

THE EFFECT OF TEACHING MATHEMATICS WITH DIGITAL STORIES ON ACADEMIC SUCCESS AND MATHEMATICS ANXIETY

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ABSTRACT

Digital Storytelling, which is formed by adding technological elements to traditional storytelling, has been frequently used in education recently. This method, also used in mathematics education, contributes to students in both cognitive and affective dimensions. For this reason, the aim of this study is to examine the effects of digital storytelling supported education on the academic achievement of sixth grade students in Integers and Absolute Value and their mathematics anxiety levels. Pre-test and post-test experimental design was used. The study group consists of 20 middle school students. An achievement test prepared by the researchers was used to measure success, and a scale to determine the level of math anxiety was used to measure anxiety. The test and scale were applied twice, at the beginning and the end of the process. In the process, teaching was carried out using digital stories prepared by the researchers. SPSS package program was used in the analysis of the data and the dependent sample t-test was used. At the end of the research, it was seen that digital story-supported education positively affected the academic success of the students, but did not affect the anxiety level.

Keywords: Digital storytelling; achievement; math anxiety; integers and absolute value

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DİJİTAL HİKÂYELERLE MATEMATİK ÖĞRETİMİNİN AKADEMİK BAŞARIYA VE MATEMATİK KAYGISINA ETKİSİ

ÖZET

Geleneksel hikâye anlatımına teknolojik öğelerin de eklenmesiyle oluşan Dijital Hikâye Anlatımı son dönemde eğitimde sıklıkla kullanılmaktadır. Matematik eğitiminde de kullanılan bu yöntem öğrencilere hem bilişsel hem de duyuşsal boyutta katkı sağlamaktadır. Bu sebeple bu çalışmanın amacı dijital hikâye destekli eğitimin altıncı sınıfta öğrenim gören öğrencilerin Tamsayılar ve Mutlak Değer konusunda akademik başarılarına ve matematik kaygı düzeylerine etkisinin incelenmesidir. Konu olarak birçok matematik konusuna temel teşkil eden tamsayılar ve mutlak değer konusu seçilmiştir. Araştırmada ön test son test deneysel desen kullanılmıştır. Araştırmanın örneklemini devlet okulunda öğrenimine devam eden 20 öğrencidir. Başarıyı ölçmede araştırmacıların hazırladığı başarı testi, kaygıyı ölçmede ise matematik kaygı düzeyini belirlemeye yarayan bir ölçek kullanılmıştır. Test ve ölçek sürecin başında ve sonunda olmak üzere iki kez uygulanmıştır. Araştırmanın uygulama kısmında ise araştırmacıların hazırladığı dijital hikâyeler kullanılarak öğretim yapılmıştır. Verilerin analizinde SPSS paket programı kullanılmıştır. Verilerin normal dağılım gösterip göstermediği tespit edildikten sonra bağımlı örneklem t testi uygulanmıştır. Araştırma sonunda dijital hikâye destekli eğitimin öğrencilerin akademik başarılarını olumlu yönde etkilediği fakat kaygı düzeyini etkilemediği görülmüştür.

Anahtar Kelimeler: Dijital hikâye anlatımı; başarı; matematik kaygısı; tamsayılar ve mutlak değer

1. INTRODUCTION

Mathematics is a science that interacts with almost every field in our daily lives. The reasons such as abstract concepts, formulas, students' inability to associate mathematics with everyday life, not using different methods and techniques, and students seeing this course as memorisation bring various difficulties in learning and teaching mathematics. Occasionally, it leads to reluctance, fear, anxiety and lack of motivation in students. If these negative situations are not eliminated, the quality of education is not at the desired level.

One of these negative situations is Mathematics Anxiety (MA). MA has become an important subject of study with the emergence of the concept of Number Anxiety. It has received increasing attention in recent years (Dowker et al., 2016). In its shortest definition, MA has negative feelings towards mathematics (Choe et al., 2019). The consequences of MA not only reduce performance in mathematics-related situations (Zhang et al., 2019) but also hinder mathematical skills (Skagerlund et al., 2019). It can also have long-term effects (Luttenberger et al., 2018), including efficient (or not so-efficient) learning, as well as course and even occupational choices (Huang et al., 2019). For this reason, people with high MA tend to avoid mathematics, mathematics-related university courses, and career goals involving mathematics (Ashcraft & Krause, 2007). In order to support students' mathematics achievement, it is necessary to control MA (İlhan & Öner- Sünkür, 2012).

