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GESAMSU (Gedrik Saruk Memang Seru) Based Environmental: Effectiveness of Games on Mathematics Communication Ability of Elementary School Students

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ABSTRACT

This study aimed to determine the effectiveness of the GESAMSU (Gedrik Saruk Indeed Seru) game-based environment on students' mathematical communication skills. This research was conducted by 3rd-grade students at an Integrated Islamic Elementary School (IT) Nurul Islam Paramarta in Seputih Banyak District in Central Lampung, with a sample of 62 students in this study. This research method used the Experiment with Pretest-Posttest Control Group Design, using a random purposive sampling technique. This study used an instrument in an Essay test of mathematical communication skills. The results showed that the increase in students' mathematical communication skills taught by applying the Environmental-Based GESAMSU (Gedrik Saruk Indeed Seru) game was significantly higher than the increase in students' mathematical communication skills taught by conventional learning models. The average posttest score of the experimental class was higher than the posttest score of the control class, namely 85.96 and 60.63, both of which were in a different category. It indicated that this game could improve mathematical communication skills. Moreover, the important thing in the application through this game is that students feel fun, motivating them to take part in learning mathematics.

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1. INTRODUCTION

Students' success in school is shown by the learning outcomes, including knowledge, skills, values, and attitudes (Bali & Musrifah, 2020; Siregar, 2018). Various factors influence these learning outcomes achieved by students, both originating from the students themselves and from outside the students

themselves (Lin et al., 2017; Ningrum et al., 2022). Success in school is a cognitive and social requirement that students must have and must have a positive attitude towards learning to show high effort in the learning process (Bowden et al., 2021; Siregar, 2019). This statement requires teachers to help students feel happy in learning and encourage students to try hard in the learning process to achieve optimal learning outcomes. However, unfortunately, some courses have abstract material, so the learning process becomes boring. Mathematics is one of the abstract courses, so students quickly get bored in the learning process, which causes poor learning outcomes (Lesmanawati et al., 2020).

Utilization of the surrounding environment as a medium is a solution that teachers can apply, one of which is a game (Suryanto et al., 2017). Educational Game Tool is a media designed and created to assist educators' teaching and learning process in the classroom and help students develop their potential (Hayati & Amilia, 2020). Educational Game Tool is one media that can be used in teaching abstract material with more fun. Applying an environment-based Educational Game Tool can attract students' interest in learning and make it faster to capture the learning (Hayati & Amilia, 2020; Susilowati et al., 2020).

Several studies have been carried out using games as learning media. Isnardiantini et al. added the traditional games to the discovery learning method. Using traditional games, Discovery learning based-mathematic teaching material can significantly improve the students' multiplying and dividing abilities (Isnardiantini et al., 2019). Nugroho et al. also used the Educational Game "Mathematic Maze" Based On Android To Improve the Calculation Ability (Nugroho et al., 2017). Then, Wijaya et al. reported increasing students' motivation in the learning process by implementing Hawgent Dynamic Mathematics Software (Wijaya et al., 2020).

Several studies have shown that games as a learning medium benefits the learning process. Nevertheless, unfortunately, today's learning media are more technology-based (Rizky & Zainil, 2021; Rochimah & Muslim, 2021; Utomo et al., 2021). Many students have currently abandoned traditional games because they look old-fashioned. If the game is not used, it will become extinct over time. Therefore, it is necessary to innovate traditional game-based learning media to look attractive to students. Handayani et al. reported that using the development of conventional Javanese games as a teaching and learning media can introduce the mathematical concept to early age students (Handayani & Iswantiningtyas, 2020). Aprinastuti et al. also developed 21st Century Skills for Elementary School Students Grade 1 by Implementing Indonesian Traditional Games in Mathematical Learning (Aprinastuti, 2020). Isnardiantini et al. utilized the traditional game "Engklek" to improve the students' multiplying and dividing abilities (Isnardiantini et al., 2019). On the other hand, Susanti reported that using the traditional game "Tong Tong Galitong Ji" could make it easier for students to understand arithmetic concepts (E. Susanti, 2020). Asrial et al. used the "Hide and Seek" traditional game to shape students' character (Asrial et al., 2021). Then, Wulansari et al. and Syahrial et al. also developed traditional games to increase the mathematic counting skill of early age students (Syahrial et al., 2021; Wulansari & Dwiyanti, 2021).

