Instructional Technology and Lifelong Learning Vol. 5, Issue 1, 86-115 (2024)

https://dergipark.org.tr/en/pub/itall

ITALL

Research Article

ISSN: 2717-8307

The Effect of Using Web 2.0 Tools on Smart Boards on Primary School Students' Mathematics Lesson Achievement, Anxiety, and Attitudes towards Smart Boards

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Abstract

The purpose of this research is to examine the effects of web 2.0 tools on primary school first-grade students' mathematics lesson achievement, anxiety and attitudes towards the smart board. In the research, the quasi-experimental design with pretest-posttest control group was preferred. In this direction, the study was conducted with 25 students in the control group and 26 students in the experimental group for five weeks. Mathematics lessons were taught with smart boards and course materials in the control group and with web 2.0 tools and course materials on the smart board in the experimental group. Mathematics achievement test, smart board attitude survey and math anxiety scale were used as data collection tools. While analyzing the data, dependent and independent groups t-test analyses were used to compare the pre-test and post-test averages of the experimental and control groups. According to the results, there were significant differences in favor of the experimental group in the post-tests. It has been concluded that using web 2.0 tools for mathematics lessons has led to significant changes in the increase of students' achievement in mathematics lessons, the development of their attitudes towards the smart board, and the decrease of their mathematics anxiety level. The results are discussed in detail, and suggestions for practitioners and researchers are provided.

Keywords: Web 2.0 Tools, Primary School Math Lesson, Success, Motivation, Anxiety

Citation: Elma, M., Küçük, S. & Samancı, O. (2024) "The Effect of Using Web 2.0 Tools on Smart Boards on Primary School Students' Mathematics Lesson Achievement, Anxiety, and Attitudes towards Smart Boards". *Instructional Technology and Lifelong Learning, 5(1)*, 86-115. https://doi.org/ 10.52911/itall.1409203

Akıllı Tahtalarda Web 2.0 Araçlarının Kullanımının İlkokul Öğrencilerinin Matematik Dersi Başarılarına, Kaygılarına ve Akıllı Tahtaya Yönelik Tutumlarına Etkisi

Özet

Bu araştırmanın amacı web 2.0 araçlarının ilkokul birinci sınıf öğrencilerinin matematik dersi başarısına, kaygılarına ve akıllı tahtaya yönelik tutumlarına etkisini incelemektir. Araştırmada öntest-sontest kontrol gruplu yarı deneysel desen tercih edilmiştir. Bu doğrultuda kontrol grubunda 25, deney grubunda ise 26 öğrenci ile beş hafta boyunca çalışma yürütülmüştür. Matematik dersleri kontrol grubunda akıllı tahta ve ders materyalleriyle, deney grubunda ise akıllı tahtada web 2.0 araçları ve ders materyalleriyle işlenmiştir. Veri toplama aracı olarak matematik başarı testi, akıllı tahta tutum anketi ve matematik kaygı ölçeği kullanılmıştır. Verilerin analizinde deney ve kontrol gruplarının ön test ve son test ortalamalarının karşılaştırılmasında bağımlı ve bağımsız gruplar t-testi analizlerinden yararlanılmıştır. Sonuçlara göre son testlerde deney grubu lehine anlamlı farklılıklar bulunmuştur. Web 2.0 araçlarının matematik derslerinde kullanılmasının öğrencilerin matematik derslerindeki başarılarının artmasında, akıllı tahtaya yönelik tutumlarının gelişmesinde ve matematik kaygı düzeylerinin azalmasında önemli değişikliklere yol açtığı sonucuna varılmıştır. Sonuçlar ayrıntılı olarak tartışılarak uygulayıcılara ve araştırmacılara önerilerde bulunulmuştur.

Anahtar Kelimeler: Web 2.0 Araçları, İlkokul Matematik Dersi, Başarı, Motivasyon, Kaygı

Date of Submission	24.12.2023
Date of Acceptance	23.04.2024
Date of Publication	30.06.2024
Peer-Review	Double anonymized - Two External
Ethical Statement	It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.
Acknowledgments	We express our gratitude to all the students who took part in the study.
Author(s) Contribution	**Elma:** Methodology, Data curation, Writing- Original draft preparation. **Küçük:** Conceptualization, Methodology, Writing- Reviewing and Editing. **Samancı:** Supervision, Validation
Plagiarism Checks	Yes - Turnitin
Conflicts of Interest	The author(s) has no conflict of interest to declare.
Complaints	Itall.journal@gmail.com
Grant Support	The author(s) acknowledge that they received no external funding in support of this research.
Copyright & License	Authors publishing with the journal retain the copyright to their work licensed under the **CC BY 4.0**.

1. Introduction

The areas related to the rapid developments arising from the conflicts have also expanded in parallel. It has become a necessity in the use of technological education and use, which comes out of almost every aspect of life (Kabak, 2020). It is important to use it in order to live effectively. For this reason, technology and education have begun to be mentioned together in today's world, and there are significant changes in the understanding of education (Mete and Batıbay, 2019). The rapidly expanding use of technology also expands and uses the field of education. Especially with the widespread use of the Internet and smartphones, computers, tablets, etc., share duplication; it allowed the opportunity to reproduce in the fast formats it obtained and easily access all the information it contained (Batibay, 2019). In order to provide access to technology in schools, its scope has been realized in the world and Turkey. With this study, we entered a period in which education was organized according to technology from the periods included in their education. In Turkey, from preschool education institutions to universities, it is tried to be taught with content such as technological literacy all over the world (Metin, 2018). The FATIH Project in Education aims to ensure equality of opportunity in education and training and to use technology in our schools. It was initiated for effective use in lessons in a way that appeals to the body (MEB, 2016). Ekici and Yılmaz (2013) aim to take the FATIH Project carried out in our country into global competition. An example of an initiative for Turkey's effort to activate education using contemporary technology defines it as. The reflections of the technological changes emerging at the global level in the fields of education in Turkey have been increasing in the last period. The first aim of the "Movement to Increase Opportunities and Improve Technology (FATIH)" project, carried out in this direction, is to provide equality of opportunity in education and training. In addition, it is a project that has emerged to improve the technology in all educational institutions and use information technologies in learning and teaching processes in a way that will appeal to more sense organs. Within the scope of the FATIH project, it is aimed to provide Internet and smart board infrastructure to the classrooms, integrate schools with technology, and realize effective and permanent learning thanks to multiple learning environments (Similar, 2019). The objectives of the project seem to be related to 21st-century skills. It can be stated that this project, which aims to combine education and training activities with information technologies, serves the field of technology, information, and media, one of the 21st-century skills (Eryılmaz & Uluyol, 2015).

