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Impact the Labirin: the board game on the student's numeracy ability

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ABSTRACT

This research aims to improve the numeracy abilities of secondary students after using the Labirin: the board game and students' perceptions of mathematics learning using the game. This empirical study research used a one-group pretest posttest design. The research population is all grade-8 students in one of the Islamic public secondary schools (MTsN) in Serang City. The sample is 76 students from two classes as the experimental class who implemented the game in learning mathematics. The instruments used to collect the data are the numeracy ability tests and students' perception questionnaires. Before use, both instruments are tested for validity and reliability. The findings showed that the students' numeracy abilities improved after implementing the game and helped students to learn mathematics easily, especially in whole numbers and fractions. In addition, the student's understanding is also achieved. The implementation of the game also showed that this learning media helps students learn in the classroom and interest in using the game. It can be concluded that, the Labirin: the board game improved the student's numeracy ability.

INTRODUCTION

As a replacement for the National Examination, numeracy skills are now a more important component in the Minimum Competency Assessment. Numeracy skills are very important for students in learning because they must be able to use their knowledge in everyday life. Numeracy abilities enable a person to contribute effectively to society and utilize their knowledge in everyday life. It also increases their opportunities in the world of work and creates a secure mathematical foundation, which can be built on through lifelong education (Gao et al., 2020). Numeracy skills are very important to improve a person's ability to use and interpret mathematics in various situations.

According to Mahmud and Pratiwi (2019), numeracy skills are the ability to understand and use various types of numbers and symbols related to basic mathematics, which is very important for solving everyday problems. In addition, according to Mahmud and Pratiwi (2019), numeracy is an ability that allows someone to complete, understand, apply and convey various mathematical symbols to solve various mathematical problems in everyday life. Therefore, according to Maulyda et al. (2021), numeracy ability is defined as the ability to count, number and understand place value. Researchers define numeracy skills as the ability to organize numbers and information and solve mathematical problems by counting and calculating.

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Table 1
Numeracy ability indicator

No	Indicator	Explanation
1.	Ability to use numbers and symbols related to basic mathematics to solve problems in a variety of daily life contexts.	Students are able to use various kinds of numbers and symbols in whole number and fraction material problems for arithmetic operations in the context of everyday life.
2.	Skills in interpreting the concept of whole numbers and fractions	Students are able to interpret the results of problem analysis to predict and make decisions in solving problems involving integers and fractions in the context of everyday life.
3.	Able to interpret the results of analyzes that have been carried out to predict and draw conclusions.	Able to interpret the results of information analysis regarding whole numbers and fractions to draw conclusions

From the statements above, it can be concluded Numeracy ability can be defined as a person's ability to analyze, formulate, interpret and solve mathematical problems that can be applied in everyday decision making. Numeracy skills show how well students can use mathematics in everyday life.

According to Kurniawati and Kurniasari (2019), students' numeracy skills are considered a measure of the quality of education in this country. PISA is held every three years and is intended to collect data on the strengths and weaknesses of Indonesian students in mathematics, reading and science (OECD, 2019). In addition, the TIMSS assessment, which is held every four years, is considered the international standard for Indonesian students' mathematics achievement (Sari, 2015). Indonesia is always among the top ten with unsatisfactory scores based on these two international assessments. Even the most recent PISA score in 2019 was 379, far below the international average (Hawa & Putra, 2018).

Students' mathematical numeration abilities are still lacking. A study conducted by Alda and Wahidin (2020) shows that out of 100 class VIII students at SMPN 7 Tambun Selatan, 11 students showed a low level of arithmetic ability, 75 students showed a medium level of arithmetic ability, and 14 students showed a high level of arithmetic ability. The research conducted by (Kustantina, Nuryadi, & Marhaen, 2021) shows that the numeracy skills of grade VIII students at MTs Kalipucang are still low. This is evident from the results of the numeracy test administered to the students, which revealed that 73% of the grade VIII students at MTs Kalipucang scored very low. Therefore, the numeracy skills of MTs students need to be improved so that they can demonstrate their ability to solve problems, use data and numbers, utilize mathematical symbols, and make decisions based on calculations.