MA has cognitive (being good at maths) and affective (nervousness, unpleasantness, tension, etc.) factors. These factors play an important role in anxiety (Süren, 2019). MA shows itself throughout the process. Truttschel (2002) explained the MA process with a model and stated that previous experiences, negative self-talk, physical symptoms, anxiety and possible consequences (feeling small,

failure, avoidance, etc.) are involved in the MA process. MA can also have several different causes. These include factors such as the abstractness of the course, inadequate teaching methods and techniques, classroom climate, and teachers' attitudes towards students and the course. Students' most frequently reported reasons for MA were associated with the risk of failure, task difficulty, time pressure and fear of getting a bad grade (Szczygieł & Pieronkiewicz, 2022). There are also strong correlations between authoritarian parenting style and MA (Macmull & Ashkenazi, 2019). It has also been observed that sometimes, doing maths in the presence of teachers and peers causes anxiety (Newstead, 1998). MA, learning motivation and self-confidence contribute to the ability to solve mathematical problems simultaneously (Irhamna et al., 2020).

MA, or the negative physiological, emotional and cognitive states that mathematics activities often evoke, is recognised as a significant threat to human development and well-being. There is a growing interest in applying new technologies to relieve and reduce MA (Haase, Guimarães & Wood, 2019). Öztop & Toptaş (2022) suggested using attention-grabbing methods and techniques that students will have fun reducing MA. They also stated that contemporary teaching approaches and digital materials can be used. For example, Chen (2019) stated in his study that students with high anxiety had higher confidence and lower anxiety in mathematics thanks to technology (Mobile Augmented Reality). Hanifah, Afidah, Soraya, and Ardiansyah (2023) similarly concluded that using technology-based learning environments can help reduce students' MA while learning mathematics. Sade (2020) found that students who received computerised coding education had lower MAs than the traditional method.

Different approaches and teaching methods have emerged in mathematics and geometry with the developing technologies. These include virtual manipulatives, dynamic geometry software and video-based applications (Altıkardeş & Yiğit-Koyunkaya, 2021). The importance of these approaches has increased in order to increase the efficiency and quality of education. One of these approaches is the Digital Storytelling (DST) method, which is based on storytelling and emerged by deepening and enriching the stories with visual and audio elements.

When the literature is analysed, it is seen that many studies have been conducted with DST. Studies such as examining the effects on students, examining opinions and experiences regarding digital story activity, rubric development, compilation and literature research have been conducted. When the usage areas of the studies are examined, it is seen that there is a wide distribution. In addition to these studies, DST studies have been conducted in mathematics education, and studies have been conducted with preservice mathematics teachers and secondary school students in order to investigate the effectiveness of digital stories. However, increasing these studies will enable us to see the place and importance of digital stories in mathematics education. At the same time, it is essential to investigate the effectiveness of these technologies by using them in teaching environments. In this context, it is thought that it is necessary to benefit from DST while teaching mathematics.

DST is a dynamic combination of story (narrative) and technology (Rossiter & Garcia, 2010). DST starts with the selection of a topic, research on the topic, creating a scenario based on these and

writing the story. Then, this story is transferred to digital media and digital stories are obtained by combining multimedia types such as audio, video, visuals and photographs (Robin, 2008). In other words, it is an audio-visual clip that combines photos, audio and images, usually 2 to 5 minutes long (Lambert, 2009). DST uses computer-based tools that can be shared online (Robin & McNeik, 2019). It has been determined that it is used continuously in the USA, where it first emerged, and its use in Asian and European countries is gradually increasing. It is often used as a stand-alone method or in combination with other methods in humanities and social sciences (Wu & Chen, 2020). DST, which supports learning (Kim, Coenraad & Park, 2021) and teaching (Robin, 2016) and is a powerful tool for students and educators, increases students' motivation and helps students understand the subject matter (Robin, 2006). One of the benefits for students is that it helps to gain 21st-century skills (Çetin, 2021; Kaeophaunek, Na-Songkhla & Nilsook, 2019; Stork, 2020), which are shown as a critical need today (Robin & McNeik, 2019). In addition, it also contributes to communication, problem-solving, and media literacy skills (Chen & Chuang, 2021). It also helps students to communicate more effectively by improving their speaking skills (Nair & Yunus, 2021) and encourages social interactions (Katifori et al., 2020). It has also been stated that it increases students' motivation and performance (Parsazadeh, Cheng, Wu & Huang, 2021).

