KumahAbi method in the inquiry model: Improved concept understanding in multiplication materials

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ABSTRACT

Mathematics is a subject studied from elementary school to university level. At the elementary school level, mathematics learning aims to provide students with an understanding of the concept of numbers. There are four basic arithmetic operations that must be mastered by primary school students, namely addition, subtraction, multiplication, and division. The concept of multiplication has a higher level of difficulty than addition or subtraction, so students need more time to master this concept. Learning methods applied in the classroom are important in encouraging students to understand learning. Conventional learning methods force students to memorize multiplication concepts, so students only memorize and do not understand basic concepts. Therefore, we need a learning method that can stimulate students' logical thinking and creativity in solving multiplication problems systematically. In this research, a new learning method was introduced by combining the inquiry learning model called the KumahAbi method. The results of this study show that the implementation of the KumahAbi method in learning is very effective in improving students' understanding of multiplication.

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INTRODUCTION

Education is a very basic thing in the life of all humans. The level of education of an individual is a reference or benchmark for that person's abilities in a community. In addition, the living standard of a community group will increase in line with the increase in education in that group. (Rahmah, 2013; Suh & Ahn, 2022). There is an opinion that education is the guarantee of individual or group success in social life. This is the basis that education has a big role in determining the well-being of a nation or country. In Indonesia, education is one of the factors that greatly influenced the development of

social life since ancient times. During the Dutch colonial era, education was something that not everyone could get, so human resources at that time were very low. One of the most influential figures in the development of education in Indonesia is Ki Hajar Dewantara and is known as the Father of Education (Febriyanti, 2021). He established an educational institution known as "Perguruan Taman Siswa" (Febriyanti, 2021). Through this institution, he aspired for the Indonesian people to be independent through education. Even today, his legacy is still often found in the world of education, namely the motto of education which reads, "*Ing Ngarsa Sung Tuladha Ing Madya Mangun Karsa Tut Wuri Handayani*", which means that "at the front to be a role model in the middle to be a counterweight at the back to encourage" (Muljana, 2008). One of the basic education that every human being must have is mathematics education. This is because every part of human life is always connected with mathematics.

Mathematics is a study material on abstract objects and is built through the process of deductive reasoning, that is, the truth of a concept is obtained as a logical consequence of the previously accepted truth, so the relationship between concepts in mathematics is very strong and clear. The goal is to train students to think systematically, logically, critically, creatively and consistently. Mathematics is an exact science that always coexists with everyday life (Llinares, 2019; Barwell et al, 2022; Thanheiser, 2023; Wild & Neef, 2023). The same thing applies in education, mathematics is the basis of learning in schools. However, mathematics is avoided by most elementary school students as it is considered difficult in terms of formulation. (Sudirman & Soleha, 2021)

Mathematics is always related to everyday life, from the most basic to the most complex. Mathematics is the main knowledge that must be learned by human from the beginning, because it is able to support and assist in the calculation process in real life (Achdiyat & Utomo, 2017; Purwanti, 2017). Therefore, elementary school institutions must introduce mathematics to their students. This aims to ensure that students can adapt to everyday life through learning mathematics and as a preparation for further education. At the elementary school level, mathematics learning is provided to students continuously from grade one (1) to grade six (6).

In the past 20 years ago, the learning method most often used by teachers in classes was based on memorization. This learning method is a conventional learning method that is implemented in almost every school. This method can provide variety of new knowledge to elementary school students, this is because the teacher is the learning center who provides knowledge to students (Bahri & Zain, 2002; Nasution, 2012). However, this method also has weaknesses which is a boring learning process and does not give students the opportunity to develop their creativity and critical thinking. This is very influential in the learning process, especially for learning mathematics (Astuti et al., 2019; Wirabumi, 2020). Conventional learning seems outdated and does not shape the character of students, so many experts have developed new learning methods and models that are more effective to apply in the classroom.

