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Easy Multiplication from Left to Right and Al Khwarizmi Method: Hypothesis Testing Against Median Values

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Abstract

This study aims to provide an overview of easy multiplication using the left-to-right method and also the right-to-left method (Al Khwarizmi Method). Furthermore, the easy multiplication method from left to right and also from the right to left method was tested to determine the level of ease in its application to the two multiplication methods. The method used in this research is experimental. While the approach in this study used is quantitative. The quantitative approach used includes hypothesis testing on the median value. The conclusion of this study is that the median value of the posttest scores for easy multiplication from left to right and easy multiplication from right to left are indeed the same. Because the median is also an average value, it can also be concluded that the average number of easy multiplication posttest scores from left to right and easy multiplication posttest scores from right to left are the same. As an implication, the two easy multiplication techniques are able to produce the same level of convenience.

Keywords: median value, multiplication from left to right, multiplication method Al Khwarizmi

INTRODUCTION

Human life cannot be separated from mathematics, almost everything in this world is related to a very important science known as mathematics. Mathematics is an important tool in various fields of science, including engineering, medical, natural sciences, and even social sciences need it as an analytical tool such as economics and psychology. In the original language, mathematics is known as Latin *Regina Scientiarum*, while in German it is known as *konigin der wissenchaften*, these two terms are interpreted as words that are related to science (Alisah and Dharmawan, 2007). Even Carl Friedrich Gauss explicitly says that mathematics is the queen of science (Suwarsih, 2018).

Learning mathematics is especially touching in terms of how teachers are able to help students understand mathematics, and provide encouragement for students to apply the use of mathematics when solving problems of daily life. Teachers must create conditions for students to be able to enjoy learning mathematics. Mathematics learning itself is defined as a learning experience process that is given to students by involving a series of planned activities so that students gain competence regarding the mathematical materials provided (Purwanti, 2015). The teaching process in learning mathematics will be more

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successful and organized if it is directed to the structure and concepts of the mathematics subject being taught (Anwary, 2017; Bito, 2014).

At the elementary school level, multiplication operation material is given. This material is very demanding how every teacher is able to instill the concept of multiplication as a whole, so teachers must have their own strategy or method by adjusting to the conditions that exist in students and their environment. The stages of learning activities in elementary schools should also pay attention to what is described by Bruner, namely: 1) enactive (concrete), 2) iconic (semi-concrete), and 3) symbolic/abstract (Youtube, 2021). Regarding the multiplication concept applied in class V, in general it is actually a continuation of the material from integers that was previously taught in class IV including addition and subtraction of integers (Wahyuningtyas & Ladamay, 2016).

The introduction to multiplication arithmetic operations has actually been found in class II, although it is still very basic (Sulistiawati, 2014). So that students should be able to apply the multiplication concept to other higher-level materials in grades IV, V, and VI. However, it can be seen that in fact students in class V which incidentally belongs to the high class, there are even students who have not memorized the basic multiplication so that doing multiplication of two or more numbers has difficulty (Lelawarna, 2017). The situation that occurs is presumably because the initial learning provided is not contextual, in the sense that there is no association of problems with the real-life context that students live in their daily lives (Raharjo et al., 2009). Whereas multiplication is a basic thing that requires absolute mastery because it serves to lead students to understand the next material and to deepen the material across fields of study (Oktafiani et al., 2018).

The right strategy is needed in making students able to master and understand correctly number operations. This learning strategy must be able to touch the stages of concrete, semi-concrete to abstract (Suwarto, 2017). The concept of number operations such as addition, standard multiplication taught in schools is generally calculated from right to left. The concept in this method teaches that the units are multiplied first and then the tens and so on. This is actually reasonable because the arithmetic technique was discovered by one of the most famous Persian Arab scientists, Muhammad bin Musa al-Khwarizmi. Because of his great service, Al-Khwarizmi was nicknamed the Father of Algebra (Arryawan, 2011).

There is nothing wrong with counting from right to left as taught in schools whose origin is the Al Khwarizmi Method. But, actually for those of us who are used to writing from left to right, Al Khwarizmi's method, can be modified into a calculation from left to right. The advantage is that because we write Latin letters from left to right and also count in the same way, namely from left to right, we don't have to guess how many digits we have to provide so that the paper we need is enough.

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This study aims to provide an overview of easy multiplication with the left-to-right method and also the right-to-left method. Furthermore, from easy multiplication with 2 methods, testing is carried out to determine the level of ease in its application to the two multiplication methods.

