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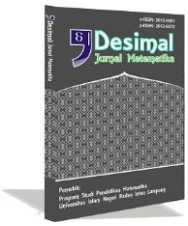

Improving of learning outcomes in greatest common divisor and lowest common multiple mater by developed safari numbered model

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ABSTRACT

The purpose of this study was to determine the improvement in learning outcomes of the Greatest Common Divisor (GCD) and Lowest Common Multiple (LCM) by developing the Safari Numbered Model (SNM). Further, the activeness of students was also measured. The method used in this study was a quasi-experimental. Data collection was carried out using a test instrument to obtain students' mathematics learning outcomes and a questionnaire to measure the activeness of the students. Data analysis is carried out using the Kolmogorov-Smirnov (KS) test and a two-way ANOVA statistical test. Based on the results of the research, it can be concluded that the implementation of SNM can improve the learning outcomes in GCD and LCM. But the student's activeness does not affect learning outcomes because the student has been active since the beginning of the lesson.

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INTRODUCTION

Mathematics is one of the subjects that are essential to the basic construction of science and technology (Anitra, 2021). According to the model theory that explores the philosophy of mathematical concepts, all mathematical concepts universally exist in the minds of everyone. So, what is learned in mathematics are various symbols and expressions to communicate (Dugdale, LeGare, Matthews, & Ju, 1998). For this reason, thinking skills are needed for students to solve problems in mathematical operations (Evi & Indarini, 2021). There are many opinions from students who think that mathematics is a scourge in teaching and learning activities in schools, even though the level of difficulty of a type or branch of mathematics is not caused by the type or branch of mathematics itself

but is caused by the difficulty and complexity of the phenomenon of communication or is investigated by the formulation of this type or branch of mathematics (Fernando, Halidjah, & Marli, 2013).

Mathematics has been studied from kindergarten until university. For many students from elementary to high school, mathematics still makes them terrified (Simamora & Rizqi, 2022). They assume that mathematics is a difficult and scary subject. This condition was worsened by uncreative teachers. The students become bored and uninterested when faced with mathematics subjects (Kahar, Anwar, & Murpri, 2020).

Whereas teaching mathematics in this era was important due to the fact that mathematics skills are a foundation for the development of sciences (Sari, Damayanti, & Sutriyani, 2022). Learning mathematics prepares us for a better future. Since elementary school, students should enjoy dealing with mathematics. Students need many adaptations before mastering an advanced cognitive skill. Learning styles affect the student's learning process so that they can be considered in designing learning (Setyaningsih, 2011).

In elementary schools, the difficulties faced by students are often seen in the Greatest Common Divisor (GCD) and Lowest Common Multiple (LCM). This difficulty comes not only from the students themselves but also from outside the students themselves, including how to deliver material by the teacher (Suwarti, 2021).

The problems faced by teachers and students in learning mathematics are: the teacher's teaching ability is lacking; the unavailability of facilities and infrastructure, such as teaching materials, learning media, and media storage; the student's motivation is relatively low, and the parent's attention is also slow; the teacher is less creative in making or creating learning media. Although some teachers already have laptops, they have never been used to present learning materials. The monotonous learning process occurs when the teacher conveys material without using media, gives examples of problems, and discusses questions (teacher-centered) (Muliandari & Tia, 2019). From the facts obtained, this work tried to provide solutions to these problems appropriately by developing a learning model called the "Safari Numbered" Model.

Safari Numbered is a learning model that combines the excellence of the Jigsaw and Numbered Head Together (NHT) models. Jigsaw in English is a jigsaw, and there are also those who call it a puzzle, which is a puzzle that arranges pieces of a picture (Zaeni & Hidayah, 2017). This Jigsaw model takes the pattern of how a saw works (zigzag) (Lu et al., 2010), namely that students carry out a learning activity by working together with other students to achieve common goals. This jigsaw-type learning model can be applied to material related to reading, writing, listening, or speaking skills. This learning model includes reading, writing, listening, and speaking activities. In the Jigsaw learning model, the teacher must understand the abilities and experiences of students and help them activate these schemes so that the subject matter becomes more meaningful. Teachers also provide many opportunities for students to process information and improve communication skills (Wheeler, 2001).