Several studies show that traditional games can also contribute to the learning process. Therefore, the author also wants to preserve traditional games by creating a traditional environment-based game called GESAMSU (Gedrik Saruk Indeed Seru). In this study, the GESAMSU game will be studied to improve mathematical communication skills, primarily written mathematical communication skills. Written mathematical communication is the ability and skill of students to use vocabulary, notation, and mathematical structures to express relationships and ideas and understand them in solving problems. (Kaya & Aydın, 2016; Ruzimurotovna, 2020).

2. METHODS

This research method used the Experiments method with Pretest-posttest Control Group Design Table 1) (Creswell & Creswell, 2017). In the initial stage, before being given treatment with the learning model, a pretest was carried out to measure the initial ability, both in the control class and the experimental category. The next step is to give different treatments between the two sample classes, the

experimental class. Furthermore, at the final stage of the study, a post-test or final measurement was held to see if there was a significant difference between before applying the learning model and after using the learning model by looking at the difference between the pretest and post-test in both the control class and the experimental class.

Table 1. The research method design

Sample Class	Pre-test Measure	Treatment	Postest Measure
Experiment	O_1	X	O_2
Control	O_3		O_4

Information:
O_1 : Pre-test Experimental Class
O_3 : Pre-test Control Class
X : Treatment
O_2 : Post-test Experimental Class
O_4 : Post-test Control Class

The instrument in this study used an essay test designed according to indicators of mathematical communication skills. By giving a pretest before implementing environment-based GESAMSU, and a posttest as a test after implementing environment-based Gesamsu. Learning materials for flat shapes, fractions, addition, subtraction, multiplication, and multiplication through question cards obtained by players. This study aims to describe environmental-based GESAMSU on mathematical communication skills in elementary school students. As for the problem in this study, are there differences in students' mathematical communication skills before and after learning using environment-based Gesamsu.

The subjects of this study were 62 students in Islamic Elementary School (IT) Nurul Islam Paramarta grade third elementary school consisting of 32 students in the experimental class and 30 in the control class. Before conducting the research, the researcher made observations first as a pre-research activity to diagnose fundamental problems. From the results of the Pre-Research activities, students', mathematical communication skills must be improved. Then proceed with analyzing the characteristics of students, then the steps are taken to study the curriculum. Analyzing the curriculum is a strategy for learning activities or scenarios that must be carried out to achieve learning objectives effectively and efficiently. At this stage of curriculum analysis, researchers develop Basic Competencies, which are compiled into indicators. The indicators compiled are formulated into environmental-based Gesamsu learning steps. The curriculum analysis process starts from developing essential competencies compiled into learning indicators. Learning indicators are arranged with learning steps. Then, a mathematical communication skill test is developed according to learning indicators. The pretest aims to determine students' communication skills before receiving environmental-based Gesamsu learning treatment. Furthermore, given the treatment, a posttest was conducted to determine the differences in student communication.

3. FINDINGS AND DISCUSSION

Based on the test results, the pretest was homogeneous and normally distributed. The initial abilities of the two classes were not significantly different. The initial test results (pretest) are beneficial to see the development of mathematical communication after being given learning treatment. After learning both the experimental and control classes, the next step is to do a final test (posttest).

Collecting research data is through a test technique with several description questions. In the test instrument, the level of validity of the questions can be measured by referring to the r-value of Product Moment with a significance level of 5% 0.355. The reliability test results using SPSS 20 show that the resulting Cronbach's alpha value is 0.946 and lies in the index range of 0.81 - 1.00, so it can be concluded that the problem-solving ability question is very reliable.

Comparison of the effectiveness of the two models used Normalized Gain (N-Gain) analysis. Descriptive statistical tests carried out the data analysis technique to determine the average, minimum, maximum, and standard deviation difference. After knowing the difference in the average increase, a prerequisite test was carried out with the Shapiro-Wilk normality test and the SPSS 20-assisted homogeneity test. If the two prerequisite tests showed normal and homogeneous results, a parametric statistical test was carried out to determine whether there was a difference in the level of effectiveness of the application. If it shows the same results are not normal, a non-parametric test is performed. The effectiveness of applying the two models can be seen by analyzing the Normalized Gain (N-Gain) assisted by SPSS 20.