RESEARCH METHOD

The research method is a natural way to obtain data with specific uses and purposes (Lestari & Yudhanegara, 2012). In this study the method used is experimental. While the approach in this study used is quantitative. The quantitative approach used includes hypothesis testing on the median value.

Research design

Research design is the whole of planning to answer research questions and anticipate some difficulties that may arise during the research process. This is important because research design is a strategy to get the data needed for hypothesis testing or to answer research questions, and as a tool to control variables that influence research (Sugiyono, 2010). The paradigm in research is illustrated as follows:

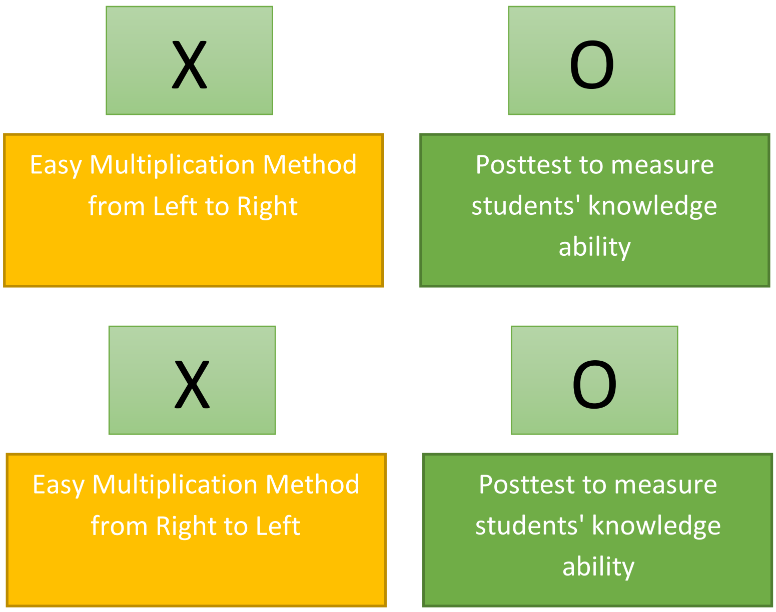

Figure 1. Research Design

Information:
X = the treatment given (independent variable)
O = posttest (observed dependent variable)

The sampling technique used for this design is purposive sampling. Purposive sampling is a sampling technique with certain considerations. The consideration in taking the sampling is that the research is intended specifically to examine the fifth grade elementary school students in Pemalang Regency.

Data Analysis Technique

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http://ejournal.umm.ac.id/index.php/MEJ

This study seeks to ensure the similarity of the median value of two or more populations from the sample, this is done through hypothesis testing of the median value (median test). The median or also called the middle value is the middle value of a series of data that has been arranged regularly, i.e. in order from the smallest value to the largest value or vice versa. By calculating the median value in a data series, the distribution of the data is divided into two equal parts, i.e. half is below the median value and the other half is above the median value. To determine the median value, it must first be determined by applying a formula.

$$P = \frac{N+1}{2}$$

Where P is the location of the median and N is the amount of data.

Besides being intended to determine the similarity of the population from which the sample originates, hypothesis testing on the median is also carried out to determine whether or not the difference in the median value of two or more populations is significant. In this case, the null hypothesis states that the two populations from which the sample originates have the same median value. While the alternative hypothesis states the opposite, that is, the two populations from the sample have different median values.

Previously, the median value derived from the combined sample distribution or the combined median value needed to be calculated first. Furthermore, from each group, the frequency of values that lie at or above the combined median value and the frequency of values that lie below it must also be calculated. If n1 and n2 are the number of observations in the two sample groups, we can use the 2 x 2 table as follows:

Table 1. Table 2 x 2 for Hypothesis Testing on the Median Value

Value Frequency	Sample Group I	Sample Group II	Total
Above the combined median value	A	B	a + b
Below the combined median value	C	D	c + d
Total	$a + c = n_1$	$b + d = n_2$	$n_1 + n_2 = n$

If the null hypothesis is proven, the two populations from which the sample originates have the same median value. Thus, this situation can also be interpreted that half of the frequency value of each sample group will lie below it and the other half above it. Based on the appearance of the table, it can be symbolically stated that:

$a = c = 0{,}50\ n_1$

$b = d = 0{,}50\ n_2$

Then, the sum of n1 plus n2 is greater than 20 and the expected frequency in a cell is at least 5, the test by means of a chi-square distribution is applied. The formula to find out the value is:

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$$x^2 = \frac{n\ x\ \left[(a\ x\ d) - \ (b\ x\ c) - \left(\frac{n}{2}\right)\right]^2}{(\ a + b)\ x\ (c + d)\ x\ (a + c)\ x\ (b + d)}$$

Where x^2 is the chi-square value, a is the frequency of values above the combined median value of sample group I, b is the value above the combined median value of sample group II, c is the frequency of values above the combined median value of sample group I, and d is the frequency values below the combined median of the sample groups.