When MEB curricula are examined, it is seen that individuals need to use technology efficiently and effectively (MEB, 2018). Smart boards, the Internet, and tablets can only be used correctly by individuals with information technology literacy. When these tools are not used correctly in daily life, both cause information pollution and problems with the reliability of this information. The ability to critically look at the media and confirm the accuracy of the information accessed over the Internet is closely related to media literacy, which is one of the 21st-century skills (Eryılmaz & Uluyol, 2015). When technology is used efficiently in education, it provides significant advantages to both teachers and students in the education process (Keskin, 2021). It is usual for the new generation of individuals who are integrated with the developing technology to want to see these technological products in their school and classroom environments. It is striking that today's students tend to lose their interest and motivation towards traditional teaching environments with the developing technology (Çakır, 2019; Batıbay, 2019; Öztürk, 2022; Gök, 2022; Arslan, 2022).

It is known that the more sensory organs are addressed in educational environments, the more effective learning becomes possible. From this point of view, educational technology tools such as smart boards have a significant impact on demonstrating this permanence (Çakır, 2019). Considering that primary school students are in the concrete operational stage, it is clear that addressing their different sensory organs will greatly contribute to their education (Mata et al., 2016; Küçükgöz, 2019). It is stated that using smart boards provides significant convenience in teaching the acquisitions in the education program (Altınçelik, 2009). It is seen that there are benefits such as enabling effective learning, providing high-level thinking skills, developing effective problem-solving skills, and facilitating knowledge transfer (Hillier, 2013; Çoklar & Tercan, 2014; Koğu, 2018; Yakut, 2019). An important effect of the smart board in the field of education is to remove the uniformity of teaching. This way, course repetition becomes easier, reducing the teacher's burden. For this reason, the importance of the effective use of smart boards is better understood by educators (Choudhury, 2014; Kandemir, 2015).

1.1. Use of Web 2.0 Applications in Education

In order to improve the technological competencies of today's students, the use of digital products in teaching activities provides them with great convenience. The most important convenience and support for teachers in this regard is using web 2.0 applications on smart

boards with internet access (Horzum, 2007). Web 2.0 tools are a structure that provides the opportunity to create content on the Internet easily and to improve teaching content. Web 2.0 tools, which are very easy to prepare and implement, contribute to social interaction and cooperation when used in the field of education and training (Bidaki & Mobasheri, 2013; Atici & Yıldırım, 2010). Using web 2.0 tools in teaching activities increases the students' motivation by enabling them to actively participate in learning activities and develop positive attitudes towards the lessons (Hillier, 2013; Özipek, 2019). Web 2.0 tools are online tools that anyone with basic computer literacy can create content and share with others without needing advanced computer knowledge. Thanks to these applications, the content created can be easily shared through different channels. Quickly shared content allows users to communicate effectively (Hillier, 2013; Choudhury, 2014; Batıbay, 2019). The advantages of web 2.0 tools, such as saving time for individuals and enabling people to come together and socialize through social media, cause widespread use. In addition, the fact that data can be stored for a long time, that they are functional in producing and accessing news independently, and that the emerging applications can be easily updated also paves the way for the frequent use of these tools (Bidaki & Mobasheri, 2013; Mata et al., 2016; Önal, 2018; Eşgi & Kocadağ Ünver, 2018; Batıbay, 2019). Due to these features, web 2.0 tools are functionally preferred in every field, from education to art, commerce to journalism (Choudhury, 2014).

The importance of web 2.0 applications, which are increasingly used in educational environments, is increasing day by day. Looking at the literature (Bidaki & Mobasheri, 2013; Hillier, 2013; Choudhury, 2014; Tatlı, 2017; Önal, 2018; Koğu, 2018; Parlak, 2019), it is seen that the activities for the use of web 2.0 in today's schools and classrooms have increased. Technological tools, such as magazines, books, blackboards, chalk, etc., have been in educational environments since ancient times. With technological developments, tools such as smart boards, computers, and projectors became popular in educational environments. Along with the emerging developments, web technologies (web 1.0, web 2.0, web 3.0) have been added to these technological tools. Along with this process, teachers met with applications such as Blog and Facebook and tools built on web 2.0 applications. In order to use these new technological tools, which are increasingly taking place in human life, teachers and students are expected to have skills such as digital literacy (Demir & Eren, 2020).

