Application of Counting Board Learning Media to Improve Student Learning Outcomes in Elementary/MI Elementary School Addition and Whole Numbers Material

Muh. Asharif Suleman[1]*, Zulfi Idayanti[1], Basri[1], Shaleh[1]

[1]Universitas Islam Negeri Sunan Kalijaga, Yogyakarta, Indonesia
*Co-email: asharifmuhammad2000@gmail.com Zulfidayanri1502@gmail.com Basribasyir862@gmail.com
Shaleh@uin-suka.ac.id

ARTICLE INFO	ABSTRACT
	This research aims to improve student learning outcomes regarding addition and whole numbers using counting board learning media. This research is experimental, with the research design being a pretest-posttest control group design. The population in this study were all class II students of MIS Asy-Syafi'iyah Kendari. The research sample was determined using a purposive sampling technique, with class II A as the control class and class II B as the experimental class. Data collection techniques use observation, tests, and documentation. The data analysis techniques used are descriptive and inferential analysis. The research results showed a significant difference between the learning outcomes of experimental class and control class students after treatment, where t_count was $2.329 > t\_table$ 2.006, with the N-Gain test results in the experimental class being 63.78% in the quite effective category. Based on the results of this research, the counting board learning medium is quite effective for use in improving student learning outcomes, especially material for addition and whole numbers for class II SD/MI.

INTRODUCTION

Elementary education is an important foundation for students' intellectual, emotional, and social development (Hoover & Bostic, 2021). At this stage, students begin to become familiar with various basic concepts that they will use throughout their academic lives. One of the basic competencies taught at the Elementary School (SD) and Madrasah Ibtidaiyah (MI) levels is the ability to count, especially addition operations and understanding whole numbers (Ayu & Syariffuddin, 2021). (This competency is very important because it not only forms the basis of their

mathematics but also logical thinking and problem-solving abilities that will be useful in everyday life.

However, the big challenge faced in basic education is the low student learning outcomes in mathematics subjects (Suandi, 2022). Many students find it difficult to understand the basic concepts of addition and whole numbers (Nengsih & Pujiastuti, 2021). This is often caused by ineffective teaching methods, which tend to be one-way and have minimal interaction. Conventional methods that rely on verbal explanations and practice questions are often unable to answer students' diverse learning needs, especially for those who need a visual and practical approach to understanding abstract concepts (Jufri et al., 2023).

The presence of innovative and interactive learning media is very important in this context. Good learning media can help clarify concepts, increase learning motivation, and facilitate deeper understanding (Abdullah et al., 2024). One learning medium that has been proven effective in helping students understand the concepts of addition and whole numbers is a counting board. A counting board is a visual aid that allows students to see and manipulate objects directly, making it easier for them to understand the addition process concretely (KHIRAWATI, 2022).

The counting board provides a different learning experience compared to conventional methods (Ningrum, 2021). With a counting board, students can learn through direct practice, which is very important to strengthen their understanding (Vina et al., 2024). Apart from that, counting boards can also make the learning process more fun and interesting, so that students are more motivated to be actively involved in learning. Teachers can also use counting boards to explain material more clearly and easily because counting boards help make abstract concepts more concrete (Ismawanti et al., 2022).

Various studies show that the use of appropriate learning media can improve student learning outcomes. For example, studies conducted by several researchers show that students who learn using interactive learning media such as counting boards tend to have better understanding and higher learning outcomes compared to students who learn using conventional methods (Akbar & Hadi, 2023). Apart from that, the use of a counting board can also increase student involvement in the learning process because they feel more challenged and motivated to learn (Sari et al., 2021).

This research aims to apply the counting board learning medium to learning addition and whole number material in SD/MI. This research is expected to provide a clearer picture of the effectiveness of using counting boards in improving student learning outcomes. Apart from that, this research also aims to provide recommendations for teachers on how to implement innovative and interactive learning media in their classes. In this way, it is hoped that improvements in the

quality of learning and student learning outcomes in the field of mathematics can be achieved, as well as encouraging students to like and understand this subject better.