The advantages and disadvantages of the jigsaw cooperative learning model are as follows: The advantages of the jigsaw cooperative learning model are: (a) it can provide opportunities for students to work together with other students; (b) Students can master the lessons delivered; (c) Each student member has the right to become an expert in his group; and (d) In the process of teaching and learning, students develop positive interdependence. While the disadvantages

are: (a) it requires a long time; (b) Smart students tend not to want to be put together with their less intelligent friends, and even those who are less intelligent feel inferior when combined with their smart friends. Even though it takes a long time, that feeling of weakness will disappear by itself. In the teaching and learning process, learning outcomes are very important because knowing the outcomes will identify the strengths and weaknesses of a learning process (Baber, 2020).

The cooperative education model of the Numbered Head Together (NHT) type is a model that makes students active in the classroom (Sonita & Febria, 2022). Education is centered on students, and the teacher is only a facilitator. In the NHT model of education, students work together with their friends, are brave, and can solve a given case either individually or as a group. Not only that, but students are also trained to work together and be responsible for their groups (Firman et al., 2021). This NHT educational model trains students to work together in groups and care about their groups. So that this can instill a sense of courage in students so that they can convey comments and speak, whether asking, responding, or expressing comments, through working together in small groups. Student participants become more active, smart, and brave and share the inspiration they gain from their knowledge. From this courage, it becomes an early fertilizer for students so they can realize what they want to achieve with courage (Pavlidou, Dragicevic, & Tsui, 2021).

Each learning model definitely has advantages and disadvantages, as does the NHT type of cooperative learning model. According to the advantages of the NHT-type cooperative learning model are (1) it can increase cooperation among students because, in learning, students are placed in groups to discuss; (2) it can increase student responsibility because each group is given different tasks to discuss; (3) it can train students to unite their thoughts because NHT invites students to unify perceptions in groups; and (4) it can train students to respect the opinions of others because the results of the discussion ask for responses from other participants (Jufrida et al., 2021). While the shortcomings of the NHT model include: (1) students feel confused about why there are still more numbers in the group; (2) it is difficult to unite students' thoughts in one group because each student holds back his selfishness; (3) discussions often stretch out for too long, so there is not enough time in the teaching and learning process; (4) there are often debates that are not useful because what is debated is sometimes not about urgent or substantive material but about material that is less important; and (5) quiet students feel difficult to discuss in groups and difficult to hold accountable (Hutapea, Leba, & Tego, 2023).

The disadvantages of the NHT are the advantages of the jigsaw, and vice versa, so it is necessary to combine the two models into a new model. This research focuses on the development of new methods, namely the Safari Numbered Model (SNM), and their implementation to improve the learning outcomes of GCD and LCM.

METHOD

Initially, the authors designed the syntax of the Safari Numbered Model (SNM). The syntax of SNM was developed based on the advantages and disadvantages of NHT and the jigsaw model. The result of the developed syntax of SNM can be seen in Table 1.

The developed SNM was then implemented for the 42 students of the 5th grade Public Elementary School, namely SDN Kedunghalang 3, Bogor, Indonesia, which consists of 21 students in experimental classes and 21 students in control classes. The scores of the pretest results were ranked, and then the class

was divided into two groups (control and experiment) with similar scores. The members of the control and experimental classes had similar academic abilities and were divided based on their achievements in the pretest (Goudeau, Sanrey, Stanczak, Manstead, & Darnon, 2021).

Table 1. Syntax of Safari Numbered Model

Steps	Teacher	Student
1. Submission of learning objectives	Conveys the learning objectives	Listen and pay attention
2. Give individual quizzes to students to get a basic or initial score	Gives a Google Form link as a pre-test question	Working on pre-test questions given by the teacher via Google Form using a mobile phone
3. Introduce learning strategies and topics	Deliver learning strategies and topics	Follow the instructions given by the teacher
4. Forming the class into 4 groups according to the level of difficulty of the questions and giving a number that becomes an identity	Distribute students according to group needs, with numbers as group identity	Spread according to the group that has been determined by the teacher according to the group number or identity
5. Asking problems to be solved	The teacher explains problems 1, 2, 3, and 4 according to the difficulty level of the material	Each group pays attention to the problems given by the teacher
6. Each group is given a number to join with other students from different groups with the same task and then discuss and exchange ideas,	Gives directions so that each student in the core group can spread out to solve problems according to their level	Spread and divide its members to find information that is in problems 1, 2, 3 and 4.
7. Each group that has finished shares their knowledge with each other and makes a summary	Provide directions to each group to gather with the core group and collect the results of the discussion of problems 1, 2, 3 and 4 to make a summary in the core group	Collect the results of discussions with the core group to make a summary of the results of problems 1, 2, 3, and 4
8. Check students' understanding by calling a number for the presentation	called the name of the group to present the results of the core group discussion	Prepare material for discussion results to be presented
9. Give a quiz to measure the level of learning achievement	Provide a link to post-tests to find out the achievement of GCD and LCM material	Finish the post test questions given by the teacher via mobile phone