RESULTS AND DISCUSSION

The following are the differences in the easy multiplication method from right to left and from left to right which are used as treatments. Suppose we want to calculate 234 x 567?

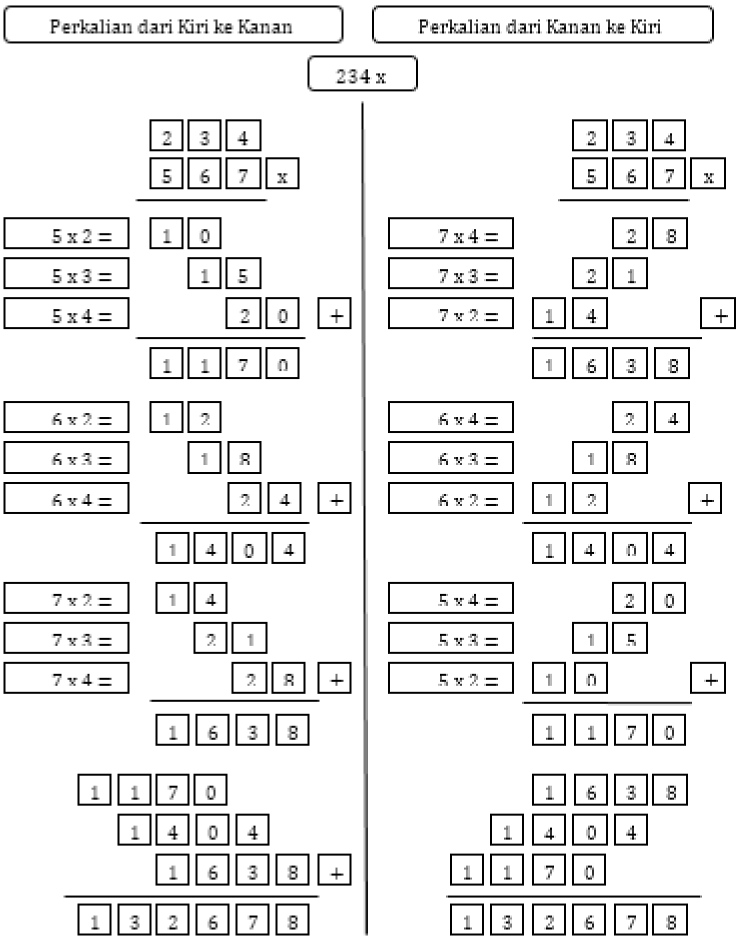

Figure 2. Multiplication from Left to Right and Multiplication from Right to Left the Long Way

What is described above is the calculation of the long way, without saving. This method can be taught to children who are not yet proficient in multiplication.

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http://ejournal.umm.ac.id/index.php/MEJ

The advantage of the long way for children is that mistakes tend to be easier to see. It's easy to check where the fault is. The drawback of course requires a longer paper

The two ways above: the multiplication of left right or left right, both are true and have their respective advantages. Of course, because it produces answers that are both correct, both methods can be used. Two ways that seem to be opposite from left to right and from right to left when placed in a row form a symmetrical rung of the ladder, which results in both correct answers.

After discussing the long way of calculating multiplication both from right to left and from left to right, now we discuss the short way. To calculate multiplication in a short way using the school method (from right to left), the method is to multiply the rightmost number by the rightmost number, if the result is tens of units, the tens are written down and stored for later added to the units of multiplication of the numbers on the left.

For multiplication from left to right, just reverse it. First, multiply the leftmost number by the leftmost number, if the result is tens of units. The tens are written, the units are stored to be added to the tens of multiplication numbers to the right.

