

# **Improving Numeracy Skills Through Games Based Learning Methods on Mathematics Learning Outcomes of Class IV SDN Pancoran 01 Pagi**

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## **ABSTRACT**

This study uses the Classroom Action Research (CAR) method aimed at improving numeracy skills through games based learning in grade IV students of Pancoran 01 Pagi Elementary School with the help of a web based Wordwall application. The research subjects involved in this study were 27 students, consisting of 12 male students and 15 female students. The research technique used observation, interviews, tests, and documentation. This study was designed in cycle I and cycle II which were carried out through four stages, Planning, Implementation, Observation, and Reflection. Based on the results of data analysis during the implementation of the test at the first meeting, the pretest was obtained an average value of 55.37% of conventionally and the second meeting through games based learning carried out the posttest obtained an average value of 82.22%, thus, this study can be said to be successful because it has achieved the KKM success indicator of 75 from the results of the arithmetic test. The results of the study showed that students at meeting I were in the category of has't improved and at meeting II were in the very good category, so that the games based learning method was more effective than conventional learning for fourth grade students of Pancoran 01 Pagi State Elementary School.

**Keywords:** Games based learning; Mathematics; Arithmetic skills

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## **Introduction**

Education has an important role in gaining knowledge and skills in creating a superior generation that forms character personalities in accordance with Pancasila values (Rahmayani, 2019), through education can form knowledge in terms of cognitive, affective, and psychomotor through the learning that is taught. (Dewi et al., 2020). To achieve better education, efforts are needed to improve the quality and standard of education, one of which is updating the learning process where there is active interaction between teachers and students in achieving learning goals (Syahidan Nurdin et al., 2023). The development of knowledge and technology, the quality of education must be improved, at the 21st century education paradigm, students must have 4C skills (critical thinking, creativity, collaboration, and communication) (Wahyuning, 2022). Success in achieving learning objectives is determined by the role of the teacher. The teacher not only explains the material, but also guides in the

holistic development and growth of the attitudes and psyche of students (Wulandari et al., 2023), in the learning process, teachers need to create an interesting and enjoyable learning atmosphere so that students' attention is focused and interested in understanding the material being explained (Rivals & Wote, 2022). These learning outcomes also show the teacher's performance in the teaching process and the success of students in understanding the material taught.

Mathematics is a subject that involves calculating numbers which requires understanding and skills to complete them (Astriyana et al., 2023). Many student think that mathematics is a difficult subject to understand. Teachers have a role to plan strategies or learning methods that are easy for students to understand, because the difficulty in understanding a material is influenced by the learning process, in the learning and teaching process teachers need a method or strategy to achieve learning goals. Inappropriate learning methods or strategies become obstacles for students to have difficulty understanding the material (Fitri Yanti & Sumianto, 2021). Mathematics learning becomes more effective and easier to understand if the learning process is made fun (Bahar & Syahri, 2021). The function of learning mathematics is as a tool, where teachers can provide explanations from various examples in solving mathematical problems related to everyday life, mathematics as a mindset to understand information for example through equations, or tables in simple mathematical concepts, mathematics as knowledge where teachers must know that mathematics must have concrete truth accompanied by accurate data (Stit & Nusantara, 2020).

Learning success is influenced by students' interest in learning so that they can easily understand the learning material (Khaerunnisa et al., 2022). High interest in learning not only improves achievement, but can also form critical, creative, innovative and proactive thinking patterns (Hidma et al., 2022), So the learning method is also a factor that influences interest in student learning outcomes. An interesting method approach emphasizes the use of strategies that arouse curiosity, and active participation of students in the learning process (Kusuma et al., 2022). Three aspects that influence student learning outcomes are cognitive, affective and behavioral aspects. Cognitive aspect, where the knowledge and understanding obtained can be developed from the material studied. The affective aspect is the feeling or emotion in the process of assessing activities that are enjoyed such as curiosity, satisfaction, towards certain subjects, while the behavioral aspect includes student actions that involve learning participation (Laili, 2022). So, an activity that is accompanied by interest will improve learning outcomes, so teachers need to create interesting learning innovations so that student learning outcomes increase (P., 2019).