Jarimatika method is a learning method that facilitates students in basic multiplication calculation operations without having to memorize multiplication and using hands as a learning media (Afriani et al., 2019; Ahmadi & Weijun, 2014). Another definition, *Jarimatika* is multiplication that uses fingers as props. *Jarimatika* is an easy and fun way to teach children the basics of arithmetic multiplication (Simanihuruk,

2013). This method has the advantage of least-cost in learning, only by using fingers the multiplication operations can be performed, but there is a weakness in this method which is only limited to multiplying one digit (Affandi, 2020; Al Musthafa & Mandailina, 2018).

Another method of learning mathematics that is being developed and has been widely used throughout Indonesia is the *Gasing* (*Gampang, Asik dan Menyenangkan*) method. This learning method was developed since 1996 by Professor Yohanes Surya. The basic principle in the *Gasing* method as presented by (Surya, 2011) is that students learn mathematics from the simplest to the most difficult concepts. The calculations are mostly done by rote (staggering) by providing continuous training (drill). Reinforcement by giving praise by the teacher is done as often as possible when the students succeed in counting, the teacher's optimistic attitude and love are also needed in implementing this method in the classroom (Agusfian & Pratiwi, 2021; Aprijon, 2021; Wibowo, 2022). Teaching and learning activities using the top math method are planned systematically and systematically by sorting the material from easy activities to difficult activities while still paying attention to the achievement of goals, thus giving meaning to students in learning mathematics. The top math method has several advantages, *Gasing* method has the advantage that the top method can be learned by all ages and suitable for children to adults. But there is also a weakness that in the process students must enter the formula to work on the problem being worked on, in the multiplication operation it still takes time to solve.

Mathematical multiplication is often something that scares students, because students do not understand calculation operations, making it difficult for students to carry out calculation process. This

results in low student interest in learning mathematics because students' motivation to understand is hindered by the feeling that mathematics is difficult. As a result, in the long run, students are easily discouraged and lazy in learning mathematics (Yeni, 2015). This is where the stigma arises in the world of education regarding learning mathematics, that mathematics is the most disliked subject by students. However, this can still be overcome by implementing fun learning methods and models, especially in multiplication. Learning methods that can simplify the operation process in multiplication calculations can increase students' interest in learning. In addition, learning methods that give students the freedom to build new, fast, and accurate ways of calculating are important in order to stimulate students' creativity to develop appropriate multiplication techniques for them to use (Sleeman et al, 2021; Dotan & Zviran-Ginat, 2022; Shih et al, 2023).

In 2023, technology will be an important part of all aspects of life, including education, so that mathematics learning resources will be more accessible. This is supported by easy internet access, gadget ownership, and various other things that greatly facilitate access to learning for students. In this way, the space for students to learn becomes very wide and unlimited in order to develop themselves and innovate regarding mathematical multiplication. It is expected that students will be able to shorten the time in the multiplication calculation process and have new knowledge about multiplication materials as well as choose to use the multiplication method that according to the students is easier to understand and use in the multiplication calculation operation.

Inquiry is a process where students identify a concept, for example observing, making conjectures, explaining, measuring, and making conclusions. The

inquiry learning model aims to increase the effectiveness of learning in the classroom. In addition, this learning model can stimulate students' creativity in solving problems in learning. Although the inquiry learning model is not something new, this learning model is still being developed until now. This is because the inquiry learning model is student-based learning, so development can be carried out from the teacher's and student's point of view. (Hong et al, 2019; Evi & Indarini, 2021; Wertz, 2022; Ay & Dağhan, 2023). The implementation of the inquiry learning model for the learning of mathematics subjects has been widely used to determine the level of understanding of students in certain topics. (Suyanti, 2013; Silaban, 2019). Recently, the inquiry learning model was also implemented to determine students' interest in learning and understanding a subject presented using different learning media. (Jong, 2023; Li, Zhang, & Piper, 2023; Radu et al, 2023).