Efforts to improve the quality of mathematics learning are not only the teacher's responsibility but also involve various related parties such as schools, parents, and the government. With good collaboration, it is hoped that a learning environment that is supportive and conducive to student development can be created so that they can achieve their full potential in academics and life in general. It is hoped that this research can be the first step in this effort by showing that the use of appropriate learning media can make a significant difference in student learning outcomes.

After conducting observations at school, the researcher obtained information from interviews with the class II homeroom teacher of MIS, Asy Syafi'iyah Kendari. The homeroom teacher for class II A reported that students still had difficulty understanding the concept of addition in mathematics, so some students did not reach the KKM. Data shows that of the 27 students in class II A, 60% have not reached the set KKM of 65, with a learning success target of 70%. The homeroom teacher for class II B revealed that of the 27 students in his class, 70% did not reach the KKM, which was also set at 65, with a learning success target of 70%. Meanwhile, the homeroom teacher for class II C stated that of the 24 students in his class, 20% had not yet reached the KKM. The KKM value set is 65, with a learning success target of 50%.

Based on the results of interviews with teachers and direct observations of the student learning process, the researchers concluded that the low mathematics learning outcomes of class II students were caused by several factors. One of them is the lack of students' ability to calculate, especially addition, due to different levels of understanding. Apart from that, the learning methods used by teachers are still conventional and do not utilize creative media, especially in learning addition. Conventional one-way learning makes teachers more active in searching for and explaining material without using learning media, while students only listen passively. This makes it difficult for students to understand mathematical concepts. Even though teachers try to implement student-oriented learning, its implementation is not optimal. As a result, students have not fully participated in mathematics learning, which emphasizes process skills and opportunities to discover new concepts independently.

To overcome this problem, more effective mathematics teaching methods are needed, especially the concept of addition. Therefore, researchers will apply fun learning media to improve students' ability to understand mathematics, especially counting. The medium that will be used is the Mathematical Calculation Board (PAHIMA). PAHIMA is made from styrofoam, used water bottles, and plastic straws

and is equipped with addition questions. This medium is designed with attractive colors to stimulate students' minds and attention when studying addition material.

Based on the description and background above, researchers want to examine the effects of using calculating board media in mathematics learning. Therefore, this research is entitled "Application of Calculation Board Learning Media to Improve Student Learning Outcomes in Elementary/MI Elementary School Addition and Count Numbers."

LITERATURE REVIEW

Learning media are tools used by educators to convey material to students with the aim of facilitating the learning process, helping students understand abstract concepts, and making learning more interesting (Fadilah et al., 2023). According to (Hingide et al., 2021), learning media is anything that can be used to channel messages from the sender to the recipient so that it can stimulate students' thoughts, feelings, attention, and interests in such a way that the learning process occurs. Thus, learning media play an important role in creating an effective and interactive learning environment.

The Mathematics Calculation Board (PAHIMA) is a form of innovative learning media specifically designed to help students understand the concepts of addition and whole numbers. PAHIMA is made from simple materials such as styrofoam, used water bottles, and plastic straws, which are arranged into interactive visual aids. This medium is equipped with additional questions designed to stimulate students' thinking and attention. With an attractive design and use of bright colors, PAHIMA is expected to motivate students to be more active and enthusiastic about learning mathematics.

The benefits of using PAHIMA learning media are very diverse. First, PAHIMA helps clarify abstract mathematical concepts, such as addition, in a way that is more concrete and easy for students to understand. Second, the use of this medium can increase students' learning motivation because interesting media tend to make the learning process more enjoyable. Third, PAHIMA can encourage students to be more actively involved in learning because they can directly interact with these tools. Thus, the use of PAHIMA media not only helps students understand the material better but also increases their active participation in the learning process.