To Innovation in appropriate learning methods or strategies can help students' understanding in gaining knowledge. The quality of learning outcomes is seen from teachers in implementing learning strategies that adjust methods according to the subject matter and student needs (Sofi & Praheto, 2023). Learning innovations need to be continuously developed to adapt to the times. One of them is the use of the Games Based Learning method, namely the presence of game elements designed to help the learning process related to fun mathematics material and create an interesting learning experience. Games based learning applies it with the help of wordwall. Wordwall is a web based application used in designing interesting learning in the form of games, for example there are open boxes, random wheels, quizzes, random cards, airplanes, mazes, bursting balloons and others. This innovation can reduce students' perception that mathematics is a difficult and boring subject (Khaerunnisa et al., 2022), by using a strategy through the games based learning method, it is hoped that it can provide stimulus to students in the learning process which is not only cognitive but also affective and psychomotor which can increase students' interest in their learning outcomes (Ningsih et al., 2021). The use of educational learning based on games can motivate students to participate in learning activities. Teachers design games that are adapted to the needs and characteristics of students (Soetan et al., 2021).

Numeracy skills are something related to basic mathematical concepts such as addition, subtraction, multiplication and division that must be mastered by students. Students who are able to master calculations and solve mathematical problems can be categorized as students who have numeracy skills (Murtafi'ah et al., 2021). Counting becomes a part of mathematics that involves

numbers and figures in the process of managing numbers with accurate data and exact science. The target of success in learning mathematics is marked by the ability of students to count in understanding the concept of material, calculating with formulas, and calculating fluently (Oktavia, 2022). Students who have difficulty in mathematical operations are in the form of multiplication and division number operations which are the basis of mathematics to master higher level material (Nadia et al., 2022).

PISA (Programme for International Student Assessment) is an international assessment program managed by the OECD (Organisation for Economic Co-Operation and Development) called PISA. Its purpose is to assess the global education system by measuring students' abilities in mathematics, science, and literacy. Indonesia is one of 81 countries participating in PISA 2022. According to Nadiem Makarim, Minister of Education, Culture, Research, and Technology, Indonesia's ranking has increased by five to six positions compared to PISA 2018. Reading literacy, Indonesia's ranking in PISA 2022 has increased by five positions compared to before. Indonesia's mathematics has also increased by five positions, while the science ranking has increased by six positions. Despite the increase in ranking in PISA 2022, Indonesia has recorded a decrease in scores in each of the reading, mathematics, and science assessment subjects. The results of PISA 2022 data show that, although some countries experienced a decrease in scores due to the pandemic, they still achieved scores above the global average. Indonesia's score achievement out of 81 countries is still considered low (Lubis, 2023).



**Figure 1.1 PISA 2022 Data Achievement Trends, source: OECD**

Literacy Indonesia obtained an average score of 359, which is 117 points lower than the global average score of 476, and down 12 points from the previous score. In mathematics, Indonesia's average score dropped 13 points to 366 from the previous score of 379, this figure is 106 points lower than the global average score. In science, the score decreased by 13 points, Indonesia obtained an average score of 383, which is 102 points lower than the global average score. This result is almost the same as the 2009 PISA score. Education in Indonesia is still very concerning because since they first participated, students in Indonesia have not experienced any changes in the learning scheme in the classroom.

It is concluded that based on the 2022 PISA data, Indonesia experienced a decrease in score compared to 2018 although it has risen in rank in position 5-6 from below other countries, but Indonesia still needs efforts to provide an increase in PISA scores for the next five years so that Indonesia is more advanced in its level of education and can compete with Singapore. If we look at the year 2024, there are still many Indonesian students, especially at the level of numeracy skills, still need to be improved again starting from elementary school to high school so that Indonesia can excel in numeracy skills which become a habit of culture in solving mathematical problems that will affect learning outcomes.