Research conducted by Kustantina et al. (2021) shows that the numeracy abilities of class VIII students at MTs Kalipucang are still low. This can be seen from the results of the distribution of numeracy tests carried out on class VIII students at MTs Kalipucang which showed that 73% of students had very low scores. So MTs students' numeracy skills need to be improved so they can demonstrate their ability to solve problems, use data and numbers, use mathematical symbols and make decisions based on calculations.

Technology can be used to create interesting and fun learning media for students, which can increase students' attention to lessons. Learning media itself functions as an intermediary and introduction between the person who sends the message and the person who receives it. Learning media stimulates students' thoughts, feelings, interests and attention. On the other hand, learning media is something that conveys lessons and stimulates students' thoughts, feelings and interests (Mashuri, 2019). Therefore, learning media can include anything used in the learning process (Batubara, 2020). Therefore, learning media can be defined as objects or tools that can influence or support student learning.

Learning media can be used in schools to teach numeracy. This is caused by students' failure in numeracy during learning. This statement is supported by the results of the 2018 Student

International Assessment Program (PISA) which were released in March 2019. The results show that Indonesia's abilities in reading, science and mathematics are relatively low; Indonesia is in 74th position out of 79 countries. By knowing this, researchers are trying to use the game-based learning media Labirin: The Board Game to improve students' numeracy skills.

The use of games is very useful in education and learning, as revealed by the literature, namely: 1) for education and learning (Sardone, 2018), 2) developing student capacity (Blackman & Belcher, 2017), 3) modeling learning (Butkhardt, 2018), 4) increasing numerical knowledge (Satsangi & Bofferding, 2018; Cheung & Mcbridge, 2017), 5) also useful for adults (Libertus, et al, 2017), 6) increasing creativity (Park & Lee, 2017), 7) gaining mathematical competence new (Skillen et al., 2018), 8) developing mathematical thinking skills (Fouze & Amit, 2018), and 9) interpersonal understanding (Chou, 2017).

Educational games can help students understand lesson material. In addition, educational games can increase students' affection, motoric, cognitive and spiritual abilities and improve their brain balance (Ramadhan et al., 2015). Studies on the development of educational games have been carried out. For example, research conducted by Abdullah and Yunianta (2018) on the educational game "TRIGO FUN" found that the use of educational games to teach mathematics was shown to be effective, valid and practical for improving student learning outcomes.

According to Fathurrohman et al. (2022), a mathematical game that is designed and developed systematically based on user needs and developer capabilities can be an alternative for using learning media. In general, in MTs students' numeracy learning, the teacher gives practice questions and then asks the students to try them; This causes students to get bored and not understand the material. By using the Maze Game application; The Board Game, it is hoped that students will gain a better understanding of mathematical material related to mathematical numeracy and avoid monotonous learning. Labirin Game; The Board Game is specifically designed to help students understand concepts, help them improve their numeracy skills, and encourage them to play the Maze Game; The Board Games.

Variations in board game models can provide quite a variety of playing experiences, especially for fans of board games. Various board models offer unique themes, rules and strategies within them. Several traditional board game models such as chess and DAM are the basis for today's modern board games, one of which is Labirin Game; The Board Game. Labirin Game; The Board Game adapts the form of a checkered board with variations in different shapes and sizes such as square and hexagonal shapes. Different board shapes can give a unique impression and game dynamics, thereby highlighting the characteristics of this game. There are also those that combine board games with technology to produce digital games with physical elements. This shows how innovation in board games has adapted to developments in the digital world.

In this digital and technological era that continues to develop, the use of game-based learning media is important to increase learning efficiency. Interactive media and games have the ability to improve students' numeracy skills and make learning more interesting and enjoyable. Literally, a board game is a game played with a board. According to Gobet, Voogt, and Retschitzki (2004), board games consist of a set of fixed rules that limit the number of items on the board, the positions of those items, and the number of moves that can be made. This medium allows players to interact with one another and follow established rules. The way players move on the board also affects their interactions with each other and the situation on the board.