METHOD

This research is quantitative with the type of research, namely experiment. Experimental research is a research method used to look for the influence or effects of certain treatments on others under controlled conditions (Sugiyono 2015: 109), in this case the effect of counting board treatment on student learning outcomes

regarding addition and whole numbers. This research was carried out at MIS Asy Syafi'iyah Kendari, Jl. Baruga Market, District. Baruga, Kendari City, Southeast Sulawesi. This research was carried out in the even semester, precisely in February, for class II students. The research variables are independent variables and dependent variables. The independent variable is the counting board learning media, while the dependent variable is student learning outcomes. The form of experimental research design can be seen in the following table.

Table1. Experimental Research Design

Class	Pretest	Addition	Postest
Experiment	O_1	X	O_2
Control	O_3		O_4

Information:
X   : Treatment in the experimental class (application of learning media)
O_1 : Experimental class pretest
O_2 : Experimental class posttest
O_3 : Control class pretest
O_4 : Control class posttest

The population in this research were all class II students of MIS Asy Syafi'iyah Kendari, totaling 78 students consisting of 3 classes. Population data can be seen in the following table.

Table 2. Experimental Research Design

No	Class	Number of students	Average
1	A	27	63.88
2	B	27	65.29
3	C	24	78.25
Total		78	

Data collection techniques include observation, tests and documentation. Observations were carried out during the teaching and learning process in class, two formats of observation sheets were used, namely for teachers and students. Data obtained from the results of teacher activity observation sheets in the learning process were analyzed using a formula $S = \frac{R}{N} \times 100\%$, with S is the percent value sought, R is score of teacher/student activities, and N is maximum teacher/student activity score.

The test technique used is Pretest and Posttest in the form of fill-in questions. The pretest was carried out to determine the initial condition of students' learning outcomes in Mathematics before being given treatment. The posttest was carried out to find out whether there were any changes in students' learning outcomes in Mathematics after being treated with the use of Calculation Board Media. The test is said to be valid if it has passed the measurement test. Validation assessment is carried out by giving a number between 1 (Not Appropriate) to 4 (Very Appropriate).

Table 3. Question Item Score

Score	Category
1	It is not in accordance with
2	Not suitable
3	Quite appropriate
4	Very suitable

Data analysis in this research uses descriptive and inferential statistical analysis. This descriptive statistical analysis is used to describe students' mathematics learning outcomes obtained from the experimental class and control class. Descriptive statistics will use data presentation methods in the form of calculating the mean, median, mode and categorization of scores.

Table 4. Score categorization

Degree of inclination	Category
$M + 1,5\ SD < X$	Very high
$M - 0,5\ SD < X \leq M + 1,5\ SD$	Tall
$M - 0,5\ SD < X \leq M + 0,5\ SD$	Currently
$M - 1,5\ SD < X \leq M - 1,5\ SD$	Low
$X \leq M - 1,5\ SD$	Very low

Inferential statistical analysis techniques in this research were used to test the success of student learning outcomes before and student learning outcomes after the action using statistical tests, namely the t test. but before that, prerequisite tests will be carried out in the form of normality test, homogeneity test, hypothesis test and normality gain test (N-Gain).

Table 5. N-GAIN index effectiveness category

| Gain Index	Category
G < 40	Ineffective
40-55	Less effective
55-75	Effective enough
>75	Effective

FINDINGS

Student learning outcomes before treatment in the experimental class (pretest)

Table 6. Frequency of experimental class Pretest results

Interval Class	Experimental Class	
	Frequency (f)	Percentage (%)
31-41	3	11%
42-52	8	30%
53-63	10	37%
64-74	2	7%
75-80	4	15%
Total	27	100%