The instruments used to obtain the data used in this study consist of instrument tests to measure learning outcomes and questionnaires to determine student learning activity. The instrument test used in the study was a multiple-choice question consisting of 10 questions, and the list of questionnaires can be seen in Table 2. The instrument test and questionnaires were given at the beginning of the implementation (pretest) and after the implementation was completed (posttest). There was no difference in content in the pretest and the posttest.

The analysis techniques in this study were the normality test by Kolmogorov-Smirnov (KS), the T-Test to determine the learning outcome improvement, and the two-way ANOVA test to determine the student's activeness (Aliberti, D'Elia, & Cherubini, 2023).

Table 2. Questionnaire Instrument to Measure Student Activity

Variable	Dimension	Indicator
Student Activity	Students are able to answer teacher questions.	1. Students pay attention and listen to the teacher's explanation 2. Students answering the teacher's question
	Discussion and question-answer.	3. Students answer the teacher's questions 4. Students record explanations of group mates 5. Students are able to understand the concept of the assigned material 6. Students are able to understand the concept of the assigned material 7. Students will listen to friends' opinions 8. Students give responses to other groups
	Solving problems given by the teacher	9. Students like to practice solving questions given by the teacher 10. Students dare to present the results of the discussion in front of the class 11. Students are ready to compete against other groups 12. Students are ready to take part in school tournaments

RESULTS AND DISCUSSION

The process of mathematics problem solving is generally divided into four stages: (1) understanding the problem, (2) devising a solution, (3) carrying out the solution according to a set plan, and (4) re-examining the solutions that have been obtained. Each stage has an indicator and hierarchy implementation. However, the process of mathematics problem solving can't be separated from two important factors, namely (1) problem characteristics and (2) cognitive maturity. Therefore, the process of mathematics problem solving posed by Polya hasn't been absolutely followed by every student in sequence (Wongwatkit, Panjaburee, Srisawasdi, & Seprum, 2020).

From the results of this research, it can be seen that there are some improvements in mathematics, especially in the GCD and LCM learning results. The results of statistics relating to the initial value (Pretest) and final value (Posttest) of students in learning by SNM are presented in Table 3 for the experimental class and Table 4 for the control class.

The experimental class is a class that uses SNM with a total of 21 students. At the pretest, the minimum score was 20 and the maximum score was 85. At the posttest, the minimum score was increasing to 60, and the maximum score was quite similar (83) to the pretest. The average posttest score significantly increased from 43.33 to 72.29. This result indicates that the SNM has improved the average score of the students.

Table 3. Analysis Result of Pre-test and Post-test in Experimental Class

	Pretest	Posttest
P-Value	0.16	0.83
Mean	43.33	72.29
Median	35	74
Modus	30	78
Max	85	83
Min	20	60
Range	65	23
Var	383.33	54.41
St Dev	19.58	7.38

The control class is a class that uses the conventional model with a total of 21 students. At the pretest, the average score of the control class was lower than that of the experimental class (32.14). However, the minimum (15) and maximum (85) scores were similar. The average posttest score of the control class increased from 32.24 to 53.43. Compared with the experiment class, the increasing gap of the control class (21.29) was lower than that of the experimental class (28.98). This result indicates that the SNM has a better

chance of improving the learning outcome than the conventional model.

Table 4. Analysis Result of Pre-test and Post-test in Control Class

	Pretest	Posttest
P-Value	0.24	0.74
Mean	32.14	53.43
Median	30	54
Modus	20	44
Max	85	67
Min	15	40
Range	70	27
Var	291.43	69.26
St Dev	17.07	8.32

In order to clarify the significance of the fact that SNM was better than the conventional model, the normality test of pretest and posttest by Kolmogorov-Smirnov (KS) was performed. The result of the normality test analysis by KS of the pretest and posttest can be seen in Table 5.