Web 2.0 tools, which today's teachers and students have started to use, increase collaboration with each other and the students' active participation in the lesson. These tools make learning meaningful and fun for students and positively affect students' motivation and attitudes (Keskin 2021). These tools include educational technologies that enable easy and fast access to information and actively include the individuals who use it in education (Çekinmez, 2009). It is possible to say that web 2.0 tools, which have an important place in educational technology, have many advantages such as increasing academic success in courses, facilitating teaching by concretizing abstract concepts, motivating learning, providing permanent learning, and providing a focus on the course (Choudhury, 2014; Blannin, 2015; Korucu, 2018; Yakut, 2019; Keskin 2021). It is stated that when web 2.0 tools are used in teaching processes, they offer enriched learning environments, motivate students to learn by attracting their attention, and increase their active participation in the lesson (Darancık, 2014). The fact that the materials used in classroom environments are mostly one of the web 2.0 tools in recent years has resulted in the research of these tools in education. In educational activities using web 2.0 tools, it becomes easier for students and teachers to see the whole process and how they structure a concept, problem or event (Horzum, 2010; Eren, 2013; Mata et al., 2016). These tools used in educational environments offer environments that provide students with the opportunity to learn on their own. Thanks to web 2.0 tools, students can examine their learning situations, realize their shortcomings, and reinforce their learning (Keskin, 2021). In activities carried out using web 2.0 tools, students' academic achievement may increase, and their metacognitive awareness levels may improve positively by becoming aware of their learning (Öztürk, 2022). However, it is stated that despite the convenience and advantages these technological tools offer, their use in education is not at the expected level (Hillier, 2013; Bursalı, 2022; Mete and Batıbay, 2019; Batıbay, 2019).

1.2. Using Web 2.0 Applications at the Primary School Level

When the literature on the use of web 2.0 tools at primary school level is examined, studies in different disciplines and research areas show that web 2.0 tools increase achievement. According to many studies from the related literature (Korucu, 2018; Ahmed & Opoku, 2022; Bamoallem & Altarteer, 2022; Bolatli & Korucu; Kaur, Bhatia & Stea, 2022; Öztürk, 2022), web 2.0 tools are an interactive tool in the education and training process. It provides an environment, supports the mental skills of students, and enables a communicative structure to

be formed between the teacher and the student. These tools offer several positive possibilities compared to traditional teaching methods and textbooks. Considering the primary school level, web 2.0 tools offer the opportunity to actively use digital technologies in lessons, attracting students' attention, contributing to their mental development, and enabling them to develop positive attitudes towards the lesson. Students who are allowed to interact with these tools are more active and become technology literate over time (Blannin, 2015). In addition, with these tools, more sense organs can be included in the learning process, students can develop better cognitively, and group work can be encouraged. This leads to the socialization of students and enables them to benefit from each other's experiences (Ahmed & Opoku, 2022).

These tools make it easier for primary school students to create content and thus improve their self-confidence (Conole & Alevizou, 2010). Web 2.0 tools provide environments that support learning, and ensure active participation, especially in primary school age, and encourage collaboration (Huang, Jeng, & Huang, 2009). Education based on web 2.0 tools can offer significant benefits, especially at primary school level. In this way, it may be possible to eliminate the monotony of the classical education system (Kaur, Bhatia, & Stea, 2022).

Using web 2.0 tools supports the active participation of students at the primary school level and helps teachers to design more actively. The use of web 2.0 tools provides teachers with more visuals for students' performance and helps students learn more easily and effectively (Conole & Alevizou, 2010; Elmas & Geban, 2012; Ahmed & Opoku, 2022). In the context of the benefits of web 2.0 tools in primary school, teachers' use of learning designs prepared by using these tools has important consequences. For this reason, all primary school teachers should be trained to use web 2.0 tools actively in their lessons (Blannin, 2015).

1.3. Mathematics Achievement and Anxiety in Primary School

The reason for the failures in mathematics may be the learner's reluctance to learn mathematics, anxiety about failure, personality traits, or the inappropriateness of the applied method (Sarı et al., 2017). The reason for the failures caused by the learner and the teacher may also be the applied methods. For this reason, the method applied in mathematics education is critical. The more the classroom, which is a learning environment for students, appeals to many senses, the more success can increase (Tabuk, 2019).

Differences in students' mathematics course success are directly or indirectly related to many variables (Batı, 2021). These variables that emerge during the education process can be evaluated as personal factors depending on the student, classroom environment, teacher, educational status, and family factors. Aysan, Tanrıöğen and Tanrıöğen (1996) stated that students' mathematics failures were related to the methods used and the learning environment. Many studies reveal the effect of technological tools used in the classroom environment (Taşkın & Ezentaş, 2018). Revealing the factors determining student success in the mathematics course has long been the focus of educational research (Koç, 2019). Anxiety or positive attitude towards mathematics lessons in students is one of the affective domain features that affect mathematics achievement (Barış 2009). Studies show that there is a relationship between students' mathematics achievement, their mathematics anxiety levels, and their positive attitudes towards mathematics (Çavdar, 2015).

In addition to the factors affecting the mathematics achievement of primary school students, the increase in the instructional quality of mathematics lessons is also an important factor that directly affects the students' mathematics achievement (Tabuk, 2019). The clarity of the teaching and the technological opportunities offered to the students are important determinants of mathematics achievement (Genç and Öksüz, 2023; Batı, 2021). When the literature is examined, it has been concluded that there is a significant positive relationship between the increase in instructional clarity for the mathematics course and the preference for technological tools and mathematics achievement (Şahin et al., 2022; Yağan, 2021). Classroom environments that support the lesson, such as the use of computers or smart boards, and the tools that the teacher uses by following the current developments in the education process are among the educational opportunities in the school. When we look at the research on this subject in our country, both at the university level and Studies at primary and secondary education levels stand out. For example, Erduran and Tataroğlu (2009) stated that teachers use smart boards in science and mathematics teaching. In their study, they examined the use of smart boards among students to determine their opinions. They determined that it increased their interest, motivation, and participation. Ekici (2008) stated that mathematics education using smart boards improved students' mathematics achievement and retention levels compared to mathematics education carried out with traditional methods. He concluded that it had a strikingly positive effect. Considering the studies, it is emphasized that supportive classroom environments contribute

positively to shaping the student's mathematical success and are an important and determining factor (Sarı et al., 2017; Yılmaz & Bindak, 2016).