If depicted in diagram form,. So the frequency distribution of student learning outcomes before treatment in the experimental class can be seen in the following picture.
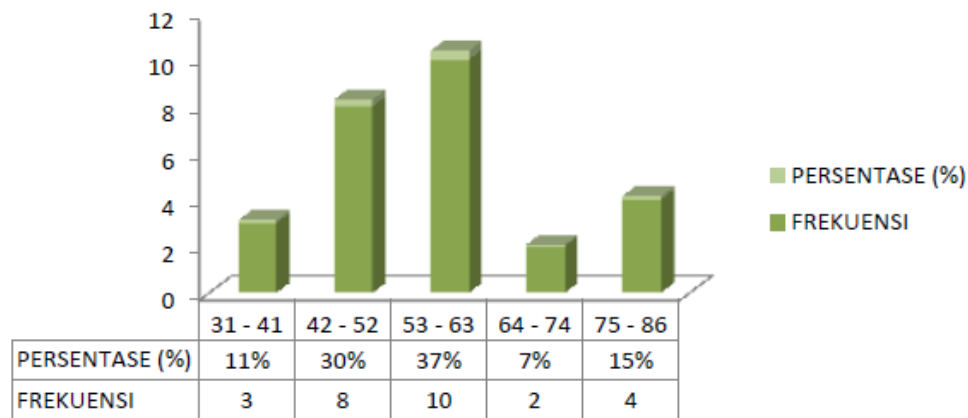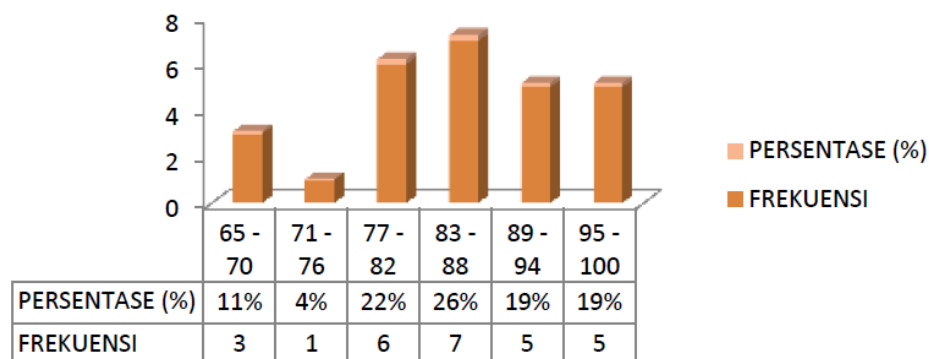

Graphic 1. Distribution diagram of experimental class pretest results

Student learning outcomes after treatment in the experimental class (posttest)

Table 7. Frequency of experimental class pretest results

Interval Class	Experimental Class	
	Frequency (*f*)	Percentage (%)
65-70	3	11%
71-76	1	4%
77-82	6	22%
83-88	7	26%
89-94	5	19%
95-100	5	19%
Total	27	100%

If depicted in diagram form,. So the frequency distribution of student learning outcomes after treatment in the experimental class can be seen in the following picture.
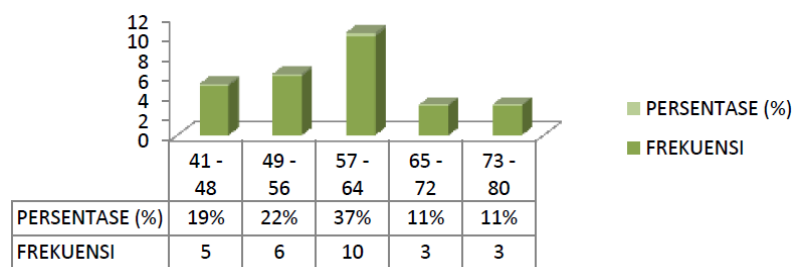

Graphic 2. Distribution diagram of experimental class posttest results

Student learning outcomes before treatment in the control class (pretest)

Table 8. Frequency of control class Pretest results

Interval Class	Experimental Class	
	Frequency (*f*)	Percentage (%)
41-48	5	19%
49-56	6	22%
57-64	10	37%
65-72	3	11%
73-80	3	11%
Total	27	100%

If depicted in diagram form,. So the frequency distribution of student learning outcomes before treatment in the control class can be seen in the following picture.


