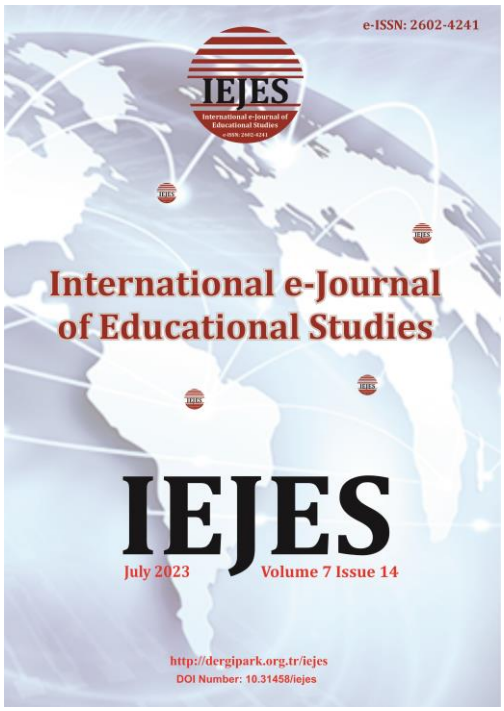

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Abstract

This study it is aimed to examine the effect of using web 2.0 tools in algebra teaching on student achievement and attitude. The research was carried out with 42 students studying in the 6th grade of a public secondary school in Rize in the second term of the 2022-2023 academic year. In the study, in which an unequal quasi-experimental design with the pretest-posttest experiment-control group was used, there were 22 students in the experimental group and 20 students in the control group. In the study, quantitative and qualitative research designs were used together. "Algebraic Expressions Achievement Test (CIBT)" developed by Okuducu (2020) and "Attitude Scale Towards Mathematics Lesson (MDKTÖ)" developed by Baykul (1990) were used as data collection tools. In addition, the "Semi-Structured Interview Form" developed by the researchers was used. While the lesson plan containing learning activities supported by web 2.0 tools was applied to the experimental group, no intervention was made in the control group. CIBT and MDKTÖ were applied to these groups as a pre-test before the application and as a post-test after the application. In addition, at the end of each web 2.0 tools activity, the experimental group students were given opinion forms and their thoughts were taken. As a result of the statistical studies, it was concluded that the use of web 2.0 tools in algebra teaching contributed positively to the academic success of the students and positively affected the students' attitudes in mathematics teaching. In addition, when we look at the results of the semi-structured interview forms, it is concluded that algebra teaching, which is processed with web 2.0 tools, is more fun, increases interest and motivation and is permanent.

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Research Article

The Effect of Using Web 2.0 Tools in Algebra Teaching on Student Success and Attitude*

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Abstract

This study it is aimed to examine the effect of using web 2.0 tools in algebra teaching on student achievement and attitude. The research was carried out with 42 students studying in the 6th grade of a public secondary school in Rize in the second term of the 2022-2023 academic year. In the study, in which an unequal quasi-experimental design with the pretest-posttest experiment-control group was used, there were 22 students in the experimental group and 20 students in the control group. In the study, quantitative and qualitative research designs were used together. "Algebraic Expressions Achievement Test (CIBT)" developed by Okuducu (2020) and "Attitude Scale Towards Mathematics Lesson (MDKTÖ)" developed by Baykul (1990) were used as data collection tools. In addition, the "Semi-Structured Interview Form" developed by the researchers was used. While the lesson plan containing learning activities supported by web 2.0 tools was applied to the experimental group, no intervention was made in the control group. CIBT and MDKTÖ were applied to these groups as a pre-test before the application and as a post-test after the application. In addition, at the end of each web 2.0 tools activity, the experimental group students were given opinion forms and their thoughts were taken. As a result of the statistical studies, it was concluded that the use of web 2.0 tools in algebra teaching contributed positively to the academic success of the students and positively affected the students' attitudes in mathematics teaching. In addition, when we look at the results of the semi-structured interview forms, it is concluded that algebra teaching, which is processed with web 2.0 tools, is more fun, increases interest and motivation and is permanent.