It has been observed that using DST in mathematics positively affects information-gathering skills, problem-solving and attitude towards cooperation (Çetin, 2021). Another result is that it is effective in students' learning of mathematical concepts, and they have favourable impressions of it (Dinçer & Yılmaz, 2019). It positively affects motivation, confidence and independence (Çakıcı, 2018). It is also used in daily life problems and in associating mathematics with daily life (Küçüköğlü & İncikabı, 2020). It is used to make incomprehensible concepts in mathematics understandable, to eliminate errors and misconceptions, and is described as fun and instructive by students (Karaoğlu - Yılmaz, Gökkurt - Özdemir & Yaşar, 2017). Teachers also find them useful as applications supporting active participation, concretising and contributing to technological developments (Kocaman-Karoğlu, 2016). Preservice teachers also find it positive for mathematics education and point out its benefits in terms of active participation, achievement, motivation and creativity (Özpınar, 2017).

The subject of integers and absolute value in mathematics is the basis for many other mathematics subjects at many levels. Students generally have problems giving meaning to the minus (-) sign in integers, sorting and making associations. Teachers also have problems making sense of negative integers (Erdem, Başıbüyük, Gökkurt, Şahin & Soylu, 2015). It was observed that the concept of absolute value, also taught in secondary education, was perceived as complex by students. It was stated that this difficulty started to occur in the primary education period when the students saw the concept for the first time. Incomplete information and misconceptions in the primary school years, when the foundation of the subject is laid, negatively affect the success status and student prejudices about the subject in the following educational periods (Yenilmez & Avcu, 2009). Şandır, Ubuz, and Argün (2002) also mentioned difficulties arising from past knowledge, order and classification of numbers,

incomplete understanding of the concept or misuse of the concept. It has been determined that technology-supported orientations are effective in eliminating difficulties (Demetgül, 2018) and increasing success (Körükçü, 2008). For this reason, the topic of Integer Numbers and Absolute Value at the 6th-grade level was selected in the study. When the mathematics curriculum is examined, the 6th-grade integers and absolute value subject achievements start with the concepts of integers (negative and positive), absolute value and signs. In addition, it continues on the axis of showing on the number line, comparing and sorting, and knowing and understanding absolute value (Ministry of National Education, 2018).

This study aimed to determine the effect of DST on student achievement and mathematics anxiety levels in the subject of Integer numbers and absolute value, which will also affect other grade levels. One of the reasons for conducting this research is that technology-supported applications are effective in both increasing achievement and decreasing MA has encouraged researchers to work on this issue.

Research Questions and Sub-Research Questions:

For this reason, the question "How does digital story-supported mathematics teaching affect sixth-grade students' academic achievement and anxiety levels towards mathematics in the subject of Integer Numbers and Absolute Value?" will be answered.

Sub-research questions:

1. How does digital story-supported mathematics teaching affect the academic achievement of sixth-grade students in the subject of Integer Numbers and Absolute Value?
2. How does digital story-supported mathematics teaching affect the mathematics anxiety levels of sixth-grade students towards mathematics in the subject of Integer Numbers and Absolute Value?

2. METHOD

This section provides information regarding the research model, population and sample, development of the measurement tool, and data collection and analysis.

2.1. Research Model

Quantitative (pretest-posttest experimental design) was used in the study. In experimental designs, the effect of a specific intervention on a group is measured by pretest and posttest and the significance of the difference is investigated by looking at the relationship between the measurements (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz & Demirel, 2013). This design was preferred in the study since it aimed to examine the change in students' academic achievement and MA with the help of pre-tests and post-tests on a single group.

2.2. Participants

The participants of this study consists of 20 sixth-grade students studying in a public school in Kars. Purposive sampling (easily accessible) was used to determine the sample. The ease of

communication and working with the students in the school where the first researcher is located enabled the selection of this sample type. A single group was used in the study because the researcher wanted to carry out the study herself, and she had a branch in her school. Nine of the participants were male and 11 were female.