The Short way

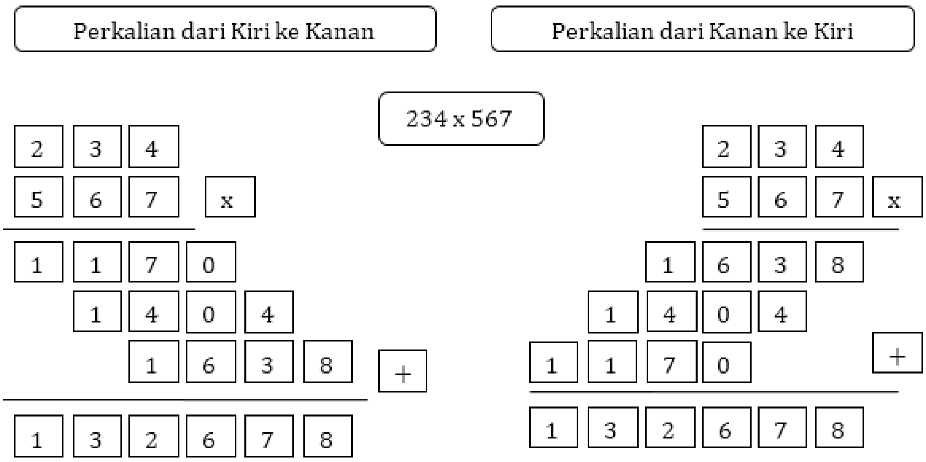

Figure 3. Multiplication from Left to Right and Multiplication from Right to Left the Short Way

The steps are described below:

- Multiplication from Left to Right

5 x 2 = 10

The number 1 is written on the left, the number 0 is stored

5 x 3 = 15

1 plus deposit 0, the amount = 1 is written to the right, the number 5 is stored.

5 x 4 = 20

2 plus deposit 5, sum = 7 is written.

ISSN : 2579-5724
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http://ejournal.umm.ac.id/index.php/MEJ

The number 0 is also written because there are no more numbers on the right.

If necessary, attach a dot or a 0 below the leftmost number to form a ladder.

Do the multiplication for 6 in the same way.

And so on and then the ladder are added up.

- Multiplication from Right to Left

7 x 4 = 28

The number 8 is written to the right of the number 2 is stored.

7 x 3 = 21

1 plus deposit 2, the amount = 3 is written to the left, the number 2 is stored.

7 x 2 = 14

4 plus deposit 2, sum = 6 is written.

If necessary, attach a dot or a 0 below the rightmost number to form a ladder.

Do the multiplication for 6 in the same way.

And so on and then the ladder are added up.

The following is an example of student work

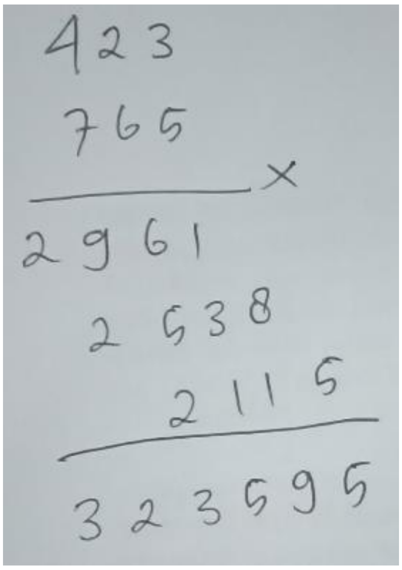

Figure 4. Example of Student Work Results Multiplication from Right to Left in a Short Way

ISSN : 2579-5724
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http://ejournal.umm.ac.id/index.php/MEJ

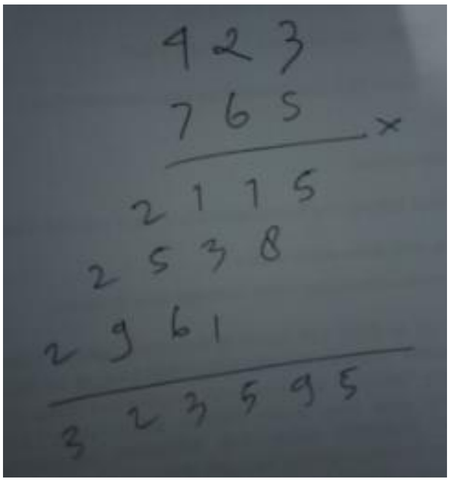

Figure 5. Example of Student Work Results Multiplication from Left to Right in a Short Way

The following table contains the posttest scores of students, these scores were obtained by giving tests to both groups after receiving treatment or treatment according to the material above.