Keywords: Algebra teaching, web 2.0 tools, success, attitude

1. INTRODUCTION

Change and development affect countries, societies and individuals of all ages. Technology, which is an indispensable part of our age, supports education and training and provides convenience as well as providing new opportunities (Atıcı & Yıldırım, 2010). In recent years, it has been observed that the use of digital technologies in daily life has increased gradually and subsequently, changes in many areas have been observed (Elçiçek & Erdemci, 2021). With the continuous change of technology and knowledge, it develops and changes different ways in mathematics teaching. Although there are various reasons for these technological developments, their results in education should not be overlooked (Yemen, 2009). By using web-based educational tools in mathematics education, students in education and mathematics education will develop their skills of performing non-memorial operations on the subject shown, attract students' attention, see and learn the concrete form and application of mathematics by combining it with life (Kilit & Güner, 2021). Since technology is an extension of human beings, fundamental technology change will always express our worldview and change our worldview (Özüsağlam, 2017).

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Active learning methods that are beneficial for the learner are preferred to increase productivity in education (Soydaş-Çakır & Akyazı, 2021). Depending on technological developments, using Web 2.0 technologies in students' daily life and teaching has gained significant importance (Ajjan & Hartshorne, 2008). While teachers contribute to the enrichment of the educational environment by using technological tools and materials such as Web 2.0 in line with their abilities (Orhan, Kurt, Ozan, Vural, & Türkan, 2014), they provide individuals with the opportunity to raise individuals who use information effectively by providing them with the skills required by the information age (Deperlioğlu & Köse, 2010). With the developing educational technologies, the classrooms form active and applied classroom environments where students learn by doing and experiencing traditional classroom models. Web 2.0 applications positively affect individuals' motivation and interest in the lesson (Efe-Aslan, Söylemez-Hak, Oral & Efe, 2014). In an area where abstract concepts such as mathematics are abundant, and students have difficulty in understanding, different resources may be needed to facilitate the interpretation process (Gün-Şahin & Gürbüz, 2022). With the help of these technological tools, we can do the subjects we cannot embody most of the time in daily life and the immediate environment. Thanks to these computer-aided teaching tools, software materials are designed for teaching mathematical concepts that are difficult to embody in mathematics (Kutluca, 2007). We can say that one of the subjects that secondary school students cannot embody is undoubtedly the algebraic expressions they have just added to their lives. Algebra teaching begins around the age of 13-14, which coincides with the age at which they begin to think abstractly (Altun, 2016). It is necessary to benefit from computer-assisted algebra teaching (Baki, 2002).

When the literature is examined, it has been determined that the use of Web 2.0 technologies in different courses and at different grade levels positively affects students' academic success and course attitudes (Alp & Deveci, 2018; Bolatlı & Korucu, 2018). However, when the relevant literature is examined, there are few studies on the effect of using Web 2.0 tools in algebra teaching on student achievement and attitudes. Therefore, studies on this subject are needed. Many studies on the subject of algebra (Okuducu, 2020; Sarı, 2012) have been included in the literature. The development of algebraic thinking can be achieved through active experiences that students will have in the algebra sub-learning field. Because of this importance, the subject of algebraic expressions in algebra learning can be prepared by web 2.0 technology-supported teaching.

This study is expected to contribute to the literature on teaching algebra because it supports web 2.0 tools. Students' achievements and views on this model will guide further studies.

1.1. Purpose of the Research

This research aims to determine the effect of web 2.0 tools in algebra teaching on student achievement and attitude and students' views on these applications. The sub-problems of the research are as follows:

1. Is there a statistically significant difference between the achievement test scores of the experimental and control group students at the end of the application?
2. Is there a statistically significant difference between the experimental and control group students' attitudes toward mathematics at the end of the application?
3- What are the students' views on the teaching process regarding using web 2.0 tools in teaching algebra?