2.3. Data Collection Tools

Two different tools were used to collect data in the study. These are the "Mathematics Anxiety Scale for Primary School Students" (Şentürk, 2010) and the "Integer Numbers and Absolute Value Achievement Test" prepared for the subject of Integer Numbers and Absolute Value.

1.2.1. Integer Numbers and Absolute Value Achievement Test

This achievement test measures and evaluates students' achievements in Integer Numbers and Absolute Value. The test was formed by combining the questions obtained from three different exams. These exams are the Ministry of National Education Boarding Without Pay and Scholarship, Primary and Secondary Education Institutions Scholarship and Level Determination Exams. The achievement test consists of 20 multiple-choice (four-choice) questions to measure students' knowledge and skills in Integer Numbers and Absolute Value. These questions are designed to measure students' mathematical thinking skills, problem-solving skills and mastery of the subject. For each question, correct answers were evaluated as 1 point and other cases were evaluated as 0 points. The maximum possible score range in the test is 0-20. One lesson hour was used for answering the test.

1.2.2. Mathematics Anxiety Scale

This scale is a scale used to measure students' mathematics anxiety levels about mathematics courses (Şentürk, 2010). The scale consists of 22 questions; five options expressing students' anxiety levels were presented for each question. The students responded by choosing the most appropriate one among the options. In this five-point Likert-type scale, there are options such as "I always get anxious (1)", "I often get anxious (2)", "I sometimes get anxious (3)", "I rarely get anxious (4)" and "I never get anxious (5)". During the process, students were given 30 minutes to answer this scale. Necessary permissions were obtained from the researcher for the use of the scale.

2.4. Organisation and Implementation of Learning Activities

The researchers analysed the gains of the subject of Integer Numbers and Absolute Value, and in order to achieve the determined objectives, the lesson was planned in accordance with the group to be studied by taking into account the school lesson hours. The process class has five weekly lesson hours; one hour is 40 minutes. The implementation study lasted four weeks in total, covering the topic of Integer Numbers and Absolute Value.

There are three acquisitions in the subject to be studied. For this study, eight digital stories were designed by the researchers in accordance with the objectives of the Animaker programme. Animaker is a Web 2.0 tool that allows both paid and free access and is used in animation and video preparation. It was preferred to be used in the research with animated objects, characters, icons and various background options. There are also options to add external audio and visuals. Expert opinion was used

while preparing the digital stories, and necessary arrangements were made. In addition, care was taken to associate the stories with daily life and mathematics. Figure 1 and 2 show examples of the digital stories used in the study:



Figure 1. Sample Images from Digital Story 5

In this digital story, the deterioration (melting) of the products was based on the deterioration (melting) that occurred in the products because two brothers shopping for food in the supermarket did not place the foods that should be stored at different temperatures in their places. Negative integers and the ordering of numbers were emphasised through the storage conditions of the food.



Figure 2. Sample Images from Digital Story 4

In this story, the account history was analysed from online banking. Here, the meaning of the + and - signs were explained.

Before starting the process, test and the scale were applied to learn the status of the students (pre-test). During the implementation process, digital story-supported teaching was provided to the students. In addition to teaching the subject, the prepared digital stories were used in the attention-grabbing, motivation, transition to the lesson, measurement and evaluation sections of the lesson according to the teaching of the subject and the suitability of the acquisition. While the gains were being taught, questions were asked to the students during the lesson with appropriate stories and feedback was received from the students when necessary. Occasionally, the stories were watched section by section and reinforcements were made. Dramatic questions and scenes were stopped, questions were asked to the students, and feedback was received. In the process, digital stories were re-watched, and reminders

and reinforcements were made in the parts where students had difficulty. The test and scale were reapplied at the end of the process.

2.5. Data Analysis

The data were analysed with SPSS software. The analyses were carried out by statistical analyses. During these analyses, a 0.05 significance level was taken as a basis. For each item of the achievement test, correct answers were evaluated as one and the others as 0. Since the research group was less than 50 people, considering the sample size, the Shapiro-Wilk test was applied for the normality of the data before starting the analyses. According to the results of this test, the appropriate analysis technique was used for each problem. Descriptive statistics (standard deviation, mean) were used to analyse the data. It was determined that the data obtained from the achievement test and Mathematics anxiety scale showed normal distribution. Dependent sample T-test was used for the difference between pre-test and post-test.