1.4. Importance and Rationale of the Research

The rapid change in science and technology makes it necessary to use the latest technological developments to transmit information (Bilgic et al., 2011). When the studies are examined, it seems complicated for institutions that cannot benefit from new technological opportunities and renew themselves in schools, which are the areas where learning takes place, to catch up with contemporary education standards (İnce, 2011; Önal, 2018; Gürleroğlu, 2019; Öztürk, 2022). Considering today's conditions, it does not seem easy for the new generation to actively participate in teaching activities using traditional methods. Because this new generation wants to access information quickly. At this point, web 2.0 tools appear as functional applications that will allow students to explore and learn quickly. In educational research, there are many studies on the impact of web 2.0 tools on student success. However, it can be said that there are not enough studies on the effects of certain web 2.0 applications on direct education. Today's students prefer compelling visuals and games over traditional studies instead of pages full of text. It is necessary to benefit from these technological tools in order to ensure that individuals of this age participate in learning activities effectively and develop a positive attitude towards their lessons (Batıbay, 2019; Bilgiç et al., 2011). However, due to the epidemic that emerged at the end of 2019 and was effective worldwide, countries around the world suspended education in schools, and compulsory distance education was started. In this process, educators were able to reach their students with web 2.0 tools. In this period, when printed materials lost their function, digital tools gained importance (Kabak, 2020).

Gezer (2020) states that products based on educational technology should be included more at the primary school level, which is the first step of education. This is because individuals at the primary school level need more concrete and rich educational experiences. Rich educational experiences, especially in the primary school period, require the inclusion of learning and teaching practices equipped with technological products (Kandemir, 2015). For this reason, there is a need to produce and use tools and materials prepared in accordance with these programs, which will clearly reveal and concretize the education curriculum at primary school levels (Gürleroğlu, 2019; Parlak, 2019; Mete and Batıbay, 2019). This study focuses on examining

the effects of animation and evaluation activities prepared with web 2.0 tools in mathematics education, suitable for primary school children, on course achievement, anxiety level, and attitude towards smart board. Thanks to the study, children can be willing to use web 2.0 tools as a learning tool and use them in their next education life. This study is important because it focuses on anxiety, which is important in mathematics and other basic school lessons. With the development of technology, the diversity in the number of web 2.0 tools is also increasing. This study is also critical because it determines which web 2.0 tools are more suitable for increasing the achievement of mathematics courses and reducing anxiety. In addition, the limited number of experimental studies on the effect of the use of web 2.0 applications on students in primary school mathematics education increases the importance of this study. It is thought that the data obtained from the research will guide the classroom teachers working in primary schools about the activities they will perform using smart boards and web 2.0 tools in the education process. This research is expected to provide clues to the use of technology in primary schools. In this direction, the problem sentence of this research is "Does the use of web 2.0 tools on smart boards for primary school students affect students' math achievement, anxiety and attitudes towards smart board?" poses a question. In line with the main purpose of the research, answers to the following questions will be researched:

1. Is there a significant difference in the students' mathematics achievement between the experimental and the control groups?

    a. Is there a significant difference between the pre-test and post-test scores of the groups?

    b. Is there a significant difference between the groups' post-test scores?

2. Is there a significant difference in the students' mathematics anxiety levels between the experimental and control groups?

    a. Is there a significant difference between the pre-test and post-test scores of the groups?

    b. Is there a significant difference between the groups' post-test scores?

3. Is there a significant difference in the students' attitudes towards the smart board between the experimental and control groups?

a. Is there a significant difference between the pre-test and post-test scores of the groups?

b. Is there a significant difference between the groups' post-test scores?

2. Method

This research is a quasi-experimental research with pre-test and post-test control groups. In this respect, the quasi-experimental method can be expressed as one of the most used quantitative methods in educational research (Büyüköztürk, 2020). In experimental studies, researchers try to reveal the effect of the independent variable on one or more dependent variables. 51 students of two classes who were educated in the first grade of a primary school in Gümüşhane in the 2022-2023 academic year participated the study. One of these classes was chosen as the control group and the other as the experimental group. While the "Natural Numbers" unit in the mathematics lesson was taught using smart boards and course materials with the control group students, the same unit and achievements were processed on the smart board with web 2.0 tools and course materials in the experimental group students. In the actual implementation process, first of all, Necessary permissions were obtained by relevant institutions for the implementation process of the study (The final decision is Ethics Committee meeting dated 23/12/2022, session number 14, and the decision number is 20).

During the implementation process, Powtoon and Plickers web 2.0 tools were used within the scope of the research. “Plickers”, one of the web 2.0 tools applied in the experimental group within the scope of the study, is an accessible, free and interesting educational tool used by thousands of instructors around the world to collect instant results in the classroom and to evaluate their students. The Plickers application can be accessed via the “www.plickers.com” web page. The Powtoon application, on the other hand, is an application in which fun animations are prepared using ready-made animations and templates in the system.

The experimental process within the scope of the research was well planned. Since the teachers of both classes were different, an attempt was made to ensure unity of practice through short meetings before the lesson. Following the precautions taken by the researcher to eliminate situations that would affect reliability, the course process of the experimental group started. First of all, the annual program prepared by the Ministry of National Education was examined and preparations were made in accordance with the mathematics course curriculum. These

plans are offered ready-made for each academic year in accordance with the mathematics curriculum. Daily mathematics activity plans have been prepared in accordance with the achievements of the mathematics course "Natural Numbers" unit. In practice, 40 minutes of class time is allocated for the activities prepared for each lesson. During the course teaching process of the control group, the textbook was downloaded to the smart board and opened, keywords were underlined, important parts were enlarged or colored, answers were highlighted, and this subject was tried to be explained to the students. Using the "Antropi Teach" application on the smart board, summaries and important points that students could see were written on the smart board. These practices were tried to be implemented in every lesson. In addition to the applications made in the control group (textbook download, Antropi Teach, etc.) in the experimental group, web 2.0 tools were used in both the teaching and evaluation phases of the course. Care was taken to ensure that the only difference between the two groups was the web 2.0 tools applied. Teachers have worked meticulously in this regard. Therefore, the only difference in the teaching of the two groups was web 2.0 tools. In other words, except for the manipulated variables, the experimental conditions were tried to be kept constant.