Combined with cards and dice, board games should be creative activities that support the creation of mathematical statements. According to Fathurrohman, Nindiasari, and Rahayu (2022), the main goal of this activity is to help students formulate mathematical statements so they can engage with mathematics while learning. This activity can be used to differentiate between students who know how to construct numbers and operations in mathematical equations and those who are unable to formulate mathematical statements. Students can use board games to achieve academic goals in a more enjoyable way. Simkin (2013), suggests that educational games can also help students recall classroom material or teach them new concepts. This activity will boost students' enthusiasm, increase their interest, address disengaged students, and make learning more impactful.

Table 2
Research design

Group	*Pre-Test*	Treatment	*Post-test*
Experimental Class	T1	X	T2

It is recognized that frequent use of digital games by students through tournaments can improve children's numerical knowledge (Satsangi & Bofferding, 2018; Cheung & Mcbridge, 2017), impact adults (Libertus et al, 2017), facilitate mathematical creativity (Park & Lee, 2017), the acquisition of mathematical competencies (Skillen et al., 2018), and the development of mathematical thinking (Fouze & Amit, 2018). Simkin (2013) suggests that educational games can also help students remember class material or teach them new things. This activity will increase students' enthusiasm, increase their interest, overcome students who are not interested, and make learning more impressive.

Labirin Game; The Board Game offers a form of play that can be used as a learning tool to develop mathematics, problem solving and strategic analysis skills. Additionally, Labirin Game; The Board Game also creates opportunities for meaningful social interaction, allowing players to interact directly, collaborate, or even compete with each other. In an educational context, board games can be an effective way to teach complex concepts in a more engaging and practical way.

Based on the description above, the aims of this research are to increase the numeracy abilities of grade-8 students after using the Labirin Game; The Board Game and students' perceptions of mathematics learning using the Labirin Game; The Board Game.

METHODS

The subjects of this research are grade-8 students in Islamic public secondary schools (MTsN) in Serang City in the 2023/2024 academic year. Thus, in this research only two classes consists of 76 students will be taken as samples in this research, namely the experimental class. The experimental class uses learning experiments using a learning-based model Labirin Game: The Board Game.

This research uses empirical study methods one-group pretest posttest design to obtain accurate data by conducting experiments directly on the subjects studied. In this research design, one pretest-posttest group (initial-posttest in a single group) is given treatment (independent variable), but before the treatment is given, the initial abilities of the sample group are known through a pretest. To monitor research results, the sample group was given a posttest after treatment as shown in Table 2.

The research instrument used in this research is a test instrument consisting of pretest questions and posttest questions. This test instrument is a written test in the form of a description consisting of 5 questions. The essay test was chosen because it will encourage students' creativity and positive activities. Descriptive tests can indicate a student's level of numeracy ability and show how far they can reach a certain level. Scoring students' answers to each question determines their numeracy abilities. Before the test instrument is used, a trial of the instrument is carried out to determine the quality of the instrument which consists of validity and reliability. In this research, the methods and data analysis used in this research are descriptive statistics and inferential statistics. Where descriptive analysis is used to describe the average value of the posttest results, while inferential analysis is used to test hypotheses with a significance level of 0.05. Before hypothesis testing is carried out, prerequisite tests are carried out including normality tests and homogeneity tests.

In this research, a perception questionnaire was used with a Likert scale to measure the attitudes, opinions and perceptions of a person or group of people about social phenomena. This research uses a scale with a minimum score of 1 and a maximum score of 4, because respondents' answers will definitely indicate whether they tend to express opinions that agree or disagree with the opinions they give. And from the validity test for the valid perception questionnaire to be used and the reliability test shows it is reliable. Research data was collected through photo documentation of research activities.