2. METHOD

2.1. Research Method

In this study, explanatory sequential design, one of the types of mixed designs, was used to determine the effect of using web 2.0 tools in algebra teaching on student achievement and attitude and whether it affects students' views on these applications. This pattern takes place in two stages.

Quantitative data are collected and analyzed according to the research question. Then, qualitative data are collected and analyzed (Creswell, 2014). The design of the study is summarized in Table 1.

Table 1. Pattern of the study

Group Name	Pre-application	Experimental Procedures	Post Experiment
Experimental Group	• Algebraic Expressions Achievement Test (CIBT) • Attitude Scale Towards Mathematics (MDKTÖ)	Web 2.0 supported Teaching Method	• Algebraic Expressions Achievement Test (CIBT) • Attitude Scale Towards Mathematics (MDKTÖ) • Structured Interview Form
Control Group	• Algebraic Expressions Achievement Test (CIBT) • Attitude Scale Towards Mathematics (MDKTÖ)	Traditional Teaching Methods	• Algebraic Expressions Achievement Test (CIBT) • Attitude Scale Towards Mathematics(MDKTÖ)

2.2. Participants

The study group of the research was determined as 6th-grade students studying at a public secondary school in Rize in the 2022-2023 academic year. Experimental and control groups were selected randomly. While 22 students consisting of 6th-grade students constitute the experimental group, 20 students constitute the control group.

2.3. Data Collection Tools

2.3.1. Algebraic expressions achievement test (CIBT)

CIBT, which he developed for his master's thesis in Okuducu (2020), was used as a data collection tool. The algebraic expressions achievement test (CIBT) was created by Okuducu (2020) and then applied to 150 7th-grade students of a secondary school in the Doğubayazıt district center. This application took place in 40 minutes, which is a class hour. A total of 30 questions were created for CIBT, ten from each outcome. As a result of the achievement test application, item analysis was performed, the items that needed to be eliminated or corrected were determined, and the test took its final form. Three items were excluded from the test because their discrimination was less than 0.20. The four items were reviewed by looking at the distinctiveness, and the necessary corrections were made and included in the test. The final version consisted of 27 questions and was prepared for research by taking expert opinions. Each correct answer was scored as "1 point", and the answer to the wrong or blank question was scored as "0 points". It was considered appropriate to complete the test application within one class hour.

2.3.2. Attitudes towards mathematics lesson scale (MDKTÖ)

In this study, the "Mathematics Attitude Scale" developed by Baykul (1990) was used to measure students' attitudes toward mathematics. This scale was developed for the research titled "Changes in Attitudes towards Mathematics and Science Courses from the Fifth Grade of Primary School to the Final Years of High School and Equivalent Schools and Some Factors Considered to be

Associated with Success in the Student Selection Examination". 30 items in the scale reflect 15 positive and 15 negative attitudes. According to the results of the factor analysis performed on the final version of the scale, the variance rate that a single factor could explain was found to be 0.56. The alpha coefficient of the mathematics attitude scale was found to be 0.96. Items in the scale were rated as strongly agree, generally agree, undecided, disagree, and never agree.

2.3.3. Semi-structured interview questions

In order to support the quantitative data collected in the research and to get their opinions on the web 2.0 tools used in algebra, semi-structured interviews were conducted with nine students from the experimental group at the end of the application. With open-ended questions, students' positive and negative thoughts about the web 2.0 tools used in algebra, whether they want web 2.0 tools in teaching other subjects in mathematics, the differences that distinguish the courses taught with web 2.0 tools used in algebra topics from the courses taught with other methods, whether web 2.0 tools affect their attitudes towards the math course. Semi-structured interview questions consisting of 5 items were prepared. This interview form was also examined by three faculty members who are experts in their fields. In line with the experts' suggestions, necessary arrangements were made in the items in the semi-structured interview form and applied to 9 students in the experimental group for a total of 35 minutes on a voluntary basis. In order to conduct semi-structured interviews, students were selected from groups whose academic achievement levels were determined according to the scores they got from the algebraic expressions achievement test. The data were coded separately by the researchers and Miles and Huberman's percent agreement formula (Miles, Huberman, & Saldana, 2014) was used to determine the reliability. According to the formula used, the percentage of agreement between the coders was calculated as 87.34.