2.6. Validity and reliability

Firstly, the reliability of the data collection tools used in the study was examined. The mathematics achievement test was selected from the exams held at different times with expert opinions. Cronbach alpha coefficient was analysed for reliability. Cronbach alpha coefficient was calculated as 0.739 and used for the study. For another scale used in the study, "Mathematics Anxiety Scale for Primary School Students", the researcher calculated Cronbach's alpha coefficient as 0.931 (Şentürk, 2010). In addition, no reliability calculation was made. Expert opinions were taken for validity. Care was taken to represent the gains with digital stories. In addition, expert opinions were taken for digital stories and achievement tests.

2.7. Ethics Committee Approval

The ethical approval of this study was approved by Kafkas University Social and Human Sciences Scientific Research and Publication Ethics Committee with the decision dated 20.10.2021 and numbered 12.

3. FINDINGS

The study's findings are presented under two sub-headings in line with the sub-problems.

3.1. The effect of digital story-supported mathematics teaching on the academic achievement of sixth-grade students in the subject of integer numbers and absolute value

Firstly, it was tried to determine whether the data showed normal distribution. When checking whether the distribution is normal in a research group, when the number of participants is less than 50, it can be checked with the Shapiro-Wilks test. If the obtained $p > 0.05$, it can be said to show normal distribution and parametric tests can be used in data with normal distribution (Büyüköztürk, 2016). The normality test data of the Achievement Test pre-test and post-tests are presented in Table 1:

Table 1. Achievement Pre-Test - Post-Test Results of Shapiro-Wilks Normality Test

	Shapiro-Wilk		
	Statistic	df	p
Pre-Test	,944	20	,282
Post Test	,929	20	,150

Since the Sharipo-Wilks test $p > 0.05$, it was concluded that the data were normally distributed. As a result, the dependent sample t-test, one of the parametric tests, was used to analyse the normally distributed data. Dependent sample t-test analysis results are presented in Table 2:

Table 2. Dependent Sample T-Test Analysis Results of Achievement Test Data

Tests	Descriptive Values			t-Test		
	N	\bar{x}	ss	sd	t	p
Pre Test	20	7,40	2,835	19	-3,268	,004
Post Test	20	10,65	4,760			

When Table 2 was analysed, it was seen that the difference was significant [$t(19) = -3,268$, $p < 0.05$]. The mean score of the students in the pre-test was 7,40, and the mean score in the post-test was 10,65. Since the mean achievement scores increased from 7.40 to 10.65, it can be said that teaching the subject of Integer numbers and absolute value with digital story support effectively increases the students' academic achievement.

3.2. The effect of digital story-supported mathematics teaching on sixth-grade students' anxiety levels towards mathematics in the subject of integer numbers and absolute value

The normality results of the data are presented in Table 3:

Table 3. Maths Anxiety Scale PreTest-PostTest

	Shapiro-Wilk		
	Statistic	df	p
Pre Test	,907	20	,055
Post Test	,931	20	,159

As seen in Table 3, since $p > 0.05$, it was concluded that there was a normal distribution in the data. Therefore, a dependent sample t-test was used to analyse the pre-test and post-test anxiety scores. The results are presented in Table 4:

Table 4. Dependent Sample T-Test Analysis Results of Mathematics Anxiety Scale Data

Tests	Descriptive Values			t-Test		
	N	\bar{x}	ss	sd	t	p
Pre Test	20	82,25	16,726	19	1,589	,129
Post Test	20	76,80	18,947			

When Table 4 was analysed, it was seen that the difference in the anxiety scores of the students in the treatment group was not statistically significant [$t(19) = 1,589$, $p > 0.05$]. According to this

statistical result, teaching Integer numbers and absolute value with digital stories did not affect students' anxiety levels towards mathematics.