Table 5. Normality Test by KS

	Pre-test	
	Experiment	**Control**
D-value	0.160	0.240
D*	0.287	0.287
Conclusion	Data is normally distributed	Data is normally distributed
	Post-test	
	Experiment	**Control**
D-value	0.083	0.074
D*	0.287	0.287
Conclusion	Data is normally distributed	Data is normally distributed

The calculated D-value of the Experimental Pre-test is 0.16, and the D* value (α = 0.05, n = 21) obtained from the statistical table is 0.287. Because 0.16 < 0.287 or D < D*, then the data was normally distributed (Demir, 2022; Khatun, 2021; Yusni, Husin, & Wulan Sari, 2022). From the normality test using the KS, it was found that all of the data were normally distributed since the calculated D-value was higher than the D*-value (0.05) from the statistical table (n=21, α=0.05).

All of the data were normally distributed, so the further analysis can proceed to the T-Test for the pretest and posttest in the experimental and control classes. The results of the T-Test for the control and experimental classes were tabulated in Table 6 and Table 7, respectively.

Table 6. T-Test Result for Experimental Class

T-Test	
T-value (sig.)	.00001
α	0.05
Conclusion	Any different value in pretest and posttest

* n=21; α=0.05

Table 7. T-Test Result for Control Class

T-Test*	
T-value (sig.)	.03
α	0.05
Conclusion	Any different value in pretest and posttest

* n=21; α=0.05

From the results in Table 6, we can interpret the α < T-value (sig.), which indicated that there was a significant difference in the pretest and posttest scores of the experiment class (Abbasi et al., 2020; Salirawati, Priyambodo, Nugraheni, & Basuki, 2021; Suh & Ahn, 2022). This means the implementation of SNM significantly improved the learning outcome in the Greatest Common Divisor (GCD) and Lowest Common Multiple (LCM) matters.

From the results in Table 7, we can also conclude that the conventional model significantly improved the learning outcome in the Greatest Common Divisor (GCD) and Lowest Common Multiple (LCM) matters. However, the T-value (sig.) of the experiment class was lower than the control class. The lower the T-value (sig.) from 0.05, the more significant the data. It can be seen that the implementation of

SNM has a greater effect than the conventional model.

This work of SNM, which combined the NHT and Jigsaw, was in line with(Sa'adiah, Syaiful, Hariyadi, & Yudistira, 2021), who concluded that the modified Jigsaw with Student Team Achievement Divisions (STAD) method is good to improve the learning outcomes in mathematics subjects. Therefore, the student may perform at higher levels with the support of the model, allowing the student to practice and gain more mathematical proficiency. The metacognitive aspects of the SNM have a positive effect on mathematics learning.

From the results of the questionnaire filled out by students and the two-way ANOVA calculations (Table 8), it can be concluded that (1) Factor A – rows (A) activeness, which means high, medium, and low activeness in the questionnaire does not affect learning outcomes; (2) Factor B – columns (B) learning model, which means the SNM affects learning outcomes; and (3) Interaction AB, which means that the SNM has nothing to do with student activity.

Table 8. Two-way ANOVA Calculations of Student Activeness

Source	DF	Sum of Square (SS)
Factor A - rows (A)	2	57.507
Factor B - rows (B)	1	2030.095
Interaction AB	2	262.130
Error	36	1370.744
Total	41	3720.476

CONCLUSIONS AND SUGGESTIONS

Based on the results of the research using the statistical test and further testing, it can be concluded that the implementation of SNM has evidenced that it can improve the learning outcomes in GCD and LCM matters for 5th grade students at SDN Kedunghalang 3, Bogor, Indonesia. However, there is no significant correlation between the activeness of students and the SNM. This may have been caused by the facts that the activeness score has been high since the beginning of the lesson.

For future researchers, the SNM can be further developed in syntax and mixed with other models. The teachers are expected to be able to use the SNM so that learning becomes more active and varied in mathematics. For schools, it is expected to provide training to develop a similar model to SNM for the improvement of education quality.

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