Before the applications in the experimental group, five video animations were prepared by the researchers with the "Powtoon" tool. These animations are created from visuals, short explanations and summary information on the subject. Each one was turned into a lesson video. It includes images from textbooks, worksheets, and computer-generated images. These visuals aim to help children understand and concretize the subject better. The selected images have been meticulously prepared to allow the subject to become concrete in children's minds. Various sound effects and music are also used in each animation. The videos are approximately 5-6 minutes long. While preparing these video animations, the elements were chosen to be close to the students and the activities were prepared by the classroom teacher. These applications were opened in the lessons and shown to the students and the lessons were taught.

In this part, the interaction of the students with the smart board was in the form of following the animations. "Plickers" tool was used in the evaluation step. After the questions related to the subject were prepared and shown to the students on the smart board, the students' answers were taken and reported with the help of the smartphone, thanks to the QR codes distributed to the students. The results were instantly shown to the students on the smart board. Five exams

consisting of 5 questions in total were administered to the students at the end of each week. These questions have been prepared by using instructors and textbooks who are experts in their fields. "Mathematics anxiety scale" and "Smart board attitude questionnaire", which were applied to the students as pre-test and post-test, were filled in by the researchers by interviewing them individually because they were children who can not yet read very well. These interviews lasted an average of 30-35 minutes for each student. The implementation flow process is shown in Table 1.

Table 1.

The Implementation Process

Time	Process
1 day before application	Experimental Group (EG) Pre-tests Control Group (CG) Pre-tests
Application (5 weeks)	Teaching the experimental group with web 2.0 tools Teaching the control group with traditional materials on the smart board
1 day after application	EG Post-tests CG Post-tests

The study group of this research consists of students who attend the first grade in a public school located in the city center of Gümüşhane in the fall semester of the 2022-2023 academic year and have smart boards in their classrooms. 51 first-grade students studying in two separate classes participated in the study. The gender distribution of the students is shown in Table 2 in detail.

Table 2.

Gender Distribution of the Study Group

Gender	Control	Experimental	Total
Girls	13	12	25
Boys	12	14	26
Total	25	26	51

In this study, the control group consisted of 25 people, 13 girls and 12 boys, and the experimental group consisted of 26 people, 12 girls and 14 boys. In total, 25 female and 26 male students are the participants of the study.

2.1. Achievement Test

In this study, an achievement test created by the researchers by examining textbooks and taking the opinions of three teachers who are experts in their fields was used to measure the knowledge levels of the students in the control and experimental groups. Before preparing this

achievement test, the purpose of the test was clearly stated. The purpose of the test is to understand the success levels of students. The type of measurement tool was determined as fill-in-the-blank and matching according to the levels of primary school students, and a specification table was created for the goals to be achieved. Since the students were first graders and might have difficulty reading, the questions were read to the students by the teachers and they were asked to answer them. Additionally, to avoid any problems during the answering process, the answers were taken with the help of teachers. For this purpose, each student was interviewed one-on-one. In this context, a question pool was created and the items were reviewed. The prepared items were administered as a pilot application to 40 first grade students at another school and the test were finalized. The same method was tried to be used in the pilot application and answers were received from the students. This tool was developed for the acquisitions of "Reading and writing numbers" and "Rhythmically counting forwards by one, five and eleven" in the "Natural numbers" unit specified in the mathematics curriculum (MEB, 2018).

Some methods were carefully followed to ensure the reliability and content validity of the achievement test used to measure the mathematics course success of the students participating in the research. The first of these ways is to use the achievement test as pre-test and post-test during the implementation phase of the study. In the second stage, a pilot application was conducted in a different school for testing. At the end of the pilot application, evaluations were made with two subject matter experts and three teachers from the university and the necessary arrangements were completed. As the third step, the existing behavioral targets within the scope of the subject were revealed and which achievements to be selected were determined by using these targets. In addition, for each test item, interviews were held with both teachers and two subject area experts to give the questions their final form. The KR-20 coefficient was used in the reliability calculations regarding the scoring system in the achievement test used in the application (Büyüköztürk et al., 2012). As a result of the analysis, the KR-20 of the test was found to be .58. The achievement test sections are presented in Table 3.

Table 3.

Achievement Test Sections

Section	Explanation	Example Question
1. Section	Distinguishing the number (marking the relevant number among other numbers and figures).	100-99-98-?
2. Section	It is expected to find which number will come before the number shown in the given picture (one and five).	5-10-15-?
3. Section	Ability to read and write the corresponding digit (write attribute). In this section, the student will write which number will come after the relevant number.	16-17-18-?
4. Section	Ability to write the number backwards. Match (fix) the corresponding pictures for it.	40-30-20-?
5. Section	Reading the number (makes a sequence with heavy use of related numbers accurate).	5- beş 6- ?

2.2. Mathematics Anxiety Scale for Primary School Students

In this study, a one-dimensional mathematics anxiety scale consisting of 10 items, prepared by Bindak (2005) and whose reliability and validity have been proven, was used. This scale aims to determine the anxiety levels of students in the control and experimental groups towards mathematics course. Cronbach's Alpha coefficient regarding the internal consistency of the scale was found to be 0.84. The scale includes a 10-item, 5-point, one-dimensional, Likert-type survey. Each student responding to the survey responds to each item on five subscales. These answers were obtained by asking each student one by one, since the students were first graders. In the survey, positive items regarding anxiety were scored as 5-4-3-2-1, and negative items regarding anxiety were scored as 1-2-3-4-5. In this way, an anxiety score emerged for each participant. The highest anxiety score that can be obtained from the survey is 50 and the lowest anxiety score is 10. An example of the positive and negative questions in the survey is “When I think of mathematics, complex and incomprehensible things come to my mind; "Mathematics is very fun for me" questions can be given.