4. DISCUSSION AND CONCLUSION

Technological approaches increase students' achievement and help to eliminate MA. Therefore, this study investigated the effect of digital story-supported instruction on sixth-grade students' academic achievement in Integer numbers and absolute value and their anxiety levels towards mathematics. DST is a storytelling practice intertwined with digital media, including pictures, texts, sounds, and other elements (Chan, 2019). It contributes to developing teachers' content, pedagogy, and technology knowledge and developing students' content and multiple intelligences (Choo, Abdullah & Nawi, 2020). In addition, DST increases students' self-confidence and self-efficacy in mathematics (Niemi & Niu, 2021). In this study, it was observed that DST was effective in increasing students' academic achievement. In this respect, similar results were obtained with the literature (Çokyaman & Çelebi, 2021; Gömleksiz & Pullu, 2017; Hung, Hwang & Huang, 2012; Karataş, 2020; Korucu, 2020; Özerbaş & Öztürk, 2017; Pala, 2021; Ulum & Yalman, 2018; Büyükcengiz, 2017; Yang & Wu, 2012). Başaran (2019) found that DST did not affect achievement in his research. However, he also stated that students felt more fear, panic and inadequacy in traditional methods. Similarly, Çakıcı (2018) stated that it did not affect achievement but positively affected motivation and attitude.

MA causes a decrease in mathematics achievement (Sherman & Wither, 2003). In addition, MA predicts achievement more than many other factors (Suren & Kandemir, 2020; Munggaran, Rachmawati & Sholihah, 2022). It also affects children's arithmetic fluency and problem-solving development. Therefore, it is essential to reduce anxiety in mathematical development (Kaskens, Segers, Goei, van Luit & Verhoeven, 2020). For this reason, in this study, the effect of DST on MA level was also examined along with success. As a result of the study, it was concluded that digital story-supported education did not affect the MA. In the literature, it is seen that DST is effective in eliminating different types of anxiety. For example, it reduces listening anxiety (Rahimi & Soleimany, 2015) and writing anxiety (Çapan, 2020).

5. RECOMMENDATIONS

Based on the research findings, the following recommendations could be made:

The research was conducted on a single group. This is interpreted as a limitation of the research. It is thought that working with more students may provide an advantage. In addition, using more stories and even having students design can be presented as a suggestion. In this way, it is thought that more contributions can be made to reduce anxiety.

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GENİŞLETİLMİŞ TÜRKÇE ÖZET

DİJİTAL HİKÂYELERLE MATEMATİK ÖĞRETİMİNİN AKADEMİK BAŞARIYA VE MATEMATİK KAYGISINA ETKİSİ

GİRİŞ

Matematik günlük yaşamımızda hemen hemen her alanla etkileşime sahip bir bilim dalıdır. Soyut kavramlar, formüller içermesi, öğrencilerin matematiği günlük yaşamla yeterince bağdaştıramaması, farklı yöntem ve tekniklerin kullanılmaması, öğrencilerin bu dersi ezber olarak görmesi gibi nedenler matematiği öğrenme ve öğretmede çeşitli zorlukları da beraberinde getirmektedir. Öğrencilerde zaman zaman isteksizlik, korku, kaygı, motivasyon yetersizliği gibi durumlara yol açmaktadır. Bu durumlardan biri de Matematik Kaygısı (MK)'dır. MK en kısa tanımıyla matematiğe karşı olumsuz duygular beslemektir (Choe, v.d., 2019). MK'nın sonuçları yalnızca matematikle ilgili durumlardaki performansı düşürmez (Zhang, Zhao & Kong, 2019), matematik becerilerini de engeller (Skagerlund, v.d., 2019). Aynı zamanda verimli (ya da çok verimli olmayan) öğrenmenin yanı sıra ders ve hatta mesleki seçimleri (Huang, Zhang & Hudson, 2019) içeren uzun vadeli etkilere de sahip olabilir (Luttenberger, Wimmer & Paechter, 2018).

MK veya matematik etkinliklerinin sıklıkla uyandırdığı olumsuz fizyolojik, duygusal ve bilişsel durumlar, insan gelişimi ve esenliği için önemli bir tehdit olarak kabul edilmektedir. MK'yı rahatlatmak ve azaltmak için yeni teknolojilerin uygulanmasına artan bir ilgi vardır (Haase, Guimarães & Wood, 2019). Öztıp & Toptaş (2022) MK'yı azaltmada öğrencilerin eğleneceği, dikkat çekici yöntem ve tekniklerin kullanılmasını önermiştir. Ayrıca çağdaş öğretim yaklaşımlarının ve dijital materyallerin de kullanılabilmesini belirtmiştir. Hikâye anlatıcılığını temel alan, hikâyelerin görsel ve işitsel unsurlarla derinleştirilmesi ve zenginleştirilmesiyle ortaya çıkan Dijital Hikâye Anlatımı (DHA) bu yöntemlerden biridir (Robin, 2008).