	41 - 48	49 - 56	57 - 64	65 - 72	73 - 80
PERSENTASE (%)	19%	22%	37%	11%	11%
FREKUENSI	5	6	10	3	3

Graphic 3. Distribution diagram of control class pretest results

Student learning outcomes after treatment in the control class (posttest)

Table 9. Frequency of control class posttest results

Interval Class	Experimental Class	
	Frequency (*f*)	Percentage (%)
33-43	3	11%
44-54	1	4%
55-65	2	7%
66-77	2	7%
78-88	12	44%
89-100	7	26%
Total	27	100%

If depicted in diagram form, the frequency distribution of student learning outcomes after treatment in the control class can be seen in the following figure.

	33 - 43	44 - 54	55 - 66	67 - 77	78 - 88	89 - 100
PERSENTASE (%)	11%	4%	7%	7%	44%	26%
FREKUENSI	3	1	2	2	12	7
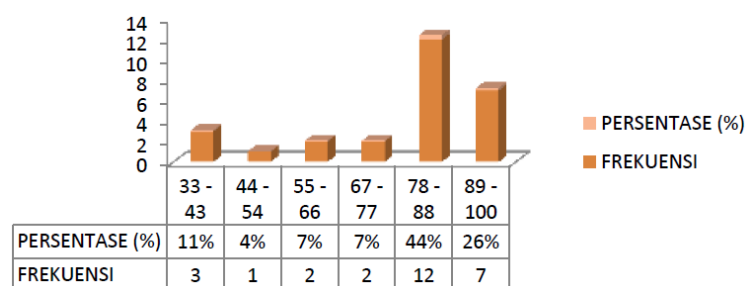
Graphic 4. Distribution diagram of experimental class posttest results

DISCUSSION

This experimental research aims to determine the effectiveness of using mathematics calculation board learning media on the learning outcomes of class II students at MIS Asy-Syafi'iyah Kendari. Student learning outcomes in the cognitive aspect are measured using test instruments in the form of fill-in questions. Before use, the instrument was validated by four experts. After being validated and corrected according to expert advice, the questions are tested on students to determine their suitability. Based on the product moment validity test analysis, 20 valid questions were obtained that can be used to measure student learning outcomes in mathematics. These questions consist of 10 pretest questions and 10 posttest questions. Apart from validity, these questions were also tested for reliability, level of difficulty, and distinguishing power.

This research used two classes, namely the experimental class and the control class, with research subjects in class II MIS Asy-Syafi'iyah. Based on the results of previous daily mathematics tests, class II A and class II B were determined as research samples because they had almost the same average learning outcomes, namely 63.88 for class II A and 65.29 for class II B. The determination of the experimental class and the control class was carried out randomly through drawing, the results of which showed class II B as the experimental class and class II A as the control class.

The implementation of learning using a mathematics calculation board takes place in accordance with the syntax of the learning medium used. The learning process went well because the material taught using a mathematical calculation board was easier to convey to students. This medium helps teachers convey material effectively and brings students into real-life situations related to the material with visual assistance. Learning in experimental classes using this medium must also be supported by students' prior knowledge, both from the environment and previous material, especially in the introduction of numbers, making it easier for students to learn addition. Teacher observations show that students are active and interested in practicing the math calculation board and working on the LKPD provided, so that learning goes well.

However, there are still shortcomings in the learning process. This is caused by researchers and students not being optimal in carrying out the learning process, limited learning time, and some students who tend to be embarrassed to appear, so that not all students participate in practicing the use of mathematics counting board learning media. After experimentation and data processing, descriptive and inferential analyses were carried out to answer the research problems. Based on data on student learning outcomes before treatment in the experimental class and control

class, it can be seen that the two classes have learning outcomes that are not much different, with an average score of 56.85 for the experimental class and 58.92 for the control class. However, after treatment, the learning outcomes of students in the experimental class and control class showed differences, with an average score of 86.11 for the experimental class and 78.15 for the control class.