Table 3
Descriptive Statistics of Pretest and Posttest Data

Data	Amount of data	x_{max}	x_{min}	Mean	*Std. Deviation*	*Variance*
Pretest	76	12	8	10.18	1.10	1.20
Posttest		20	17	18.97	0.86	0.74

Table 4
Normality test*Shapiro Wilk*

Data	*Shapiro Wilk*		
	Statistics	df	Sig.
Pretest	0.886	76	0,000
Posttest	0.828	76	0,000

Table 5
Test for Differences in Numeracy Ability

Wilcoxon Signed Ranks Test	Information
Sig. (2-tailed)	
0,000	H_0Rejected

FINDINGS

The research results were collected through tests of students' numeracy abilities and perception questionnaires regarding the use of the Labirin Game; The Board Game from 76 students from classes VII F and VII G. All 76 students in the experimental class received the same lesson using the Labirin Game; The Board Games. At the initial meeting in the experimental class, learning begins with greetings and then an introduction session with students. After that, it is explained about the learning that will be carried out during the research. First, a pretest is carried out to determine students' initial abilities in numeracy, then they move on to discussing material regarding whole numbers and fractions using the module that has been prepared.

Furthermore, a game-based learning model was used for students in grades VII F and VII G. Labirin Game; The Board Game, pay attention and note it during the learning process as well as the teacher's explanations that are relevant to students. During learning, students must seek information from various sources. After learning, a posttest was carried out to evaluate students' final numeracy abilities and the improvements that occurred in Class VII F and Class VII G. After that, a general analysis was carried out to draw conclusions about students' numeracy abilities. This test consists of five questions and takes 45 minutes to complete. First, descriptive analysis was carried out to get a clear picture of students' numeracy abilities from start to finish.

Based on Table 3, it shows that students' initial numeracy skills in the pretest had an average value of 10.18 and the posttest had an average value of 18.97. Based on the numeracy ability test assessment categories given in Table 3, student scores in the pretest are included in the poor category, while student scores in the posttest are included in the very good category. The average difference in students' numeracy abilities in the posttest was greater than the pretest. In addition, the pretest standard deviation and variance were greater than the posttest, with differences of 0.24 and 0.45. This shows that higher standard deviation values indicate greater data variation, while lower standard deviation values indicate that data variation is closer to the average.

Different from the average value of students' final numeracy abilities. The pretest received lower scores than the posttest, 10.18 and 18.97, respectively. Both classes have a very good category based on the values shown in Table 3. Students' numeracy abilities show significant differences between pretest data and posttest data, as shown in the description.

To test this hypothesis, the results of the pretest and posttest of students' numeracy ability tests were used. This normality test uses IBM's Statistical Package for Social Sciences (SPSS). The Shapiro Wilk test is used to test normality, and the Mann Whitney U test is used to test pretest and posttest data if the data is not normally distributed.

Table 6
Use of learning media

Item No	Number of Items	Information	F	Total Average Score	%
1, 2, 3, 4, 5	5	STS	0	0	0.00%
		TS	6	12	0.95%
		S	232	696	55.24%
		SS	138	552	43.81%
Amount			376	1260	100%
Maximum Score				1520	
Average Percentage				82.89%	
Category				Good	

Table 7
Student attitudes in using learning media

Item No	Number of Items	Information	F	Total Average Score	%
6, 7, 8, 9, 10, 11	6	STS	7	7	0.51%
		TS	54	108	7.86%
		S	289	867	63.10%
		SS	98	392	28.53%
Amount			448	1374	100%
Maximum Score				1824	
Average Percentage				75.33%	
Category				Pretty Good	

Table 8
Benefits of using learning media

Item No	Number of Items	Information	F	Total Average Score	%
12, 13, 14, 15, 16, 17	6	STS	7	7	0.47%
		TS	19	38	2.57%
		S	268	804	54.43%
		SS	157	628	42.52%
Amount			451	1477	100%
Maximum Score				1824	
Average Percentage				80.98%	
Category				Good	

In Table 4, the results of the normality test using the Shapiro Wilk test for pre-test and post-test data on students' numeracy abilities from both classes are shown; The significance value is 0.00 < 0.05, which indicates that the data is not normally distributed, and H_0= accepted. Therefore, a non-parametric test using the Mann Whitney U test was carried out to determine whether the data was not normally distributed.