Chau et al (2021) developing an inquiry learning model by integrating technology so as to increase the effectiveness of students in understanding knowledge. In 2023, the inquiry learning model is used as a medium to promote the improvement of the global competence of prospective teachers to improve teaching and education programs. (Wu, 2023). Apart from improving students' understanding of knowledge, the inquiry learning model can also be used to improve students' literacy skills through digital reading. Most of the studies that have been conducted related to the development and implementation of inquiry learning models are done by integrating technology (Chen, Li, & Chen, 2022). Meanwhile, to improve students' abilities and understanding of the concept of multiplication, technological distractions need to be minimized. Based on this problem, this research will propose a more dynamic learning method for calculating multiplication by tens and hundreds where students can innovate in the solution process. This is optimized by combining the proposed learning methods with the inquiry learning model.

METHOD

In this research, a new learning method is proposed to calculate multiplication of tens and hundreds, hereinafter referred to as the KumahAbi method. In order to find out the effectiveness of the proposed method, it will be implemented to the 25 fifth grade students at SDN 03 Kedunghalang, Kecamatan Sukaraja, Kabupaten Bogor. In this study, researchers used pre-test and post-test as research instruments. According to (Anas, 1996) The pre-test or initial test is a test carried out with the aim of knowing the extent to which the material to be taught has been mastered by students. While the post-test is a test that is carried out with the aim of knowing whether all the material that is classified as important can be mastered as well as possible by students. This study aims to determine the difference in the achievement of grade 5 Mathematics learning outcomes applying the inquiry method with quick calculations at SD Negeri Kedunghalang 03.

Figure 1. The classroom atmosphere of the learning process at SDN 03 Kedunghalang

In this study, researchers used the KumahAbi method, this method is a fast multiplication calculation operation of one (1) digit and two (2) digits, where 1 digit multiplication uses similarities multiplication, 2 digits with cross multiplication method.

Similarities multiplication is multiplication where the numbers are equalized first, then the calculation operation is carried out, this multiplication is expected to be able to help students in the calculation process without having to memorize multiplication, because today's students, it is more interesting for them to learn in a new way, not boring and more hone their brain skills.

Cross Multiplication is a multiplication operation in a fast way, not only fast but also fun. (Irawati et al., 2020), in this method, students are guided so that they are able to understand the steps in the quick calculation, and it is hoped that in the future, students will be able to use this calculation. The model used by researchers in this study is the inquiry learning model. The inquiry model is a way of conveying learning that is critically investigating and analyzing using certain steps to reach a conclusion (Usman & Setiawati, 1993).

Inquiry or investigation is a process where students identify a concept, for example observing, making conjectures, explaining, measuring, and making conclusions (Evi & Indarini, 2021, Hamalik, 2001; Roestiyah, 2001). The inquiry learning model aims to increase the effectiveness of learning in the classroom. In addition, this learning model can stimulate students' creativity in solving problems in learning (Hong et al, 2019). Inquiry learning models can be divided into discovery inquiry learning models, guided inquiry learning models, and open inquiry learning models.
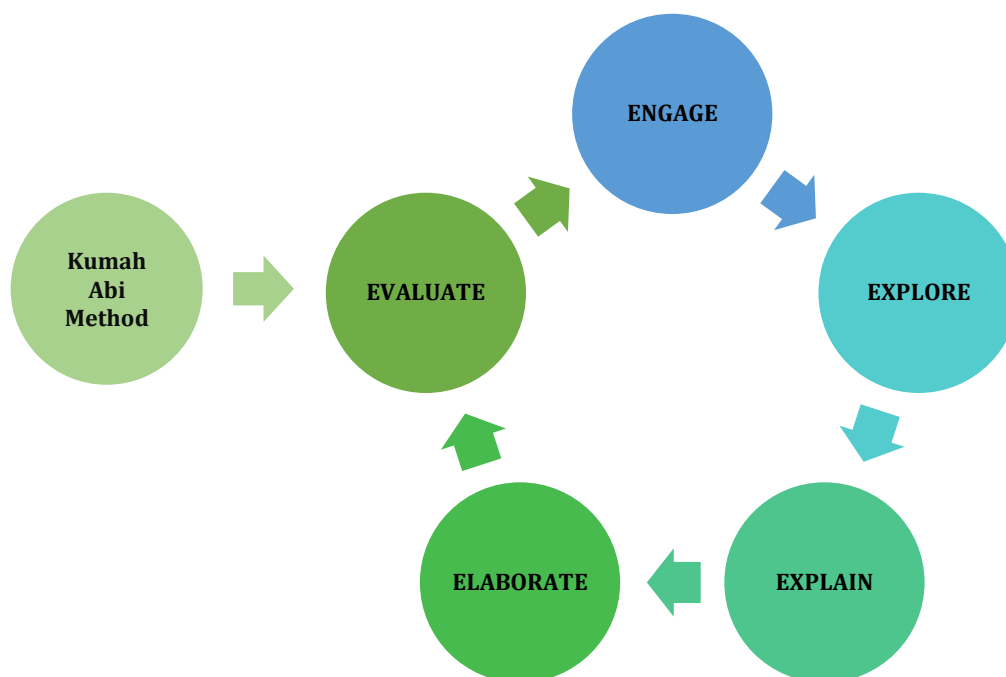
Figure 2. Inquiry model learning chart