2.4. Data Collection and Analysis

The research data were obtained from 42 students in the 6th grade of a public secondary school in the province of Rize in the second term of the 2022-2023 academic year. The researcher carried out the application. In the experimental group, web 2.0 teaching activities, which were prepared by considering certain acquisitions related to algebraic expressions in the 6th-grade textbook of MEB, were applied for 5 lesson hours. While preparing these activities, the Ministry of National Education's 6th-grade mathematics textbook and Education Information Network (EBA) were used. In the control group, the lessons were taught as specified in the curriculum. At the end of the study, the achievement test and the attitude scale were applied as a pre-test and post-test in order to measure the knowledge levels of the experimental and control groups about the objectives aimed to be gained, and the effects of the two methods on their achievements and attitudes were examined. In addition, opinions were determined by applying a semi-structured interview form to get opinions about web 2.0 tools applied to the experimental group. SPSS 21 package program was used for data analysis. In the achievement test prepared to determine the achievement test scores of the students, "1 point" for each question with the correct answer to each question and "0 points" for the answer to the wrong or blank question were entered into the package program. To check the equivalence of the experimental and control groups, the 5th-grade mathematics course grade point averages were checked. The data obtained from the achievement test was used to determine whether there was a significant difference between the achievement test average scores of the groups using the t-test in the experimental and control groups. The data obtained by conducting semi-structured interviews with nine students from the experimental group were analyzed according to content analysis. The qualitative data obtained were read by two independent coders, and common themes were created by making individual coding. Frequencies and percentages related to these themes were calculated.

3. FINDINGS

In this part of the study, the findings obtained from the study are included. The findings of the research and the interpretations of these findings are given below.

3.1. Findings and Comments on Algebraic Expressions Achievement Test (CIBT)

In this section, "Does using web 2.0 tools in algebra teaching affect students' algebra success?" In order to get an answer to the research problem, first of all, the Algebra Achievement Test (CIBT), developed by Okuducu (2020) in his master's thesis, was applied as a pre-test to the experimental and control groups before starting the application. Thus, "Is there a significant difference between the pre-test scores of the students in the control and experimental groups?" An answer to the sub-problem was sought. The students' pre-test scores were examined and compared with the t-test. The t-Test Results for the Resulting Algebraic Expressions Achievement Test (CIBT) Pre-Test are shown in Table 2.

Table 2. t-test results for experimental and control group CIBT pre-test

Groups	N	X	t	sd	p
Experiment	22	23,00	1,288	14	,219
Control	20	18,60			

From Table 2, as a result of the pre-test, the mean scores of the students in the experimental group were 23.00 and the mean of the control group was 18.60. Thus, it was determined that there was no significant difference between the experimental group and the control group in terms of achievement pre-test scores ($t(14)= 1.288$; $p>0.05$).

At the end of the application process, the t-test was applied to determine whether there was a significant difference between the post-test scores of the students in the experimental and control groups. The results obtained are given in Table 3.

Table 3. t-test results for the experimental and control groups CIBT post-test

Groups	N	X	t	sd	p
Experiment	22	27,6	2,197	14	,045
Control	20	22,4			

Looking at Table 3, the average of the students in the experimental group was 27.6 and the average of the control group was 22.4. A significant difference was determined between the experimental group and the control group in terms of achievement post-test scores, and it is seen that this difference is in favor of the experimental group ($t(14)=2.197$; $p<0.05$). Using web 2.0 tools in algebra teaching positively affects students' success.

3.2. Findings and Comments on the Attitudes Towards Mathematics Lesson Scale (MDKTÖ)

In this section, "Does the use of web 2.0 tools in algebra teaching affect students' attitudes towards mathematics?" In order to find an answer to the problem, the Attitude Scale Towards Mathematics Lesson (MDKTÖ) developed by Baykul (1990) was applied to the experimental and control groups as a pre-test before the application process. The pre-test results of the students were analyzed with the t-test. The results of the findings of the MDKTÖ pre-test of the experimental and control groups are given in Table 4.