Next, the average difference test for numeracy skills was carried out using the IBM SPSS application Test *Wilcoxon Signed Rank Test.* Table 5 shows the results of the Wilcoxon Signed Ranks Test. The results show that H_0 rejected, because the p or sig value. (2-tailed) is 0.000 < 0.05. The test results showed that students' numeration skills were better after using Labirin Game; The Board Game.

After carrying out the numeracy skills test, they distributed a perception questionnaire on the use of the Labirin Game; The Board Game to students in classes VII F and VII G, data was collected and analyzed. The Table 6 shows that the majority of students are in the good category. This shows that teachers use media that helps students. They also became interested in the learning process after the teacher used the Labirin Game; The Board Games. Therefore, teachers must master the media because one of the obligations of being a teacher is the ability to use learning technology, especially

learning media. If there is good and supportive learning media, the learning process will take place effectively and will have a positive impact on learning outcomes.

Table 7 shows that the majority of students agree with the fairly good category. This shows that using learning media can help students follow lessons well. Students can not only concentrate on the media provided but can also focus and understand the substance of the lesson material. Teachers also don't feel bored with different learning media such as Labirin Games; The Board Game although the media must be adapted to the subject matter.

Table 8 shows that the majority of students are in the good category. This shows that when teachers use learning media in the learning process, students' understanding of the learning material increases. Students become more interested and more focused on the teacher's explanation. The use of learning media that is adapted to appropriate methods allows the delivery of more interesting material and the achievement of learning objectives.

DISCUSSION

The pretest results show a significant difference between the posttest results and the average. The focus of this research is to determine students' numeracy abilities after implementing a game-based learning model using the Labirin Game; The Board Game. Before class begins, students are assigned to read a mathematics textbook about integers and fractions. Before learning begins, students answer questions about the material.

When learning began, students in classes VII F and VII G took a pretest to determine their numeracy skills, as shown in the picture above. The results show that the numeracy skills of students in this class are low. This is in line with research conducted by Kania et al. (2023), where teachers do not know how to use learning media, which is the main factor that prevents students from understanding lessons in class. As a result, teachers who are able to create an innovative, creative and enjoyable learning atmosphere for students, especially if they want to improve their numeracy skills are needed.

Therefore, special interventions are needed to improve students' numeracy skills from various categories. This includes students who have only limited knowledge of mathematics, only a small percentage of students understand the concept or it is incomplete, and students who have limited numeracy skills. Thus, it is clear that students are still unable to use symbols for whole numbers and fractions in arithmetic operations.

Furthermore, a game-based learning model was used for students in grades VII F and VII G. Labirin Game; The Board Game, pay attention and note it during the learning process as well as the teacher's explanations that are relevant to students. During learning, students must seek information from various sources. In addition, they are required to find problems and find the best solutions. Additionally, students must have the ability to translate different math problems into their own language so that they can solve them. This is expected to improve students' numeracy skills.

This is in line with research conducted by Fathurrohman et al. (2022), the main objective in the Labirin Game; The Board Game is to help students play while learning mathematics by compiling mathematical statements. This activity can be used to differentiate between students who know how to arrange numbers and their operations in mathematical equations and students who are unable to construct mathematical statements.

After learning, a posttest was carried out to evaluate students' final numeracy abilities and the improvements that occurred in Class VII F and Class VII G. After that, a general analysis was carried out to draw conclusions about students' numeracy abilities. After analyzing, it was found that there was an average difference between classes VII F and VII G. There was a significant difference between the pretest and posttest average scores. After carrying out the posttest, the numeracy abilities of class VII F and VII G students experienced a significant increase.

After carrying out the posttest, students will be able to understand the concept of whole numbers and fractions and be able to use various symbols to solve problems regarding whole numbers and fractions in daily arithmetic operations. They will also be able to understand the results of the analysis to predict and make decisions. Students are categorized as proficient in numeracy, which means they are able to use their mathematical skills in everyday life.