After treatment, the average score of student learning outcomes in the experimental class and control class increased compared to the average score on the previous daily test, namely 65.29 for the experimental class and 63.88 for the control class. This increase cannot be separated from differences in the abilities of teachers and researchers as well as students' ability to accept learning with different concepts. Hypothesis test calculations in this research were carried out manually with the help of Microsoft Excel 2010. Hypothesis testing used the independent sample t-test and paired sample t-test at a significance level of 5%. The independent sample t-test was used to test the first hypothesis, which compared learning outcomes between the experimental class and the control class before treatment. The test results showed that the two classes did not have significant differences in learning outcomes before treatment, as indicated by the pretest test results: t count (0.648) < t table (2.006).

The paired sample t-test was used to determine differences in student learning outcomes before and after treatment in the experimental class. The results of this test show that there are significant differences in learning outcomes, with a calculated t value of 9.235 > t table 2.052. Apart from that, the independent sample t-test was used to compare the learning outcomes of experimental class and control class students after treatment. The results also show a significant difference, with a calculated t value of 2.329 > t table 2.006. Based on the N-Gain test, the average N-Gain score for the experimental class was 63.78%, which is included in the quite effective category.

The paired sample t-test was used to determine differences in student learning outcomes before and after treatment in the experimental class. The results of the hypothesis test show a significant difference in learning outcomes with a calculated t value of 9.235, which is greater than the t table of 2.052. The independent sample t-test was used to compare the learning outcomes of experimental class and control class students after treatment. The results of this test also show a significant difference with the calculated t value of 2.329, which is greater than the t table of 2.006. The N-Gain test results show that the average N-Gain score in the experimental class is 63.78%, which is included in the quite effective category.

Based on learning outcome data and N-Gain scores from both classes, it can be concluded that the experimental class, which used the mathematics calculation board learning medium, showed better results compared to the control class, which used conventional learning. The results of this research are in line with research by Nurul

Hikmah (2019) entitled "Effectiveness of Using Addition and Subtraction Calculation Board Media to Improve Class I Students' Numeracy Skills at SDI Sunan Ampel II Trosobo Taman Sidoarjo," which shows that the calculation board media is effective in improving students' numeracy skills. first grade elementary school. Apart from that, research by Hanik Maulidatul Zahara (2019) entitled "The Influence of Addition Board Media on Mathematics Learning Outcomes for Class I Elementary School Students" also supports that the addition board media has a positive effect on the mathematics learning outcomes of Class I Elementary School students. Based on descriptive data analysis and hypothesis testing using the independent sample t-test and paired sample t-test on the pretest and posttest, as well as the N-Gain test, this research concludes that the use of mathematics counting board learning media is effective in improving the mathematics learning outcomes of class II students. Ash-Shafi'iyah Kendari. These results are supported by previous relevant studies.

CONCLUSION

Learning using the mathematics counting board (Pahima) media runs smoothly and effectively because it makes it easier for teachers to convey material to students. Pahima brings students into real-life situations with the use of visual media, improving the numeracy learning process. The results obtained showed that there was no significant difference between the learning outcomes of experimental class and control class students before treatment (pretest). This can be seen from the results of the independent sample t-test for both classes during the pretest, where it was obtained that t = 0.648 was smaller than the t table = 2.006. There is a significant difference between the learning outcomes of experimental class students before and after treatment. This can be seen from the results of the paired sample t-test, where the calculated t = 9.235 is greater than the t table = 2.052. There is a significant difference between the learning outcomes of experimental class and control class students after treatment (posttest). This can be seen from the results of the independent sample t-test for both classes during the posttest, where the calculated t = 2.329 was greater than the t table = 2.006. Based on the results of this research, the counting board learning medium is quite effective for improving student learning outcomes, especially in addition and whole number material for class II SD/MI.