Based on the results of field observations and interviews with the homeroom teacher of grade IV of Pancoran 01 Pagi State Elementary School, it shows that the arithmetic skills of grade IV students are still lacking or have not been mastered and this affects their learning outcomes. Students are less active, less enthusiastic and less attentive to teachers when explaining the material, because teachers are only conventionally monotonous, therefore an innovation in fun learning methods is needed, namely Games Based Learning with the help of the Wordwall web based application, making

students not bored and restoring students' interest in the learning process, increasing students' understanding of numeracy skills by utilizing the development of digital era technology.

## Methods

This type of research uses the Classroom Action Research method or called PTK. Classroom action research conducted by teachers as researchers in the classroom or collaborating by designing, implementing and reflecting on actions collaboratively and participatively to improve and enhance the quality of learning through action research in a cycle. Classroom Action Research (PTK) is considered strategic in improving the quality of learning in elementary schools, if implemented properly and correctly in accordance with existing theories. This research was conducted in two or more cycles by applying the Games Based Learning method. The purpose of this study was to determine whether student learning activities and outcomes had increased or not. This research was conducted on fourth grade students of Pancoran 01 Pagi Elementary School which focused on two aspects, namely the application of the Games Based Learning method and student learning outcomes.

This study uses a model design developed by Kemmis & Taggart which is designed through the stages of planning, giving action, observation or observation and reflection which are carried out repeatedly until successful which is called a cycle, for the implementation of the number of cycles it depends on the problems that need to be improved. The subjects of this study were 27 students, consisting of 12 male students and 15 female students with the Kemmis & Taggart model design as follows:



**Figure 1.2 Kemmis and Taggart Model, source: (Pahleviannur, 2022)**

The image above with the Kemmis & Taggart model design, action research begins with the planning stage, then implementation, observation, and ends with reflection. At the implementation stage (giving action) and observation are carried out at the same time, but are carried out by two different people, in this study, giving action in learning activities is carried out by the class teacher, while observation of giving intervention is carried out by the researcher.

## Data and Data Sources

### 1. Data

Data is a value that can provide a description of an object or event. So, the existence of data can provide a description that can be used as a determinant of the success or failure of the research that has been done. In this study, data is grouped based on its type and source. This study aims to improve the numeracy skills of fourth grade students of Pancoran 01 Pagi Elementary School using the games based learning method. Based on its type, data is grouped into two categories, as follows:

#### a) Qualitative Data

Qualitative data is a type of data that is usually in the form of written statements or words other than numbers.

## b) Quantitative Data

Quantitative data is data in the form of numbers or in this research, data in the form of scores from arithmetic skills tests.

## 2. Data Sources

The data used in this study come from various sources, with primary data taken from research subjects being the primary source used in study. Other data sources include observation notes and relevant document analysis results, which support and complement the primary data.

## Data collection technique

This research uses data collection techniques using test and non-test data collection techniques.

### 1. Test

Test is a systematic and objective tool or procedure to obtain data or information used. Test is used to measure students' numeracy ability before or after the implementation of the action to collect data on the results of improving students' numeracy ability before and after the application of the games based learning method, to determine the results or initial scores of the test is done with a pretest where conventional learning and determining the results or final scores are done with a posttest through the games based learning method. After all tests are done, the results of the pretest and posttest of each student are calculated on average as the results of their improvement.

### 2. Non Test

#### a. Observation

Observation is a data collection technique by observing activities directly to find out how the learning process is in the classroom. This observation is carried out in planning and implementation activities. Planning is carried out to find out the situation, conditions and problems that occur, then implementation to observe the situation that occurs in the classroom during the learning process.

#### b. Interview

Interview is a form of conversation that contains related questions asked between the interviewer and the interviewee which is done in a structured manner, the purpose is to collect data in obtaining information directly from related sources. This is done to better understand the problems faced by students and teachers.

#### c. Documentation

Documentation is used to strengthen the data obtained during observation activities. Documentation can be in the form of images or photos during implementation to document each activity of the learning process that is being carried out. This is to strengthen the research and there is accurate data.

