, as is the current teaching method. Another result of the research is that the digital storytelling method is more effective on the success of the students than the current teaching method in teaching integers. There was a significant difference between the post-test success scores between the groups. It was observed that the success score increased in both groups, but the increase in the scores of the experimental group students, whose mathematics education was carried out with digital stories, was greater than the increase in the scores of the control group students, whose methods in the current curriculum were used. With the result obtained here, it is said that the digital storytelling method is more effective in increasing the students' mathematics success than the methods in the current curriculum. When the studies in the literature were examined, studies with results similar to the results in this research were identified. Öztürk (2023) examined the effect of teaching the subject of percentages in the fifth grade by enriching it with digital stories on mathematics success and concluded that educational digital games integrated with digital stories had a significant effect on students' learning of percentages in mathematics. Tosun (2023) found that there was a significant increase in success when he investigated the effect of digital storytelling on the mathematical success of sixth grade students in integers and absolute values. When we look at the use of digital storytelling in other courses, Toygar (2023) found that the use of digital stories in teaching idioms increased success in teaching idioms; Bahadır (2022) found in his experimental study that digital storytelling, which he associated with multi-dimensional teaching, had an effect on the success of the individual, motivation and today's skills, and that interdisciplinary digital storytelling had a positive effect on the participants' success in history class and technology; Emiroğlu (2021) found that digital storytelling had a significant difference in success in his research, in which he examined the

students' block-based coding success, their attitudes towards learning coding and their views on the process. Similarly, in a quasi-experimental study conducted by Gürbüz (2023) to investigate the effects of digital storytelling applications based on the 5E model used in science classes with middle school students on their science achievements, critical thinking, and digital literacy skills, there was a significant difference between the achievement test scores of the experimental and control groups in favor of the experimental group; when Sezer-Yıldırım (2023) evaluated the effects of science teaching supported by digital stories on students' academic achievement and views on the nature of science within the scope of the matter and heat unit, they reached the conclusion that science teaching supported by digital stories had a positive effect on the academic achievement of sixth-grade middle school students.

Also, there is no statistical difference between the motivation scores of the experimental andcontrol group (t=-0,584; p=0,563>0,05).Thus, it can be deduced that both groups have same mean for motivation scores

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ETİK ve BİLİMSEL İLKELER SORUMLULUK BEYANI

Bu çalışmanın tüm hazırlanma süreçlerinde etik kurallara ve bilimsel atıf gösterme ilkelerine riayet edildiğini yazar(lar) beyan eder. Aksi bir durumun tespiti halinde OJOMSTE'nin hiçbir sorumluluğu olmayıp, tüm sorumluluk makale yazarlarına aittir.

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