According to (Rahmawati et al., 2012) The advantages of the inquiry model are that students are able to measure hypotheses independently, emphasizing students to be able to be creative and innovate in their own way, the center of learning is on students. The inquiry method has steps, namely 1) problem-oriented, 2) formulating problems, 3) making hypotheses, 4) exploration (collecting information or data), 5) testing hypotheses, 6) making conclusions (Rositawati, 2019).

The results of this research will be analyzed using statistical methods. Statistical methods are data processing and analysis techniques whose use provides a clear basis for the relationships that exist between the observed variables The data obtained will be analyzed using descriptive statistics as well as inferential statistics (Aisyah et al., 2023; Aliberti et al., 2023; Darwin & Reynalda, 2021; Saputra et al., 2023).

The hypothesis testing was carried out to prove whether there was a significant difference in Mathematics learning achievement at SD Negeri Kedunghalang 03 Bogor Regency in class V which was selected as the experiment class and control class. This hypothesis can be tested parametrically if the data is normally distributed or non-parametrically if otherwise.

$$N - Gain = \frac{Posttest\ score\ - \textbf{Pretest score}}{Ideal\ score - \textbf{Pretest score}}$$

To determine the type of statistical test that can be used on the data obtained, then in this research the normality test was used on the Normality-Gain (N-Gain) value of the Pre-test and Post-Test results. The N-Gain formula is shown as follows.

According to (Sugiyono, 2009) the normality test aims to determine the distribution of the scores of each variable whether the data concerned is normally distributed or not. The normality test is the first statistical analysis carried out in the context of data analysis, ensuring the fulfillment of normality requirements will guarantee accountability. Data analysis can be continued if the data is normally

distributed. To test normality with the Kolmogorov-Smirnov test.

RESULTS AND DISCUSSION

In this research, the learning process is carried out using a learning approach based on the inquiry model where the KumahAbi method will be implemented in the problem assessment process. This aims to increase the effectiveness of solving multiplication problems carried out by students.