Table 4. The t-test results of the experimental and control groups for the MDKTÖ pre-test

Groups	N	X	t	sd	p
Experiment	22	120.24	,043	14	,966
Control	20	118.06			

When Table 4 is examined, the average of the students in the experimental group is 120.24 and the average of the control group is 118.06. It was determined that there was no significant difference between the experimental and control groups in terms of MDKTÖ pre-test scores. t(14)=-.043; p>0.05). Therefore, it was determined that the pre-attitudes of the two groups were at the same level.

The results obtained from the t-test for the experimental and control group's posttests on MDKTÖ are presented in Table 5.

Table 5. t-test results for the experimental and control group MDKTÖ posttests

Groups	N	X	t	sd	p
Experiment	22	125.24	1,552	17	,010
Control	20	118.34			

As a result of the examination of DG and CG's posttests on MDKTÖ by examining Table 5, the average of the students in the control group was found to be 118.34 and the average of the experimental group was found to be 125.24. It is obvious that there is a significant difference from the results of the findings and this difference is in favor of the experimental group (t(17)=1.552; p<0.05).

3.3. Findings and Comments on the Semi-Structured Interview Form

In this part of the research, the findings related to the data analysis obtained from the semi-structured interviews conducted with nine students from the experimental group are included. Table 6 shows the answers given by the experimental group students to the semi-structured interview questions and the frequency and percentage values of these answers in order to seek an answer to the question of the research, "What are the opinions of the experimental group students at the end of the application of using web 2.0 tools in teaching algebra?"

Table 6. Frequency values and percentages of semi-structured ınterviews

Semi-Structured Interview	*Answers Given*	*f*	*%*
1. Do you think positively about using web 2.0 tools in teaching algebra? If so what is it?	It makes the lesson fun.	7	85
	I entered the class with enthusiasm.	7	85
	I learned more.	6	70
	I understood better.	6	70
	We learned with friends.	2	30
	I found out by myself.	2	30
	More solution-oriented	1	15
	An activity-packed lesson	1	15
2. Do you have any opposing thoughts about using web 2.0 tools in teaching algebra? If so what is it?	I have no negative thoughts.	7	85
	There is much noise when doing some activities.	1	15
	The lesson seems very simple.	1	15
3. Would you like to use web 2.0 tools while studying other mathematics subjects Why?	Yes, I would.	5	60
	I do not want. The current processing style is more	1	15
	I enjoy.	3	40
	Very fun and beautiful	5	60
	I am learning better.	5	60
	It interests me more.	1	15
	Subjects are closer to life	2	30
4. Is there an essential difference between the courses taught with web 2.0 tools and those with other methods? If so, what is the difference?	I don't think so.	1	15
	Lessons are learned more fun.	6	70
	Topics stay in my mind.	7	85
	The lesson is more exciting and intriguing	3	40
	I tried to find the topics myself with the questions asked.	1	15
5. Has the use of Web 2.0 tools affected your attitude towards mathematics?	Yes, it affected me a lot.	7	85
	No, it didn't affect me much.	1	15
	I loved math class, I started to like it more.	6	70
	I didn't like the math lesson very much, it made me love it even more.	2	30

In Table 6, 85% of the students who participated in the interview stated that they enjoyed the courses taught with web 2.0 activities in teaching algebra. About using Web 2.0 tools, 85% of students say the lessons are fun, 85% say they enjoyed the lesson, 70% said they understood more and better, 30% said I learned by finding myself, we learned together with friends, solution-oriented and full of activity 15% of the students who say a course. In addition, it is seen that web 2.0 activities used in algebra subjects positively affect students' attitudes towards mathematics lessons by 85%. In addition, 85% of the students stated that they wanted web 2.0 activities to be used in other subjects of the mathematics course. Table 6 shows two students who expressed negative thoughts about web 2.0 activities used in algebra subjects. 15% of the students stated that there was much noise during the activity, and 15% found that the lessons were handled in this way at an elementary level. In addition, the number of students who want to avoid using web 2.0 tools while studying other subjects in mathematics is 1. In this study, only some students who learned through web 2.0 activities used in

algebra subjects used negative expressions. Most students stated that the lessons were memorable, they learned more, they learned better, they learned together with their friends, the lessons were engaging, they were fun, and they produced something themselves.