From the explanation above, it can be concluded that students who use game based learning with the Labirin Game: The Board Game have better numeracy abilities than students who do not use this learning method. This conclusion is in accordance with the research results of Ramadhan et al. (2023). According to research conducted at SDS Dharma Bhakti, game-based learning media significantly improves students' numeracy skills. Additionally, they show that students have a better understanding of mathematical concepts and that their ability to complete mathematical tasks improves.

Students can have better numeracy skills because they are given material about whole number and fraction arithmetic operations earlier in the lesson. After that, they took part in the Labirin Game; The Board Game also uses this material. This means that students' numeracy level is categorized as proficient, which means they can apply mathematical knowledge in various situations.

It is recognized that frequent use of digital games by students through learning can improve children's numerical knowledge (Satsangi & Bofferding, 2018; Cheung & Mcbridge, 2017), impact adults (Libertus et al, 2017), facilitate mathematical creativity (Park & Lee, 2017), the acquisition of mathematical competencies (Skillen et al., 2018), and the development of mathematical thinking (Fouze & Amit, 2018). It is acknowledged that there are many interesting games to learn in mathematics, because counting skills and number sense can be supported through them (Nasrullah & Zulkardi, 2011).

According to Dienes, mathematical games are very important because the mathematical operations in these games show concrete rules and further guide and sharpen students' understanding of mathematics (Widya, 2013). It can be said that concrete objects in the form of games have a very important role in learning mathematics if they are manipulated well. According to Dienes, mathematical concepts will be successful if studied in certain stages (Widya, 2013).

From this research, it can be concluded that students are experiencing a numeracy development stage called the numeracy knowledge stage. Students learn to use mathematical symbols and language in the context of formal education which helps them improve their ability to calculate abstract concepts.

In this research, a perception questionnaire was used as a research instrument and also to see students' perceptions of using the Labirin game; The Board Games. The type of questionnaire used is a closed questionnaire, which has several optional questions that will be answered by the respondent. The Linkert scale questionnaire model used in this research uses a rating scale (Strongly Agree, Agree, Disagree, Strongly Disagree). This research shows that the Maze Game; The Board Game, can be used to teach material about integers and fractions for students in class VII F and VII G at MTsN 1 Serang City. Apart from that, this learning media helps students learn in class. With the good category is 82.89% on the criteria for using learning media, the quite good category is 75.33% on the criteria for student attitudes in using learning media, and the good category is 80.98% on the criteria for benefits in using learning media. This shows that the average students in classes VII F and VII G have an interest and tendency to use the Labirin Game; The Board Game is in the medium category.

The use of games is very useful in education and learning, as revealed by the literature, namely: 1) for education and learning (Sardone, 2018), 2) developing student capacity (Blackman & Belcher, 2017), 3) modeling learning (Butkhardt, 2018), 4) increasing numerical knowledge (Satsangi & Bofferding, 2018; Cheung & Mcbridge, 2017), 5) also useful for adults (Libertus et al., 2017), 6) increasing creativity (Park & Lee, 2017), 7) gaining mathematical competence new (Skillen et al., 2018), 8) developing mathematical thinking skills (Fouze & Amit, 2018), and 9) interpersonal understanding (Chou, 2017).

This is in line with research conducted by Suliani (2020) that the use of teaching aids can influence the way students perceive the material provided by the teacher, thereby improving student learning outcomes. Apart from that, with the help of learning tools, learning activities can be improved, which means the learning process and results will be better.

CONCLUSIONS

The implementation of Labirin Game; The Board Game increased the students' numeracy abilities especially on integers and fractions materials. Apart from that, this learning media helps students learn in class. In addition, the students' perception on the use of game are the good category (82.89%) on the criteria for using learning media, the quite good category (75.33%) on the criteria for student attitudes in using learning media, and the good category (80.98%) on the criteria for benefits in using learning media. This shows that the students have an interest and tendency to use the Labirin Game; The Board Game Game on the medium category.

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