Furthermore, this learning method is applied for one week at school. In order to determine the effectiveness of the KumahAbi method, pre-test and post-test were used as research instruments. The data collection procedures for the research are presented in Figure 3.
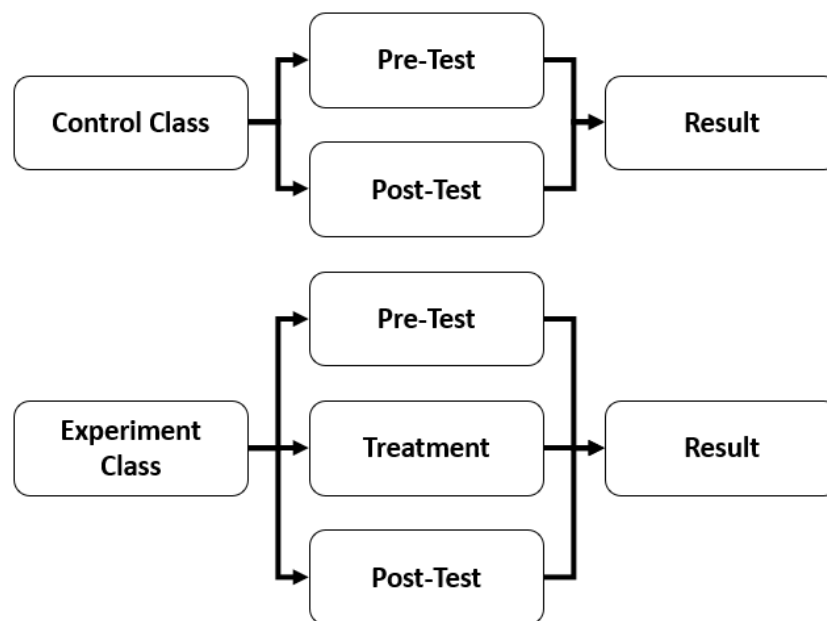

Figure 3. Data collection instrument.

The control class is a class that undergoes learning using conventional methods according to what has been taught before. Meanwhile, the experimental class is a class that undergoes learning using KumahAbi methods.

In these learning activities, the teacher provides learning with the inquiry model and the KumahAbi method, first the teacher provides pre-test questions to be given to students, after completion, the teacher provides material about multiplication or treatment to students about multiplication of units and tens using the KumahAbi method.
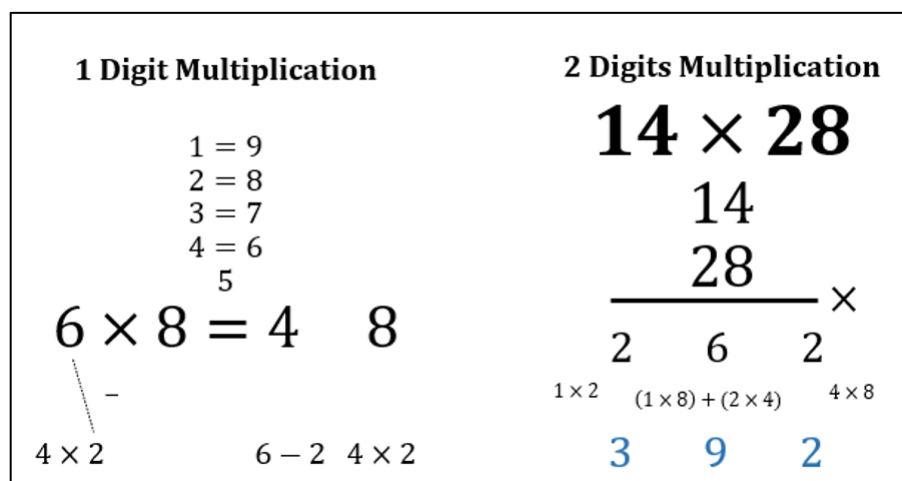
Figure 4. KumahAbi learning method.

After being given the multiplication material, students are directed to work on problems in front of the class using the KumahAbi method, while the teacher guides them in the process. After completing the lesson, students were given a post-test question of ten (10) items, then the teacher gave a reflection to students to reflect and recall the learning that had been given. The results of this research show that there is an increase in students' understanding of multiplication concepts in experimental classes. Statistically, the results of the pre-test and post-test that have been conducted in the control class and the experimental class with the KumahAbi learning method are presented in Table 1 and Table 2.

to 48.26 (post-test). The same was true for the experimental class, which increased from 42.86 (pre-test) to 83.33 (post-test). Even so, there is a significant difference between the control class and the experimental class, especially in the post-test results which are 48.26 (control class) compared to 83.33 (experimental class). In addition, a significant difference was shown at the the Normality-Gain (N-Gain) average between control class (10,54) and experimental class (68,28). In addition, there is also a significant difference in the lowest score between the control class and the experimental class which is 30 compared to 70. This shows that the KumahAbi method is far more effective in improving students' understanding of the concept of multiplication.