Matematikte Tam sayılar ve Mutlak değer konusu diğer birçok düzeyde birçok matematik konusuna temel teşkil etmektedir. Tamsayılar konusunda öğrenciler genellikle eksi (-) işareti anlam vermede, sıralama yapmada ve ilişkilendirmede problem yaşamaktadır. Ayrıca öğretmenler de negatif tamsayıyı anlamlandırırken sorun yaşamaktadır (Erdem, Başbüyük, Gökkurt, Şahin & Soylu, 2015). Konunun temelini atıldığı ilköğretim yıllarında eksik bilgiler ve kavram yanlışları sonraki eğitim dönemlerinde konuya dair başarı durumunu ve öğrenci önyargılarını olumsuz etkilemektedir (Yenilmez & Avcu, 2009). Teknoloji destekli yönelimlerin güçlükleri ortadan kaldırmada etkili olduğu (Demetgül, 2018) ve başarıyı artırdığı (Körükçü, 2008) tespit edilmiştir. Bu araştırmada diğer sınıf düzeylerini de etkileyecek olan Tam sayılar ve mutlak değer konusunda DHA'nın öğrenci başarısına ve Matematik Kaygı düzeyine etkisinin belirlenmesi amaçlanmıştır. Teknoloji destekli uygulamaların hem başarıyı artırmada hem de MK'yı düşürmede etkili olması araştırmacıları bu konuda çalışmaya teşvik etmiştir.

Bu doğrultuda araştırmanın problem cümlesi şu şekildedir:

“Dijital hikâye destekli matematik öğretiminin Tam Sayılar ve Mutlak Değer konusunda altıncı sınıf öğrencilerinin akademik başarılarını ve matematiğe yönelik kaygı düzeylerini nasıl etkilemektedir”

Alt problemler

1. Dijital hikâye destekli matematik öğretimi Tam Sayılar ve Mutlak Değer konusunda altıncı sınıf öğrencilerinin akademik başarılarını nasıl etkilemektedir?
2. Dijital hikâye destekli matematik öğretimi Tam Sayılar ve Mutlak Değer konusunda altıncı sınıf öğrencilerinin matematiğe yönelik kaygı düzeylerini nasıl etkilemektedir?

YÖNTEM

Araştırmanın Modeli

Çalışmada nicel (ön test-son test deneysel desen) kullanılmıştır. Deneysel desenlerde belirli bir müdahalenin bir grup üzerindeki etkisi ön test ve son test ile ölçülür ve ölçümler arasındaki ilişkiye bakılarak farkın anlamlılığı araştırılır (Büyüköztürk, v.d., 2013). Araştırmada tek bir grup üzerinde ön test- son testler yardımıyla öğrencilerin akademik başarı düzeyleri ve MK düzeylerindeki değişimin incelenmesi hedeflendiğinden bu desen tercih edilmiştir.

Çalışma Grubu

Araştırmanın çalışma grubu Kars'ta bir devlet okulunda öğrenim gören 20 altıncı sınıf öğrencisidir.

Veri Toplama Aracı

Veriler araştırmacılar tarafından geliştirilen “Tam Sayılar ve Mutlak Değer Başarı Testi” ve Şentürk (2010) tarafından geliştirilen “İlköğretim Öğrencilerine Yönelik Matematik Kaygı Ölçeği” ile toplanmıştır. Başarı testi ulusal sınavlarda çıkmış 20 adet çoktan seçmeli (dört seçenekli) sorudan oluşmaktadır. Kaygı ölçeği ise toplam 22 sorudan oluşmakta olup, her soru için beş seçenek sunulmaktadır.

Araştırma Süreci

Araştırmacılar tarafından Tam Sayılar ve Mutlak Değer konusu kazanımları incelenmiş ve belirlenen hedeflere ulaşmak için okul ders saati dikkate alınarak dersin işleniş çalışmaları yapılabilecek gruba uygun olarak planlanmıştır. Uygulama sınıfında bir ders saati 40 dakika olmak üzere haftalık beş ders saati vardır. Uygulama çalışması Tam Sayılar ve Mutlak Değer konusunu kapsayacak şekilde toplamda dört hafta sürmüştür. Çalışma yapılacak konuda üç kazanım yer almaktadır. Bu çalışma için kazanımlara uygun olacak şekilde araştırmacılar tarafından sekiz adet dijital hikâye bir Web 2.0 aracı olan Animaker programı ile tasarlanmıştır. Dijital hikâyeler hazırlanırken uzman görüşünden yararlanılıp gerekli düzenlemeler yapılmıştır.

