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Using Didactic Games in Teaching Mathematic

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This article aims to examine the effect of the use of didactic games in mathematics teaching on students' achievements and knowledge accumulation in the classroom. The study also assessed the students' perceptions of these learning games. The study was carried out with the experimental pre-test-post-test control group design. The research team of this study is five. The class consists of 64 students. Two groups of fifth grade students were randomly assigned as experimental and control groups. According to the results, it is shown that didactic games increase students' academic achievements and are an effective tool for lecturing.

Keywords: didactic games, mathematics, education, control group, experimental group

Introduction

Today, the question is raised about the education of a competent, conscious citizen, comprehensively developed in the direction of the development of our society. Any child, as well as the culture of a person, develops through play. And today, in the learning process, the game is at the forefront, with the help of game technologies, it is easier to increase the motivation and interest of the child in learning.

Didactic games (DG) transform the routine work of children, arouse their interest in the subject, instill desire and develop students' attention, thinking. That is why the game plays a leading role in educational activities (Smilansky, 1986).

Didactic games, as its name implies, are one of the methods in developing the child's intelligence and distinguishing the concepts of cognition. The use of these games develops observation, imagination, memory, speech, thinking, and sensory orientation of the student. Students are more eager to learn when the lesson takes place in a fun and active way.

Relevance

The game is the main activity of preschoolers. After all, the game clearly traces the inclinations, opportunities, and interest of the child in one subject. The first movement of a child to life is a game, so it has a special meaning. However, at present, most school teachers do not pay attention to the use of didactic games in math lessons due to lack of time and the need for a lot of preparation.

Overview of Didactic Games in Education

Many different educational types of didactic games are used in educational institutions and schools. The use

List of Abbreviations: DG: Didactic games; EG: Experimental group; CG: Control group.

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of games helps to develop critical thinking skills on a specific topic by encouraging students to think outside the box as they follow the rules (Komensky, 1657). There are other games that can be used which limit to improving knowledge in a specific subject and the most popular ones are math games. Yue and Zin (2009) discussed that games like chess cannot be viewed as educational games as these improve logic skills, reasoning, and other traits valued in education but they are not considered educational because they do not deliver content or relay curriculum material. Games that incorporate curriculum content or other educational material are referred to as educational games (Yue & Zin, 2009).

Objective

To identify the importance of using didactic games in mathematic lessons.

Research Question

1. What are didactic games?
2. What are the results of the use of mathematical didactic games in the teaching of mathematics?
3. The difference between using and not using didactic games in teaching mathematics

Research Objective

The use of didactic games in mathematics lessons.

Research Forecast

If didactic games are used in a math lesson, then students' interest in the subject of mathematics increases and their activity increases.

Sources of Research

Scientific and pedagogical literature, newspapers and magazines, works of our own and foreign scientists, the Internet.

Research Methods

Analysis of scientific and pedagogical literature, survey and its results, open lessons.

Didactic Games in Education

Didactics (gr.didaktikos-instructive)—the theory of education, training, education; a branch of pedagogy that studies the patterns of assimilation and education of knowledge, skills, and abilities of students, determines the scope and structure of the content of education at each stage, deals with the scientific justification of ways to improve methods and organizational forms of education (Guerriero, 2010).

The term "Didactics" was first used by the Czech scientist in the XVII century. Prucha, Walterová, and Mareš described and characterized a didactic game in their pedagogical word forensic book written in 1998:

> Didactic play: is a round of play that resembles a random children's activity pursuing didactic goals. These games can take place anywhere, for example in school classrooms, outdoors, on the playground or in a home environment. But these games have their own rules and require constant evaluation. The role of a pedagogical leader is very important and is aimed at student groups. The priority is the stimulating nature of children, as it arouses interest in the lesson, increases the participation of students, stimulates their creativity, spontaneity, cooperation and competitiveness, allows them to use different knowledge and abilities, and sustains their life experience. Some didactic games are designed in connection with real life. (Průcha, Walterová, & Mareš, 1998, p. 5)

The history of games and their use in education and upbringing began along time ago. The views of important

characters about the role of games in education and the history of didactic games are detailed in the article of Vankus (2005).

The first research in the area of games and their educational function date back to the 18th century. A pedagogic system of games prepared by the German priest and pedagogue F. W. A. Fröbel (1782-1852) is well-known.

Renowned psychologists, philosophers and pedagogues made detailed analyses of games and their importance in the lives of people in the 19th century. Let's mention J. W. Goethe, F. Schiller, H. Spencer, and K. Groos from among many others.

The important German playwright J. W. Goethe, who lived in 1749-1832, drew attention to the importance of games in education. The German playwright was particularly interested in the creative and dramatic sides of plays. He thought that didactic games developed children's imagination, memory, and emotional feelings (Smilansky, 1968).

The German poet and philosopher F. Schiller (1759-1805) reflected the ideals of freedom and sense in the plays he designed. He saw these games as a form of activity that allows students to express themselves freely and thus have a better lesson. Schiller investigated the causes of playful behavior. According to him, didactic games are an expression of life energy (Sawyer, 2001).