## Data analysis

Data analysis techniques are the process of processing, presenting, and analyzing data by including information obtained during the research. The aim is to be able to describe a situation in improving the achievement of success indicators in each cycle and to see the success of numeracy skills in grade IV students of SD Negeri Pancoran 01 Pagi. Data analysis from student learning outcomes achieves at least 75% of the learning objectives, which will be considered complete. Student learning results are declared complete if the student gets a score greater than or equal to the KKM, namely 75. This research data analysis technique is carried out quantitatively on calculated skill test result data. Below is a description of research data analysis techniques as follows:

### 1) Quantitative Engineering

Quantitative data analysis techniques are used as a determinant of improving student learning outcomes as an influence on each action taken. This data analysis technique is used to be able to determine improvements in skills based on student performance before or after using the method games based learning. This technique analyzes data in the form of numbers or values based on the results of calculations or test measurements which form percentage percentages to find the average value by using the following formula:

$$M = \frac{\sum x}{N}$$

**Information:**  
 M = Mean (average value)  
 $\sum x$  = Sum of all values  
 Student  
 N = Number of students

$$\frac{\text{jumlah siswa yang tuntas belajar}}{\text{jumlah seluruh siswa}} \times 100\%$$

**Figure 1 Presentase learning completion**

No.	Rentang Nilai	Kriteria
1.	86 – 100 %	Sangat Baik
2.	76 – 85 %	Baik
3.	60 – 75 %	Cukup
4.	55 – 59 %	Kurang
5.	≤ 54 %	Kurang sekali

**Table 1 Learning Completion Criteria**

**Result and Discussion**

Research findings show that research methods. Game Based Learning on numeracy skills for students in class IV elementary school, providing improvement in student learning outcomes. Positive influence of using the method Games Based Learning in mathematics learning, from questions in the form of games that create a positive learning environment, the presence of interesting game elements, creating experience. Students who change their perception that mathematics is considered difficult actually easy. In class lessons, teachers have not yet used methods or interesting and varied strategies. This makes students less likely to understand the material and less active in class. In the preliminary study activities carried out by researchers, the aim was to find out the numeracy skills of class IV students at SD Negeri Pancoran 01 Pagi. In this preliminary study, researchers carried out observations by observing the learning activities of class IV students in mathematics lessons and trying to do so find solutions to solve problems in improving their numeracy skills.

The results of observations show that students more often use textbooks as their learning media. Researcher also conducted interviews with class teachers related to mathematics in class IV. When conducting interviews, researchers found that some students were still unable to solve the questions and some understand the meaning of the question. Many students assume that mathematics is a scary and difficult lesson, with lots of formulas and memorizing formulas. Many students have not yet mastered multiplication and still forget the formula, thinking that mathematics is just material taught at school that cannot be related or applied in everyday life. This is because there are factors that influence students' self-discipline in learning, parental attention, the environment or methods or learning strategies in class, this can be a problem in research.

Researcher obtain data consists of 27 students, consisting of 12 male students and 15 female students. The results of data collection on student learning outcomes were carried out before implementing the method Games Based Learning. This data collection is to find out students' grades and to be able to compare before and after applying the method Games Based Learning is done. Researcher carries out learning processes on basic arithmetic operation materials such as multiplication and division and fractions. The learning process is carried out at the beginning in a conventional manner and then the subsequent learning process applies the method games with the help of the wordwall web application. When students play games, researchers observe student behavior, whether the students understand or not and whether the students are actively involved or not. researchers observe students' learning results after applying them method Games Based Learning by comparing students' learning results before and after applying the method Games Based Learning, data

obtained from the results of class IV students' grades increased significantly. The majority were declared complete or more than KKM 75 from the test questions given and the results of observations of student activities during the learning process, 90% of students were active in following them. learning process, paying close attention when students explain the material.

The main focus of preliminary study activities is to observe students' learning activities related to counting skills, understanding related problems by implementing learning and trying to find solutions to solve problems. The results of observations in the context of the preliminary study show that the numeracy skills of class IV students in Pancoran 01 Pagi State have not yet been completely mastered.