Table 2. Posttest Scores

Student Name for Each Group	Easy Multiplication Post-test Score	
	From Left to Right	From Right to Left
Student 1	82	80
Student 2	84	83
Student 3	83	84
Student 4	86	86
Student 5	82	87
Student 6	93	88
Student 7	91	90
Student 8	89	87
Student 9	92	94
Student 10	93	95

If we want to know whether or not the median value of the easy multiplication posttest from left to right and from right to left, we can determine it through the hypothesis testing step. The test procedures that must be applied to determine the truth of the allegation are:

Formulating the null hypothesis and alternative hypothesis, in this experimental study, the null hypothesis essentially states that the median value of the total posttest scores for easy multiplication from left to right and from right to left is the same. While the alternative hypothesis states that the median value of the number of posttest scores of easy multiplication from left to right and from right to left is not the same. Thus, the formula for the null hypothesis and the alternative hypothesis are:

ISSN : 2579-5724
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H_0 : Md value of easy multiplication post-test from left to right = Md value of easy multiplication post-test from right to left
H_1 : Md value of easy multiplication post-test from left to right ≠ Md value of easy multiplication post-test from right to left

Md value of easy multiplication post-test from right to left

Determining a certain level of significance, for the context of this study, the significance level is determined at 5% or 0.05. If the applied significance level is 5% and the degree of freedom is 1, the chi-square value in the distribution table is 3.841.

Formulating the test criteria, the test criteria applied in this experimental research is that the null hypothesis is accepted if

$$x^2 \leq 3{,}841$$

While the null hypothesis is rejected if

$$x^2 > 3{,}841$$

Calculating the chi-square value, before the chi-square value is calculated, the data regarding the easy multiplication posttest scores from left to right and from right to left must be sorted first so that the combined median value can be known. The order of posttest scores is not sorted by easy multiplication from left to right or easy multiplication from right to left, but rather a combination of the two. After sorting from the smallest to the largest number, then the order of the values is as follows:

Table 3. Order of Easy Multiplication Posttest Values From Left to Right and From Right to Left

Order	1	2	3	4	5	6	7	8	9	10
Score	80	82	82	83	83	84	84	86	86	87
Order	11	12	13	14	15	16	17	18	19	20
Score	87	88	89	90	91	92	93	93	94	95

Then, the location and the median value must be found. The location of the median in the data series is:

$$P = \frac{N+1}{2}$$

$$P = \frac{20+1}{2} = 10{,}50$$

The median location based on the above calculation is 10.50. This means that the value is between the 10th and 11th data sequences. In the array of values, the 10th and 11th data values are 87. Next, a 2 x 2 table must be arranged to show the frequency of values that are above and below the combined median value.

ISSN : 2579-5724
ISSN : 2579-5260 (Online)
http://ejournal.umm.ac.id/index.php/MEJ

Table 4. Frequency of Values Above and Below the Combined Median Value

Value Frequency	Easy Multiplication Post-test Score from Left to Right	Easy Multiplication Post-test Score from Right to Left	Total
Above or at the combined median value	5	6	11
Below the combined median value	5	4	9
Total	10	10	20

The next step is to calculate the chi-square value. In this experimental study, the magnitude of the chi-squared value is:

$$x^2 = \frac{n\ x\ \left[(a\ x\ d) - \ (b\ x\ c) - \left(\frac{n}{2}\right)\right]^2}{(\ a+b)\ x\ (c+d)\ x\ (a+c)\ x\ (b+d)}$$

$$x^2 = \frac{20\ x\ \left[(5\ x\ 4) - \ (6\ x\ 5) - \left(\frac{20}{2}\right)\right]^2}{(\ 5+6)\ x\ (5+4)\ x\ (5+5)\ x\ (6+4)} = \frac{8000}{9900} = 0{,}81$$

Formulating the final conclusion, the conclusion is formulated by comparing the chi-square value in the distribution table with the chi-square calculation results and then aligning it with the applicable test criteria. From the calculations that have been done, the chi-squared value is 0.81. This value is much smaller than the chi-square value in the table of 3.841. Based on the testing criteria applied in this experimental study, if the chi-square value of the calculation result is less than the chi-square value in the distribution table, the null hypothesis is accepted.