Veri toplama araçları uygulama öncesinde öğrencilere ön test olarak uygulanmıştır. Uygulama sürecinde öğrencilere dijital hikâye destekli öğretim verilmiştir. Hazırlanan dijital hikâyeler konunun ilerlemesine ve öğrencilerin durumuna göre dersin dikkat çekme, motivasyon, derse geçiş, uygulama, ölçme ve değerlendirme bölümlerinde kullanılmıştır. Öğrencilerin hikâyeleri günlük hayatla

ilişkilendirmeleri ve konu ile bağlantı kurmaları sağlanmıştır. Uygulama sonrasında veri toplama araçları son test olarak uygulanmıştır.

Verilerin analizi

Veriler SPSS programı ile analiz edilmiştir. Analizlerde 0.05 anlamlılık düzeyi baz alınmıştır. Normallik testleri yapılarak verilerin normal dağıldığı tespit edilmiştir. Ön test ve son testler arasındaki fark için bağımlı örneklem t-testi kullanılmıştır.

BULGULAR

1. Dijital hikâye destekli matematik öğretiminin Tam Sayılar ve Mutlak Değer konusunda altıncı sınıf öğrencilerinin akademik başarılarına etkisi bulguları

Ön test ve son test başarı puanları incelendiğinde farkın anlamlı olduğu görülmüştür [$t(19) = -3,268, p < 0.05$]. Öğrencilerin ön testte dair puan ortalamaları 7,40 ve son teste dair puan ortalamaları 10,65'tir.

2. Dijital hikâye destekli matematik öğretiminin Tam Sayılar ve Mutlak Değer konusunda altıncı sınıf öğrencilerinin matematiğe yönelik kaygı düzeylerine etkisi bulguları

Öğrencilerin ön test son test kaygı puanları incelendiğinde farkın istatistiksel olarak anlamlı olmadığı görülmüştür [$t(19) = 1,589, p > 0.05$]. Bulunan bu istatistiksel sonuca göre Tam sayılar ve mutlak değer konusunun dijital hikâyelerle öğretilmesi öğrencilerin matematiğe yönelik kaygı düzeyleri üzerinde bir etki göstermemiştir.

TARTIŞMA VE SONUÇ

Teknolojik yaklaşımlar öğrencilerin başarılarını artırmakta ve MK'yı gidermeye de yardımcı olmaktadır. Bu çalışmada DHA'nın öğrencilerin akademik başarılarını artırmada etkili olduğu görülmüştür. Bu açıdan literatürle benzeşik sonuçlar elde edilmiştir (Çokyaman & Çelebi, 2021; Gömleksiz & Pullu, 2017; Hung, Hwang & Huang, 2012; Karataş, 2020; Korucu, 2020; Özerbaş & Öztürk, 2017; Pala, 2021; Ulum & Yalman, 2018; Büyükcengiz, 2017; Yang & Wu, 2012). Başaran (2019) araştırmasında DHA'nın başarıyı etkilemediğini tespit etmiştir. Fakat geleneksel yöntemlerde öğrencilerin daha korku, panik ve yetersiz hissettiklerini de belirtmiştir. Benzer şekilde Çakıcı (2018) de başarı üzerinde bir etkisinin olmadığını fakat motivasyon ve tutumu olumlu etkilediğini söylemiştir. Araştırmanın sonucunda Dijital hikâye destekli eğitimin MK üzerinde bir etkisi olmadığı sonucuna ulaşılmıştır. Literatürde DHA'nın farklı kaygı türlerini gidermede etkili olduğu görülmektedir. Örneğin dinleme kaygısını (Rahimi & Soleimany, 2015) ve yazma kaygısını azaltmaktadır (Çapan, 2020).

Anahtar kelimeler: Dijital hikâye anlatımı, başarı, matematik kaygısı, tamsayılar ve mutlak değer