German psychologist and pedagogue K. Groos (1861-1946) elaborated the first comprehensive concept of the causes and meanings of playful behavior. In his works (Groos, 1896; 1899), he emphasized the function of games as preparation for adult tasks and behavior.

The Austrian scientist and philosopher R. Steiner (1861-1925) developed a method of education used in Waldorf schools. With this method, he emphasized the general development of the students, their success in the lesson, their social skills, and spiritual values. The Austrian scientist believes that education should take into account the current needs of students, which change with their physical and emotional development. He said that children under the age of seven should learn more about games, drawing, learning about nature and common life objects. In his theory, a game is considered a mirror of human character (Miller & Almon, 2009).

Advantages of Using Games in Education

Attracting the Attention of Students

One of the best ways to attract the attention of students to the lesson and keep them busy is to use technology. The use of games in education plays an important role in engaging students by encouraging a hands-on approach.

Help Students Remember the Lesson

It aims to help students remember what they have learned in class by encouraging students to actively participate in the lesson. Students can use the games to remember critical points that they have applied in their exams and in real-world situations.

Visual and Computer Literacy

This is something which is vital in light of the fact that we live in a world which is ruled by innovation. By playing games, students gain visual and computer literacy skills which will prepare them for the world of work.

Rule Following and Problem-Solving Skills

Didactic games are developmental games that enable students to follow the rules on a vital basis. Students may forget the rules or they may not want to follow the rules. It is precisely here that the importance of didactic games is very much.

Beneficial for Students With Attention Disorders

Using didactic games can help keep students interested in the lesson and help them learn the lesson in a fun way. According to the researches, it was understood that didactic games can help children with attention problems.

Teach Other Skills

Didactic games can also be used to teach other skills, such as critical thinking, problem solving, interacting with friends, and being able to fit in with the classroom. This helps to create less overwhelmed individuals who are not limited, but are able to adapt to any real-world situation (Boyle, 2011).

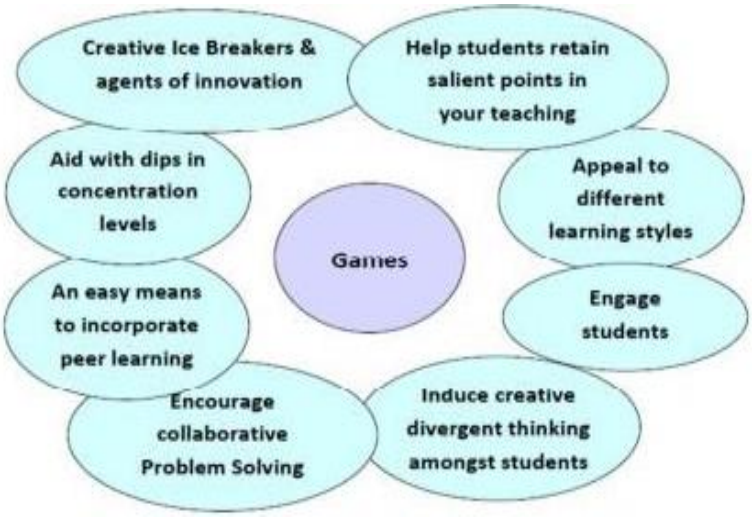

Figure 1. Role of games in education (Boyle, 2011).

Methodology

The study was carried out with the design of an experimental pre-test-post-test control group together with fifth-grader students.

Participants

Participants were 64 fifth-graders from Baizhanov Secondary School in Kaskelen, and 34 students from the experimental group and control groups. The participants of the study were determined by a convenient selection method in the secondary school wherethe second researcher works as a teacher. The age of the students ranged from 11 to 12 years.

Data Collection Tools

A success test and a research monitoring diary developed by the researchers were used to collect the data. In the process of preparing and designing the achievement test of didactic games, a table of specifications was developed, which reflects the objectives of the main topics in the curriculum of mathematics in the fifth grade. For the validity of the test developed a test consisting of 15 questions based on learning objectives. Opinions of two experts in the field of mathematics education and two teachers of mathematics on the scientific relevance and content of the questions were considered. For this study experiment, we used an observation log. Each game of each day recorded the observations of the researcher. The researcher observed how each game began and ended, the discussions that took place during the games, the students' reactions during the game, the reflections of the teaching and learning processes, and recorded these observations in the observation diary.

Research Design and Implementation of Research

In the school where the teaching was conducted, two fifth grade students were randomly given lessons as an experimental group (EG) and a control group (CG). The study was applied for seven weeks as three lesson hours per week. This teaching method was applied in both groups. Review of the topics was made by researcher through the question-answer method and giving the activities in the textbook as group, educational games were used to review, reinforce, and assess the topics. At the end of the study, the score of post-test and the retention implemented for two months showed significant educational games enhance students' achievement and are an effective tool in providing the retention of new knowledge.

Data Analysis

In the analysis of quantitative data, content analysis was used in the analysis of qualitative data from open-ended questions to compare the test scores of the test and control groups, pre-test, final test, and continuity test. The researchers studied the data of the participants and came to a 100% agreement.