Table 2. Comparison of average measurement results

Measurement	Average Score (Mean)		n	Deviatio
	Pretest	Post-test		
Experiment	50.03	85.96		35.93
Control	50.80	60.63		9.83

Based on table 2, the difference between the pretest and post-test scores was 35.93. The average difference between the pretest and posttest scores in the control class was 9.83. The data comparison diagram between the two types can be seen in figure 1.

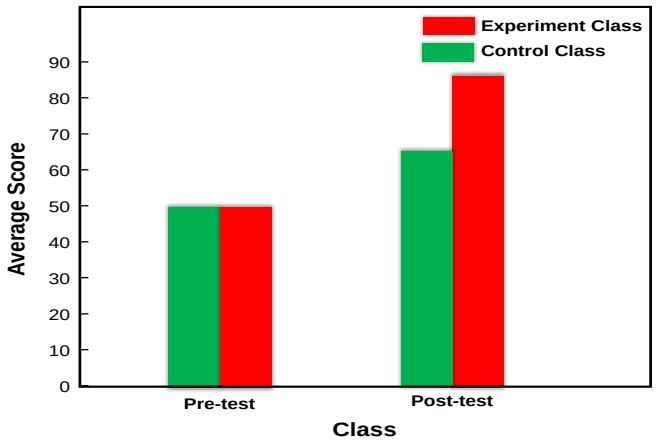

Figure 1. The average measurement results

Figure 1 shows the difference in the average learning using GESAMSU on students' mathematical communication skills. After the difference in the average value, to determine the data analysis technique, a normality test was carried out on the pretest and posttest results in the experimental and control classes. The results of the normality test can be seen in table 3.

Table 3. Normality test results

Pretest and Posttest	Shapiro- Wilk			Category
	Statistics	Df	Sig.	
Experimental Pretest	.960	32	.543	Distribute Normal
Experiment Posttest	.977	32	.892	Distribute Normal
Pretest Control	.965	30	.653	Distribute Normal
Control Posttest	.944	30	.289	Distribute Normal

From the results of table 3, the normality test results with the help of the SPSS program obtained the Kolmogorov-Smirnov significance value of the experimental and control class gain scores on mathematical communication skills, respectively, are 0.200 and 0.197. It shows that the value of Sig> = 0.05 means that the data on the gain score of mathematical communication skills in the experimental class and control class comes from a normally distributed population.

The normality test used Shapiro-Wilk, and the results of the normality test were obtained with a significance level of > 0.05. In addition to the normality test, a homogeneity test is also needed to determine the type of data analysis. The results of the homogeneity test are shown in table 4.

Table 4. Homogeneity test results

Type	Lavene's Statistic	Sig.	Category
Pretest Experiment Class and Control Class	.000	.996	Homogen
Posttest Experiment Class and Control	.155	.696	Homogen

From table 4, it can be seen that the homogeneity test of the pretest results shows that the significance value (Sig.) is 0.996 > 0.05, so the variance of the pretest data for the experimental class and the control class is the same or homogeneous. Likewise, in the posttest homogeneity test, it is known that the significance value (Sig.) is 0.696 > 0.05, so the variance of the posttest data is the same or homogeneous. From the two prerequisite tests, it was obtained that the data used were normally distributed and homogeneous so that parametric statistical tests carried out data processing with Independent Samples Tests to determine whether there were differences in the effectiveness of the two models.

Table 5. Parametric test results (independent samples tests)

	Lavene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Equal variances	1.917	.172	-5.401	50	.000	4.123	-30.551	-13.987
Assumed Equal variances not assumed			-5.731	47.618	.000	3.886	-30.083	-14.455

Based on table 5, the equal variances value of Sig. (2-tailed) of 0.000 < 0.05, then obtained a significant average difference in students' mathematical communication skills with the two models. So it was concluded that H0 was rejected and Ha was accepted. The formulation of the problem answered that there were differences in students' mathematical communication skills through the application of GESAMSU learning in mathematics for third-grade elementary school students. Furthermore, to determine the difference in the effectiveness of the two models, an N-Gain analysis was carried out.