In order to reveal the attitudes of students in the control and experimental groups towards the use of smart boards, the literature was examined and the "Smart board attitude survey" was developed (Akkaya, 2019; Batıbay, 2019; Gürleroğlu, 2019; Kabak, 2020; Ranger, 2015; Mete and Batıbay, 2019; Öztürk, 2022). While developing this survey, the steps expressed by Büyüköztürk

(2020) were followed. These steps; It can be expressed as planning the survey, writing the survey items, reviewing and editing the prepared items, conducting the pilot application, making arrangements according to the results and finalizing the survey. Additionally, at the beginning of the survey, there are questions about the demographic information of the participants and their use of technological tools. In order to obtain data, these questions were asked to each student separately by the researcher. Each stage has been carefully implemented to ensure that students do not have problems in reading and understanding. Teachers meticulously monitored that all students understood and answered the exam correctly. The survey contains a 10-item, 3-point Likert type survey form. In the survey, positive items regarding attitude were scored as 3-2-1, and negative items were scored as 1-2-3. Thus, an attitude score was obtained for each participant. The highest score that can be obtained from the survey is 30 and the lowest score is 10. Examples of positive and negative questions in the survey include “I like the lesson better when the smart board is used; Questions such as "I'm bored of using the smart board" can be asked.

2.3. Data Analysis

In this study, mathematics course achievement test, mathematics anxiety survey and smart board attitude survey were applied to the students. The data obtained as a result of the applications were examined with the SPSS package program. As a prerequisite for quantitative data analysis, the normality of the pretest and posttest of the test data was examined. In order to reveal whether the scores obtained from these groups showed normal distribution, Shapiro-Wilk normality test and skewness-kurtosis coefficient values were calculated. Since the number of participants in the experimental and control groups was less than 50, it was deemed appropriate to use the Shapiro-Wilk test. In the literature, it is recommended to use the Shapiro-Wilk test to calculate the normality assumption for groups of less than 50 people (O'Donoghue, 2012). Different values for skewness and kurtosis are mentioned in the literature. The fact that the skewness and kurtosis indices, calculated by dividing the skewness and kurtosis values by their standard errors, are close to 0 within the limits of -1.96 and +1.96, is considered as evidence for the existence of a normal distribution. Descriptive measurement results (arithmetic mean, standard deviation, median) of the tests applied were also obtained in order to obtain information about the general distribution of scores. When the data obtained at the specified evaluation points were examined, it was seen that the scores showed a normal distribution

according to these data. Dependent and independent sample t tests were applied to the data where normality was achieved. The Cohen d effect value of the average scores obtained by the control and experimental groups after the training and applications was also examined (Yıldırım and Yıldırım, 2011). As a general recommendation, Cohen's d effect value can be expressed as weak if this value is less than 0.2, medium if it is 0.5, and strong if it is greater than 0.8 (Cohen, 1988; Kılıç, 2014). The Shapiro-wilk values of the data obtained within the scope of the study are presented in Table 4.

Table 4.

Shapiro-wilk Values for Groups

Data collection tool	Groups	p
Math achievement test	EG Pre-test	.528
	EG Post-test	.465
	CG Pre-test	.343
	CG Post-test	.685
Math anxiety scale	EG Pre-test	.146
	EG Post-test	.112
	CG Pre-test	.095
	CG Post-test	.569
Smartboard attitude survey	EG Pre-test	.311
	EG Post-test	.095
	CG Pre-test	.120
	CG Post-test	.141

The researchers implemented the following measures to eliminate some factors that could affect the validity and reliability of the study. In the research, care was taken to develop the mathematics achievement test to be applied in the selection of surveys and scales representing quantitative data sources. The data were analyzed impartially in order to reveal the pre-test and post-test effects of these tests, especially on the students. In order to clearly demonstrate objectivity, the scores of each student taken as data were coded, and each student's own scores were recorded directly in the pre-test and post-test. In addition, in order for the students to answer the scale items sincerely and independently, the scales were administered by the researcher in a classroom environment by meeting each student one-on-one. The fact that the students were in the first grade made this mandatory, and since there were also students who could not read yet, the survey and scale data were collected through one-on-one interviews. It took an average of 30-35 minutes to fill out each survey and scale, and the data was collected

objectively. All these applications were carried out meticulously by the researchers, and the opinions of two academicians who were experts in their fields were taken at each stage. This also prevented data loss and ensured accurate measurements. The raw data collected by the researcher was examined together with two academicians who are experts in their field. An attempt was made to reduce the effect of independent variables that could affect the participants in the control and experimental groups and harm the reliability of the application process. In this context, the data of the study were collected by researchers and in their natural environment. The reason for this is to reduce the influence of external factors that could disrupt the impartiality of researchers and participants. In addition, in order to increase the reliability of the research, the opinions of colleagues (1st grade teachers) were frequently consulted during the implementation process. The opinions of three first grade teachers were taken at each stage of these applications.

3. Findings

In this part of the research, the findings that emerged as a result of the analysis of the data collected for the research questions are included. The findings were presented in accordance with the order of the research questions. In this direction, the results obtained from the findings of the study are interpreted in the discussion and suggestions section.

3.1.. Findings Related to Achievement in Mathematics Lesson

The experimental and control groups' pre-test and post-test scores were compared using t-test analyses. As seen in Table 5, a significant difference was found in favor of the post-test in the achievement test averages of the experimental group students [$t(26)= -13.255$; $p<.05$]. According to Table 6., it is seen that the web 2.0 tools applied for the mathematics lesson have a high level of positive effect on the achievement of the students. A statistically significant difference was found in the achievement test averages of the control group students in favor of the post-test [$t(25)= -5.095$; $p<.05$].