Results

Quantitative Results

Unpaired samples *t*-test results regarding the control and experimental group students' pre-test achievement scores are shown in Table 1.

Table 1

Pre-test Achievement Scores

Group	*N*	$\bar{x}$	*s*	*sd*	*t*	*p*
Control group (CG)	34	8.10	1.59	66	-0.909	0.366
Experimental group (EG)	34	7.63	2.58			

There was not much difference between the pre-test success scores of the control and experimental group students [t (66) = -0.909, $p > 0.005$]. According to these results, it was found that the pre-test success scores of the students of the two groups were similar.

Unpaired samples *t*-test results regarding the control and experimental group students' post-test achievement scores are shown in Table 2.

Table 2

Post-Test Achievement Scores

Group	**N**	$\bar{x}$	**s**	**sd**	**t**	**p**
Control group (CG)	34	12.07	2.72	66	16.66	,000
Experimental group (EG)	34	26.60	4.28			

The average of the pre- and post-test scores shown in Tables 1 and 2 was compared. After using didactic games, we can see that the average scores of each group increased, but the average score of the experimental group processed using didactic games in mathematics lecture was higher.

Unpaired samples *t*-test results regarding the control and experimental group students' retention test scores are shown in Table 3.

Table 3

Retention Test Scores

Group	*N*	$\bar{x}$	*s*	*sd*	*t*	*p*
Control group (CG)	34	10.91	2.44	66	18.100	0.000
Experimental group (EG)	34	21.94	2.58			

In Table 3, the average scores of both groups were indicated. Considering the average scores of the groups, the average of the experimental group students was significantly higher than the control group students six months after the application.

The use of didactic plays in mathematics lessons has made a significant contribution to the increase in students' academic achievements. In addition, it was determined that the course described is effective in ensuring that the course remains in memory for a long time. It can be said that the questions and objectives in didactic games facilitate the learning of students by activating students' course participation.

Qualitative Results

The question "What are your views on the use of didactic games in the mathematiclesson?" was posed to the students. Their responses to this question are shown in Table 4.

Table 4

Students' Views on the Use of Didactic Games

Students' views	*N*
Games made me understand the lesson.	12
The design and types of didactic games were interesting.	10
I enjoyed playing these games and I had fun.	7
Games helped me to adapt with my classmates.	7
The games increased my interest in mathematics and my participation in the lesson.	6
The games have increased my motivation for the math.	6
I did not get bored in the lesson at all.	5
Games made me like the lesson.	4
The games helped me to increase my trust in myself.	4
I was given the chance to correct my mistakes with games.	3
Games provided me to participate in the lesson.	2
Some games didn't interest me.	2
I don't like playing didactic games in class.	0

As Table 4 showed, the students (n = 12) stressed that the use of didactic games encouraged the mathematics lesson. The majority of the students (n = 10) stated their opinions about the design and types of the games. The students said that the games were fun and enjoying playing (n = 7) provided the compliance in class (n = 7). In addition, some students stated that the use of these games is reviewed, increasing their motivation, engaged in the course and increasing their trust. Some of the students' views on the first question are shown below. S1 emphasized the contribution of games to learning and said that he likes in terms of the forms and contents of the games and expressed his views on the use of games.

Conclusion

This study examined the effects of using multifaceted and fun educational games. The results showed the importance of didactic games. We can see some differences in the results of the students of the experimental group. This confirmed the hypothesis of the study. It was also found that didactic games increase the activity of students. In addition, these games, used in math lessons, have been an effective tool for success and promotion.

Students in the experimental group expressed their thoughts about the use of didactic games in the course. According to their answers, the use of didactic games in mathematics classes has shown that they help students learn certain skills and increase their academic achievement. In addition, the students stated the benefits of the games:

- They help to make the lesson more fun.
- They ensure cooperation and harmony among students.
- They motivate students to the lesson.
- They increase the interest of students' in mathematics.
- They make lessons enjoyable and draw attention to the subject.

They contribute to effective communication between students. Summing up the research, I would like to focus on the results. Our main goal is to show the importance of didactic games to increase students' interest in mathematics and increase their knowledge. To do this, we analyzed the results, and conducted testing in mathematics using didactic games.

What did we do to prove it?

- We practiced didactic games at school.
- We received 15 test questions.

Didactic games based on the results of testing can play an important role in the teaching of mathematics. With the help of didactic games, we can improve the relationship between teacher and student, students will have fun, and we can explain mathematics in simple language.

Summing up the results of research work, I would like to note that after using didactic games in math lessons, I have increased my interest in further work. I can say that in the near future I want to work more on this topic.

Recommendations

This research has shown that didactic games have a good effect on students' understanding of the lesson. Therefore, the following suggestions can be made:

- A more comprehensive research can be done to understand the effect of games in mathematics lessons.
- An optional mathematics lesson with didactic games can be used in schools.
- Lesson plans using didactic games should be created by teachers.
- At least twice a week, these types of games should be used in the lecture.

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Appendix 1: Pictures about using didactic games in mathematics lessons

Name of the game: **What can be found in the picture?**

Name of the game: **Who is the first?**