CONCLUSION

In this experimental research, the null hypothesis is accepted. Thus, the median value of the posttest scores for easy multiplication from left to right and easy multiplication from right to left are indeed the same. Because the median is also an average value, it can also be concluded that the average number of easy multiplication posttest scores from left to right and easy multiplication posttest scores from right to left are the same. The median is called the positional average because it divides the data set into two equal parts. As an implication, the two easy multiplication techniques are able to produce the same level of convenience.

REFERENCES

Alisah, Evawati dan Prasetyo, Eko. (2007). *Filsafat Dunia Matematika: Pengantar untuk Memahami Konsep-Konsep Matematika*. Jakarta: Prestasi Pustaka Publisher.

Anwary, Nurlis. (2017). Meningkatkan Pemahaman Konsep Hitung Perkalian dengan Menggunakan Kelereng Sebagai Media Pembelajaran di Kelas III Pada Tema 7 (Perkembangan Teknologi) SD Negeri 66/IV Kota Jambi. *Skripsi Program Studi Pendidikan Guru Sekolah Dasar*, FKIP Universitas Jambi.

ISSN : 2579-5724
ISSN : 2579-5260 (Online)
http://ejournal.umm.ac.id/index.php/MEJ

Arryawan, E. (2011). *Matematika Yin Yang (Jurus Hitung Sakti Dari Barat dan Timur)*. Jakarta: PT Elex Media Komputindo.

Bito, Gregorius Sebo. (2014). Aktivitas Bermain sebagai Konteks dalam Belajar Matematika di Sekolah Dasar dengan Pendekatan Matematika 110 Realistik. *Jurnal Pemikiran dan Pengembangan SD*, 1(4).

http://www.youtube.com/watch?v=gDtfzVr-Raw, diakses tanggal 28 Maret 2021.

Lelawarna. (2017). Effort Increasing Learning Result Of Communication Operations Calculating Methods Using Napier Bone Students Class Students In Basic Schools 12 TebatKarai. *Jurnal PGSD: Jurnal Pendidikan Guru Sekolah*, 11(2), 112-119.

Lestari, Karunia Eka & Yudhanegara, Mokhammad Ridwan. (2015). *Penelitian Pendidikan Matematika*. Bandung: PT Refika Aditama.

Oktafiani, Wilda; Budiarti, Miladi Rizkyah; Solekha; Yulistia, Tia Fuja; Oktaviani, Oriza Mutia & Widodo, Suprih. (2018). Trans Model Mathematics Education (T2ME) Untuk Meningkatkan Keterampilan Operasi Hitung Perkalian Berbantuan Teknik SUBATSAGA di Sekolah Dasar. *Jurnal Metodik Didaktik*, 14 (1), 1-7.

Purwanti, Kristi Liani. (2015). Pembelajaran Perkalian Pecahan Biasa Berbantu Media Benda Konkret: Studi Kasus Perbedaan Gender terhadap Kemampuan Matematika Siswa Kelas V SDN Sambiroto 3 Semarang. *Jurnal Sawwa*, 10 (2), 193-208.

Raharjo, Marsudi; Waluyati, Astuti & Sutanti, Titik. (2009). Modul Matematika SD Program BERMUTU: Pembelajaran Operasi Hitung Perkalian dan Pembagian Bilangan Cacah di SD. Jakarta: Departemen Pendidikan Nasional Direktorat Jenderal Peningkatan Mutu Pendidik dan Tenaga Kependidikan.

Sugiyono. (2010). *Metode Penelitian Bisnis (Pendekatan Kuantitatif, Kualitatid dan R&D).* Bandung: Alfabeta.

Sulistiawati, (2014). Pembelajaran Perkalian Bilangan 1-10 dengan Matematika GASING untuk Meningkatkan Hasil Belajar Siswa SD. *Prosiding Seminar Nasional Matematika VIII*, FKIP Universitas Negeri Semarang, 99-112.

Suwarsih, Sri. (2018). Meningkatkan Hasil Belajar Siswa Tentang Perkalian dan Pembagian Bilangan Cacah Melalui Alat Peraga. *Mosharafa: Jurnal Pendidikan Matematika*, 7(3), 433-444.

Wahyuningtyas, Dyah Tri & Ladamay, Iskandar. (2016). Meningkatkan Pemahaman Konsep Perkalian dan Pembagian Bilangan Bulat Menggunakan Media Wayangmatika. *Jurnal Pancaran,* 5(3), 51-60.