Table 1. Analysis on the pre-test and post-test of the control class

Value	Pre-Test	Post-Test	N-Gain
Mean	39,57	48,26	10,54
Med.	50	50	0
Mode	50	50	0
N Max	60	90	80
N Min	0	30	-50
Range	60	60	130
Var.	367,98	242,29	1020,49
Std. Dev.	19,18	15,57	31,95

The results of statistical analysis show an increase in the average test result of the control class from 39.57 (pre-test)

Table 2. Analysis on the pre-test and post-test of the experimental class

Value	Pre-Test	Post-Test	N-Gain
Mean	42,86	83,33	68,28
Med.	50	80	66,67
Mode	50	80	66,67
N Max	80	100	100
N Min	0	70	25
Range	80	30	75
Var.	651,43	123,33	484,87
Std. Dev.	25,52	11,11	22,02

In order to clarify that learning with the KumahAbi method is more effective than the conventional method, it is necessary to conduct a statistical test between the data in the control class and the experimental class. Before running a statistical test, it is necessary to run a normality test on N-Gain to determine the appropriate type of statistical test. The results of the normality test with the Kolmogorov-Smirnov test are shown in Table 3 (Aliberti et al., 2023).

Table 3. Normality test

| D-value | N-Gain | |
	Control	Experiment
	0,19414	0,12019
p-value	0,30979	0,88704
Conclusion	Data is normally distributed	Data is normally distributed

The results of the Kolmogorov-Smirnov test show that the N-Gain of the control and experimental classes have p-values greater than alpha (α) (5%). This means that the data from the control class and the experimental class are normally distributed, so that parametric statistical tests can be conducted. Next, an independent 2-sample t-test was performed.

Table 4. 2-sample t-test result.

t-test	
t-value	-6,93
p-value	0,00001
α	0.05
Conclusion	There is significant different between control class and experiment class

Based on the Table 4, shows the p-value is 0.00001, which means that the p-value <0.05 or null hypothesis is rejected. Indicating that there is different result between control class and experiment class. This shows that the implementation of the KumahAbi method has a significant

impact on learning multiplication compared to conventional methods. In addition, the inquiry learning model also stimulates students' creative thinking in solving the problems faced. Therefore, the implementation of the KumahAbi method in the inquiry learning model is able to increase the effectiveness of student learning in the classroom.

Based on the results of previous research, it shows that the inquiry learning model can improve student understanding and the effectiveness of student learning in the subjects given by the teacher. Furthermore, in this research, the inquiry learning model is combined with the KumahAbi method in order to significantly improve students' understanding of multiplication solutions. This is because the KumahAbi method is included in the evaluation process in the inquiry model to give an understanding of the concept of multiplication operations. Furthermore, not only improving the understanding of the concept of multiplication but also implementing the KumahAbi method in the inquiry model forces students to be more creative in finding the most efficient multiplication solution.

CONCLUSIONS AND SUGGESTIONS

Mathematics is a subject studied from elementary school to university level. At elementary school level, mathematics is often a threat because it is considered difficult. In this regard, when students begin to learn about multiplication, they need a multiplication solution method that is easy to understand and apply by elementary school students. In this research, a method of solving multiplication is proposed, is called the KumahAbi method, which is student-centered as learning subjects. The results of this research show that the KumahAbi method has successfully improved

students' understanding and ability in the concept of multiplication.

The KumahAbi method with the inquiry learning model aims to help students understand the concept of multiplication as well as stimulate students' creativity in solving multiplication problems. The results of statistical analysis show that students are able to solve problems of tens and hundreds well. For further research, it is necessary to develop multiplication learning methods for larger numbers

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