Table 6. N-Gain analysis results (%)

Category	N	Mean
Experiment Class	32	66.9681
Control Class	30	38.9476

Based on the results of the N-Gain Percent analysis found average in the two classes regarding the effectiveness category of the N-Gain Percent is known that the experimental class with GESAMSU learning is 66.9681% and is included in the category quite effective for improving mathematical communication skills in fourth-grade students (Table 6). In the control class with the conventional model, the elementary school obtained an average of 38.9476% included in the ineffective category to improve mathematical communication skills in third-grade elementary school students. So it can be concluded that there is a difference in the improvement of students' mathematical communication who is taught the game of Gesamsu (Gedrik Saruk is fun) with the conventional model. Based on the results of the analysis, descriptively and inferentially, it can be seen that there is a difference in the increase in the value of mathematics communication for grade 3 students at an Integrated Islamic Elementary School (IT) Nurul Islam Paramarta who participates in learning with the GESAMSU game which follows learning with a conventional model. Based on the data that has been explained, it is known that the average pretest score for the control class is higher than the average pretest score for the experimental class, namely 23 and 25. However, after being given treatment in each class, the experimental class's average posttest score is higher than the posttest scores of the control class, namely 88 and 75, both of which are in high intervals.

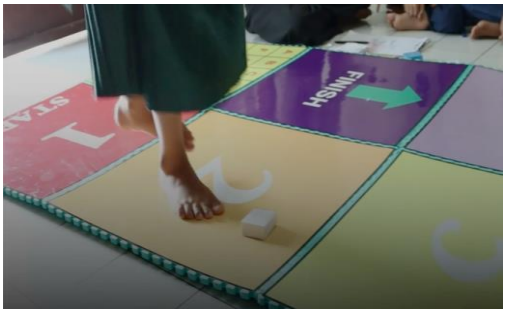

Figure 2. Students playing GESAMSU (GEDRIK SARUK MEMANG SERU)

In the initial stages, students put together puzzles arranged sequentially by starting with the number 1 (start) until assembling the puzzle to the finish (ending with a century card containing a question card). The game is done by throwing a cube-shaped gaco. The gaco is thrown into the number one box and cannot exceed the box provided. The player jumps on one leg (ankle) then kicks the gaco to the next box until the fifth box is instructed to stop. After boxed five, players stop and take the gaco to the shooting box.

Figure 3. Students get question cards

Once in the shooting box, the player then kicks the gaco towards the alphabet box. If the gaco lands on one of the characters, the player gets a question card. Shiva, who can answer the questions given by the teacher, will get a star reward. Learning activities that emphasize the process by utilizing the surrounding environment are expected to provide a pleasant experience for students so that learning becomes meaningful and quality. Learning is said to be of quality if the teacher presents problems that

are challenging, fun provides opportunities for students to explore, provide experience, develop thinking skills, communicate related to the answers they think about, and utilize learning resources in the form of natural learning resources and design results (Schultz-Jones & Ledbetter, 2009).

The results of this study are also reinforced by opinions which state that: 1. Students are actively involved intellectually and emotionally to explore natural phenomena using games. 2. Train students' mathematical communication skills through various ways, for example, through observation, discussion, games, conducting experiments, 3. providing opportunities for students to complete assignments together, and 4. Students can think creatively if students are guided to be enthusiastic and confident in answering the questions given so that students' creativity and communication skills develop for the better (Coleman & Money, 2020; Greipl et al., 2021; Karakoç et al., 2020; Park et al., 2019). Applying mathematics learning through a pleasant student environment can impact mathematical communication skills (Hirschfeld-Cotton, 2008; Trisnawati et al., 2018).

The environment is very important to use in the learning process the competence of elementary school students because it can be used as learning targets, learning resources, and learning tools. The role of the surrounding environment in learning mathematics is very important and supportive. Learning by utilizing the surrounding environment can develop pedagogical aspects. Israel-Fishelson & Hershkovitz, 2022; Siegler et al., 2020; T. Susanti et al., 2020).

4. CONCLUSION

In this research, the traditional game "GESAMSU" to improve mathematical communication skills has been successfully implemented. Based on the data result, the mathematical communication ability of students who are taught by applying the GESAMSU game is significantly higher than the increase in the mathematical communication skills of students who are taught conventionally. Results of the N-Gain in the two classes regarding the effectiveness category of the N-Gain Percent is known that the experimental class with GESAMSU learning is higher than the control class and is included in the category quite effective for improving mathematical communication skills in fourth-grade students. From the results of this study, the GESAMSU game can be applied to both individual learning and classical group learning.

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