REFERENCES

Abdullah, D. S., Hadi, R. N., & Suryandari, M. (2024). Peran Media Pembelajaran dalam Konteks Pendidikan Modern. Sindoro: Cendikia Pendidikan, 4(1), 91–100.

Akbar, H. F., & Hadi, M. S. (2023). Pengaruh Penggunaan Media Pembelajaran Wordwall Terhadap Minat Dan Hasil Belajar Siswa. Community Development Journal: Jurnal Pengabdian Masyarakat, 4(2), 1653–1660.

Ayu, F., & Syariffuddin, H. (2021). Pengembangan Bahan Ajar Local Instructional Theory Kelas V Sekolah Dasar Topik Perkalian Pecahan Berbasis Realistic Mathematics Education (RME). Jurnal Basicedu, 5(6), 6339–6348.

Fadilah, A., Nurzakiyah, K. R., Kanya, N. A., Hidayat, S. P., & Setiawan, U. (2023). Pengertian media, tujuan, fungsi, manfaat dan urgensi media pembelajaran. Journal of Student Research, 1(2), 1–17.

Hingide, M. N., Mewengkang, A., & Munaiseche, C. P. C. (2021). Pengembangan media pembelajaran berbasis multimedia interaktif platform android pada mata pelajaran ppkn smk. Edutik: Jurnal Pendidikan Teknologi Informasi Dan Komunikasi, 1(5), 557–566.

Hoover, S., & Bostic, J. (2021). Schools as a vital component of the child and adolescent mental health system. Psychiatric Services, 72(1), 37–48.

Ismawanti, A., Unaenah, E., Putri, D. C., & Azzahra, F. D. (2022). Analisis Penggunaan Media Pembelajaran Papan Pecahan Kelas Tinggi di SD Negeri Periuk Jaya Permai Tangerang. ARZUSIN, 2(4), 343–351.

Jufri, A. P., Asri, W. K., Mannahali, M., & Vidya, A. (2023). Strategi Pembelajaran: Menggali Potensi Belajar Melalui Model, Pendekatan, dan Metode yang Efektif. Ananta Vidya.

KHIRAWATI, U. F. (2022). Peningkatan Kemampuan Operasi Hitung Penjumlahan Melalui Penggunaan Media Papan Flanel Pada Murid Tunagrahita Ringan Kelas Dasar Iii Di Slb Somba Opu Kabupaten Gowa.

Nengsih, G. A., & Pujiastuti, H. (2021). Analisis kesulitan dalam menyelesaikan soal materi operasi bilangan cacah siswa sekolah dasar. JKPM (Jurnal Kajian Pendidikan Matematika), 6(2), 293.

Ningrum, K. S. (2021). Keefektifan Model Make A Match Berbantuan Papan Perkalian Terhadap Pemahaman Konsep Perkalian. Joyful Learning Journal, 10(3), 161–168.

Sari, S. G., Fauzan, A., Armiati, A., & Yerizon, Y. (2021). Pengembangan Media Pembelajaran Matematika Interaktif Berbasis Problem Based Learning di Kelas V SDN 22 Duku Kecamatan Koto XI Tarusan. Jurnal Cendekia: Jurnal Pendidikan Matematika, 5(2), 2123–2132.

Suandi, I. N. (2022). Metode Diskusi Kelompok untuk Meningkatkan Hasil Belajar Matematika Kelas VI SD. Journal of Education Action Research, 6(1), 135–140.

Vina, A. A., Hadi, M. S., Sundi, V. H., & Sugiyanti, S. (2024). Implementasi Problem Based Learning Berbantuan Papan Statistika untuk Meningkatkan Hasil Belajar Siswa Kelas VII. Proximal: Jurnal Penelitian Matematika Dan Pendidikan Matematika, 7(2), 548–558.