Table 5.

t-test Results Regarding Achievement Test Pre-test and Post-test Scores of Experimental and Control Group Students

Tests	n	M	SD	t	p	d
EG Pre-test	26	56.42	15.85	-13.255	.000	0.74
EG Post-test	26	88.61	13.71			
CG Pre-test	25	55.20	17.05	-5.095	.000	0.66
CG Post-test	25	82.60	14.19			

As seen in Table 6, there is a statistically significant difference in favor of the experimental group in the achievement test post-test averages [t(51)= 3.754; p<.05].

Table 6.

t-test Results of Pre-test and Post-test Scores of Achievement Test Experimental and Control Group Students

Tests	n	M	SD	t	p	d
EG Post-test	26	88.61	11.44	3.124	.002	0.47
CG Post-test	25	82.60	14.04			

3.2. Findings Obtained Regarding the Level of Anxiety in Mathematics Lesson

As seen in Table 7, there was a significant difference in favor of the post-test in the mean anxiety levels of the students in the experimental group towards the mathematics lesson [t(26)= -12.669; p<.05]. A significant difference was found in the mean anxiety levels of the students in the control group towards the mathematics lesson in favor of the post-test at the low effect level [t(25)= -5.195; p<.05].

Table 7.

t-test Results of Experimental and Control Group Students' Anxiety Levels for Mathematics Lesson, Pre-test and Post-test Scores

Tests	n	M	SD	t	p	d
EG Pre-test	26	35.30	14.85	-12.669	.000	0.83
EG Post-test	26	23.88	12.71			
CG Pre-test	25	31.00	17.95	-5.195	.000	0.31
CG Post-test	25	25.92	14.36			

As seen in Table 8, it is seen that there is a significant difference in favor of the experimental group in the post-test averages of the students [t(51)= 3.124; p<.05].

Table 8.

t-test Results of the Pre-test and Post-test Scores of the Experimental and Control Groups' Anxiety Levels towards the Math Lesson

Tests	n	M	SS	t	p	d
EG Post-test	26	23.88	11.44	3.124	.002	0.16
CG Post-test	25	25.92	14.24			

3.3. Findings Regarding Attitudes Towards Smart Board

As seen in Table 9, a significant difference was found in favor of the post-test in the mean attitude of the experimental group students towards the smart board [t(26)= -12.909; p<.05]. A significant difference was also found in the average of the control group students' attitudes towards the smart board in favor of the post-test at the moderate effect level [t(25)= -5.495; p<.05].

Table 9.

t-Test Results of the Experimental and Control Group Students' Attitudes Towards Smart Board Pre-Test and Post-Test Scores

Tests	n	M	SD	t	p	d
EG Pre-test	26	14.61	14.85	-12.909	.000	0.68
EG Post-test	26	24.57	12.71			
CG Pre-test	25	16.48	18.05	-5.495	.000	0.43
CG Post-test	25	23.68	15.04			

As seen in Table 10, it is seen that there is a significant difference at the small effect level in favor of the experimental group in the post-test averages [t(51)= 3.217; p<.05].

Table 10.

t-Test Results of the Experimental and Control Groups' Attitudes Towards Smart Board Pre-test and Post-test Scores

Tests	n	M	SD	t	p	d
EG Post-test	26	24.57	13.71	3.217	.020	0.06
CG Post-test	25	23.68	15.04			

4. Discussion and Conclusion

Within the scope of this study, the collected data on the effects of web 2.0 tools on primary school 1st grade students' success in mathematics lessons, their anxiety, and their attitudes towards smart board were analyzed and evaluated. According to the research results, the academic success of the students who learn mathematics with web 2.0 tools changes positively. As a result of teaching with web 2.0 tools, the fact that the mathematics achievement of the experimental group students was higher than that of the control group students means that

these applications have a positive effect on student success. After the experimental procedures, it was found that there was a significant difference in mathematics learning in favor of the experimental group. When the literature is examined, many studies show that web 2.0 tools have positive contributions to students' mathematics lesson achievement. Conole & Alevizou (2010), Bidaki & Mobasheri (2013), Blannin (2015), Bursalı (2022), Keskin (2021), Gürleroğlu (2019), Batıbay (2019), who stated that the academic success of the students increased at the end of the training with web 2.0 tools.), Tatlı (2017), Similar (2019) support the results of these studies. Studies showing that web 2.0 tools used in education increase the success of students are not limited to these. In their study, Deperlioğlu and Köse (2010) emphasized the use of web 2.0 tools in education, the areas of use of which are gradually expanding. According to the research, users stated that web applications facilitate interaction between users, enable them to work collaboratively over the Internet, and are effective in educational environments. Borich (2017), on the other hand, states that web 2.0 tools have been frequently used in educational environments in recent years as they facilitate teaching and learning. Many of these applications are free to use and allow collaboration. These tools, which have a dynamic structure, make students active in the education process. However, when the literature is examined, it is seen that some studies do not support these results. However, these studies are only a small part of them. As an example of these studies, İnce (2011) found no significant relationship between the use of Web 2.0 tools and their ability to write English words. When all these studies and this study are considered, it is seen that web 2.0 tools positively contribute to students' mathematics achievement. The situation that emerged because of the study offers important clues about the importance of Web 2.0 tools. Especially in primary school, these technological tools can be evaluated to facilitate mathematics teaching.