Based on the results of the pre-test and post-test conducted, the score data was obtained in the following table:

**Table 1.1 Results of Pretest and Posttest Score Analysis**

No.	Name	X1 Pretest Score	X2 Posttest Score	d = X2 - X1
1.	Aisha	60	100	40
2.	Alya	40	80	40
3.	Atta	40	40	0
4.	Azka	80	100	20
5.	Ammar	20	80	60
6.	Arjuna	40	80	40
7.	Disha	40	80	40
8.	Faith	60	100	40
9.	Fakhri	100	100	0
10.	Faza	15	40	25
11.	Ilham	60	100	40
12.	Kirani	60	80	20
13.	Khanza	80	80	0
14.	Kirana	20	100	80
15.	Monzu	20	60	40
16.	Nayla	60	80	20
17.	Owen	80	100	20
18.	Putri	40	80	40
19.	Qalbi	40	80	40
20.	Rajwa	40	80	40
21.	Rifa	60	100	40
22.	Safina	100	100	0
23.	Sharena	40	100	60
24.	Shane	100	100	0
25.	Sabit	60	80	20
26.	Zaki	40	80	40
27.	Zivanka	60	100	40
Amount		1495	2220	845
Average value		55.37	82.22	31.29

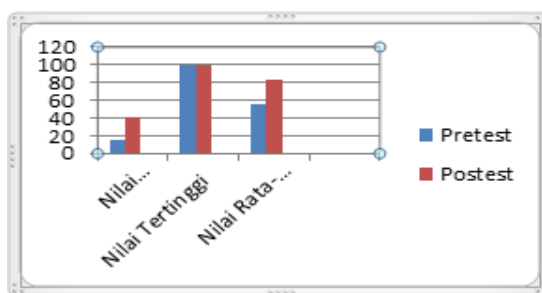
$$M = \frac{\sum x}{N}$$

$$= \frac{845}{27}$$

$$= 31.29$$

The results of the data obtained showed that the average score of students' arithmetic skills in the pre-test was 55.37, while in the post-test it was 82.22. The lowest score in the pre-test was 15 and the highest score was 100, while in the post-test, the lowest score was 40 and the highest score was 100. The data diagram of the highest, lowest scores and average values in the pre-test and post-test of students is presented as follows:

**Diagram 1.1 Average scores of fourth grade students in the pretest and posttest**



**Table 1.2 Mathematics Pretest Scores of Grade IV Students**

No.	Value Interval	Many Students	Percentage
1.	86 – 100%	3	11.11%
2.	76 – 85%	3	11.11%
3.	60 – 75%	8	29.62%
4.	55 – 59%	-	-
5.	≤ 54%	13	48.14%
Amount		27	100%

Based on table 1.2 in the score interval of 86 – 100 there are 3 students with percentage percentage. 11.11%, interval value 76 – 85, there are 3 students with percentage percentage 11.11%, score interval 60 – 75, there are 8 students with percentage percentage 29.62%, interval value 55 – 59 percent 0%, and the interval value ≤ 54 there are 13 students with percentage percentage 48.14%. If we look at the completeness of student learning, it can be seen in Table 1.3 as follows:

**Table 1.3 Learning completion in the pretest**

No.	Learning Completion	Number of Students	Percentage
1.	Completed	6	22.22%
2.	Not finished	21	77.78%
Amount		27	100%

Based on the table in the first pertemuan pretest. there were 6 students who completed the percentase 22.22% and 21 students did not complete the percentage percentage 77.78 %.

**Table 1.4 Mathematics Posttest Scores of Grade IV Students**

No.	Value Interval	Many Students	Percentage
1.	86 – 100%	12	44.44%
2.	76 – 85%	12	44.44%
3.	60 – 75%	1	3.70%
4.	55 – 59%	-	-
5.	≤ 54%	2	7.40%
Amount		27	100%

Based on table 1.4 in the value interval 86 - 100 there are 12 students with a percentage of 44.44%, the value interval 76 - 85 there are 12 students with a percentage of 44.44%, the value interval 60 - 75 there is 1 student with a percentage of 3.70% and the value interval 55 - 59 there is none 0%, the value interval ≤ 54 there are 2 students with a percentage of 7.40%. If viewed from the completeness of student learning, it can be seen in Table 1.5 as follows:

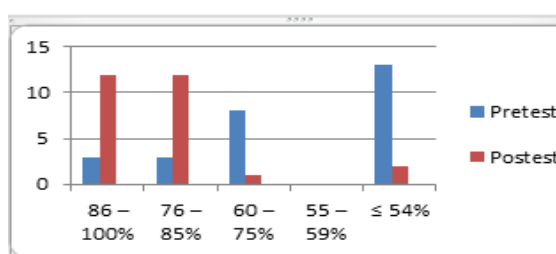
**Table 1.5 Learning completion in the posttest**

No.	Learning Completion	Number of Students	Percentage
1.	Completed	24	88.88%
2.	Not finished	3	11.11%
Amount		27	100%

Based on the table in posttest II, there were 24 students who completed the persentase 88.88% and 3 students did not complete the percentage 11.11 %.

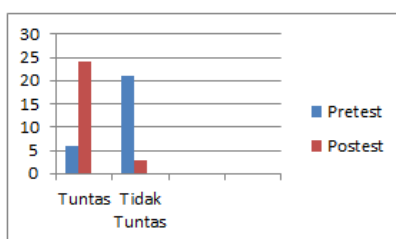
Cycle stage 1 in pretest meet I is the stage where the wordwall application has not yet been implemented. The learning process is still conventional, in the implementation of the first learning activity, student learning outcomes are still low where the average has only reached 55.37. Cycle II stage of learning activities II begins with appreciation, conveying learning objectives and motivation as well as providing direction to teach students the questions. The teacher explains and guides students in understanding the material as well as the final activity, namely reviewing the material. In the second cycle of competition II, there was an increase, namely with an average of 82.22%. There is reflection to find out what deficiencies exist when studying through games based learning.

This class action research can be seen from the student's grade interval, starting from first meet pre-test, and second post second meet exam very good improvement. This improvement occurred from the application of the method games based learning with the help of a web based application wordwall. More clearly, the increase in student grades can be presented in the following diagram:

**Diagram 1.2 Grade IV students' scores on pretest and posttest**

If we look at the learning completion of grade IV students in the pre-test and post-test of mathematics from meeting I and meeting II, it can be seen in diagram 1.3 as follows:

**Diagram 1.3 Learning Completeness of Grade IV Students in the Pretest and Posttest**



Based on the data results above, a comparative data table will be presented summarizing the results of student learning on pre-test and post-test scores as follows:

**Table 1.6 Recapitulation of Learning Outcomes of Grade IV Students**

No.	Data Variety	Results		Improvement
		1	2	
1.	Total value	1495	2220	+725
2.	Average value	55.37	82.22	+26.85
3.	Number of students completed	6	24	+18
4.	Percentage of students completing	22.22%	88.88%	+66.66%
5.	Number of students not complete	21	3	-18
6.	Percentage of students who did not complete	77.78%	11.11%	-66.67%

Overall, it can be seen from the results of the data that the learning outcomes in numeracy skills of students in Class IV of SD Negeri Pancoran 01 Pagi have experienced a significant increase after using the method games based learning. So method games based learning on arithmetic skills related to arithmetic operations, multiplication, division and fractions in class IV students can improve learning outcomes learners. This provides a positive impact from the application of the method games based learning.

## Conclusion

It was concluded that, before implementing the games based learning method, it was still below the indicators of success and had not achieved learning completeness by carrying out a pretest

the average value was 55.37%, there were 6 students who completed and 21 students who did not complete. The process after implementing games based learning improved students' numeracy skills. This research can be said to be successful because it has achieved indicators of success in achieving learning mastery with the average score in the posttest implementation increasing to 82.22%, there were 24 students who completed and 3 students who did not complete with the lowest score of 40 and the highest score of 100. The research results were obtained on the learning outcomes of class IV students in the pretest of the first meeting which was carried out conventionally but was not successful and was continued in the posttest of the second meeting using the method games based learning has increased and can be categorized as successful, then the method is applied games based learning can improve learning outcomes for fourth grade students at SDN Pancoran 01 Pagi.

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