4. DISCUSSION and CONCLUSION

The advancement of technology and science has also expanded the application areas of mathematics. For this reason, it is necessary to raise a sound generation that will have a say in the world of the future. Students should be able to see the mathematical problems they encounter from different perspectives, develop different ideas, and generalize and apply these ideas instead of simple calculations. It is known that mathematics has an essential effect on the development of thinking (Kükey, Aslaner & Tutak, 2019). Students will be able to solve mathematical problems and benefit from these methods by learning the learning sub-field of algebra, which affects the entire mathematics curriculum, meaningfully and permanently. In this study, the effect of using web 2.0 tools in algebra teaching on student achievement and attitude was examined, and significant results were obtained using the findings related to the sub-problems of the research.

When the results of the achievement test and attitude test applied to both groups on algebraic expressions after the application are examined, it is seen that there is a significant difference in favor of the experimental group between the achievement test scores of the students in the experimental group, where web 2.0 tools were used in algebra teaching, and the students in the control group. In other words, it was seen that the experimental group students were more successful and had more positive attitudes than the control group students. In the light of this method, the experimental group students learned by constructing their concepts about algebraic expressions. With the activities prepared for the stages of this model, the students experienced concrete experiences and made a better sense of the abstract concepts in their minds. In parallel with this study; (Kibar, 2006; Tüysüz & Aydın, 2007; Tüysüz & Çümen, 2016) revealed that the use of web 2.0 tools in algebra teaching is an effective method in increasing both success and attitude.

Semi-structured interviews with nine students selected from the experimental group revealed that the lessons taught with the use of web 2.0 tools in algebra teaching were more fun and exciting, it increased the motivation of the students, the concepts were learned concretely, the students were more active in the lessons, the lessons were more permanent, and the students were more resistant to the mathematics lesson. Found to have a positive effect on their attitudes. As a result of the use of web 2.0 tools in algebra teaching, it was seen that 85% of the students liked the mathematics lesson more. As a result of the semi-structured interviews, it was concluded that the majority of the students approached the lessons taught with the activities of web 2.0 tools in algebra teaching positively, and they wanted other subjects of the mathematics course to be processed appropriately by the web 2.0 tools in the teaching of algebra; Hangül and Üzel, (2010) found similar findings with this study in their study. The results obtained to support this study.

In light of the results obtained within the scope of this research, the following suggestions were made:

Seminars should be given to teachers to introduce web 2.0 tools used in education.

The preparation phase is critical in technology-supported teaching. For this reason, activities should be prepared within the framework of a good lesson plan and a lesson plan before the lesson.

Preparing events using Web 2.0 tools can be time-consuming. For this reason, books that guide teachers and contain ready-made activities should be prepared.

Existing educational software should be developed considering scientific findings and valuable and practical new software should be developed.

Teaching methods with web 2.0 tools can be used to increase students' success in different mathematics subjects.

The problems teachers face and may encounter during teaching supported by Web 2.0 tools should be examined.

The effects of two different teaching environments on attitude and achievement were examined in the study. Research can be improved by increasing the number of dependent and independent variables.

This research was conducted with 6th-grade students in a secondary school with a limited study group. Similar studies can be applied to students at different grade levels. The study can be improved by increasing the number of schools and subjects.

Ethics Committee Decision

This research was carried out with the permission of Fırat University Social and Human Scientific Research and Publication Ethics Committee with the decision numbered 14949-2023/04 dated 09.03.2023.

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