According to the results of the data obtained from this study, a significant difference was found between the mathematics anxiety levels of the students before and after the use of web 2.0 tools. According to these results, it can be stated that the use of web 2.0 tools has positive effects on students' math anxiety levels. The anxiety levels of the students who only took mathematics education on the smart board were higher than the students who took the course with web 2.0 tools on the smart board. This is the result of studies carried out in different times and conditions (Keklikci, 2011; Baştürk, 2012; Elmas & Geban (2012), Choudhury (2014), Korucu (2015), Sezgin et al., 2016; Yalçınkaya, 2016; Kesici, 2018; Süren, 2019) in parallel. As a result of

the training with web 2.0 tools, the mathematics anxiety of the students in the experimental group decreased significantly. It was observed that the mathematics anxiety pre-test average scores of the students in the experimental group were higher than the pre-test average scores of the students in the control group. It was observed that there was a significant difference between the post-test mean scores of the students in the experimental group and the post-test mean scores of the students in the control group. It was observed that there was a significant difference between the mathematics anxiety pre-test and post-test mean scores of the students in the experimental group. In parallel with the results of this research, Arslan (2008) emphasized that these technological environments have a significant effect on anxiety and success in his study, in which he examined the effects of web-based education on students' attitudes, mathematics anxiety and academic success. If the results of the study are evaluated in general, it is understood that the education made with web 2.0 tools has an effect on reducing the mathematics anxiety levels of the students. The fact that the students liked the prepared animations and had fun while watching may have resulted in this situation. In addition, it can be said that the active participation of the students in the education process during the Plickers application provides an opportunity for their active learning. In this study, it can also be stated that the students' anticipation of the mathematics lesson with excitement and their love for it more are due to the effect of these web 2.0 tools. Although there was no significant difference between the control and experimental groups regarding math anxiety in the pre-tests, there was a significant difference in favor of the experimental group according to the post-test results. These results may indicate that students who receive education with web 2.0 tools have less math anxiety. This result shows parallelism with the result of Bekdemir (2009)'s study. All these results may mean that education with web 2.0 tools and smart boards reduces math anxiety in students.

Attitude scores of the students in the experimental group, who used web 2.0 tools on the smart board, were higher than the scores of the students in the control group. As a result of this situation, it can be said that students have a more positive attitude towards web 2.0 tools and smart board. Considering the scores of the students from the smart board attitude questionnaire, it is understood that most of the students are satisfied with the use of smart boards. When we look at the previous studies, it is seen that the studies are mostly focused on the effect of web 2.0 tools on motivation. Hillier (2013), Mata et al. (2016), Yapıcı & Karakoyun

(2017), Çetin (2018), Koğu (2018), Türker & Genç (2018), Akkaya (2019), Mete and Batıbay (2019), Yüksel (2019), Gezer (2020), As a result of the research conducted by Ahmed & Opoku (2022), it was determined that web 2.0 tools were effective in increasing motivation. In the study conducted by Şeker (2020) on the effect of Plickers, one of the web 2.0 tools, on the academic success of secondary school 5th grade students, a significant difference was found in favor of the experimental group. In another study, Akkaya (2019), who investigated the effects of activities developed with multiple web 2.0 tools on academic success, reached a similar conclusion. Korucu (2015) determined that the students' motivation in the course increased in the collaborative learning environment created by using web technologies. Parallel to this, in this study, it can be concluded that different web 2.0 applications used for mathematics lessons contribute positively to individuals' attitudes towards mathematics lesson. In other words, the smart board increased the motivation of the students. At the end of the training, the motivation of the experimental group students was higher than the motivation of the control group students. This result is in parallel with the result obtained by Yüksel (2019). As a result of this study, it was seen that there was a positive development in the attitudes of the control group students towards the smart board. The effective use of the smart board in the control group may have caused this situation.

This study has limitations in terms of experimental/control groups and scope. The study is limited to the application carried out in two branches of a primary school, as an experimental/control group study limitation. The research has no scope other than the stated problem and sub-problem situation. In order to reveal the effect of web 2.0 applications on students, it is limited to the application of tests to be applied as a pre-test before the application process on a quantitative basis and as a post-test at the end of the application process.

In this part of the research, based on the research findings, some suggestions are given in the light of the data obtained after examining the effect of teaching the mathematics course with web 2.0 tools on the success, anxiety level and motivation of the students. These recommendations highlight important practical points. In addition to this, there are also suggestions for the application area of web 2.0 tools used in education and training activities and this situation. The study is limited to the data obtained from the data collection tools developed by the researchers and the students who have smart boards in their classrooms.

- Widespread use of the web 2.0 tools applied in the study in schools may enable students to gain many knowledge and skills that they cannot gain with the current program or that they can gain in a long time. It may be helpful for teachers to be aware of Plickers and Powtoon applications.
- This study was conducted to reveal the effects of two different web 2.0 tools on achievement, attitude, and anxiety level towards mathematics lesson, was carried out with a control and an experimental group. A study with more groups and more students may contribute to the results being more comprehensive and generalizable.
- This study is limited to 5 weeks and 25 lesson hours during the education and training process. In order to determine the effect of web 2.0 tools on academic achievement, attitude and mathematics anxiety, studies covering a semester, or an academic year can be conducted.
- The research was carried out on the "Natural numbers" unit of the 1st grade Mathematics lesson. Similar studies can be carried out in different subjects of the mathematics course or in different courses at different grade levels.
- It is recommended that teachers use smart board applications that appeal to more senses in lessons, considering that especially 1st grade students may have higher anxiety about mathematics starting from primary school.
- Since it is thought that the use of technology will become an important part of education wherever there is education and training, a large number of in-service trainings are organized to prepare all educators for this, especially with the help of 1st grade students to improve themselves in digital methods in order to overcome the difficulties in the initial adaptation process. It is recommended that they should attend the training.
- It is recommended to examine the mathematics anxiety levels of primary school students in more detail and to carry out studies to reduce anxiety, especially to investigate the main causes of mathematics anxiety of 1st grade students and solutions for them.

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