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The Influence of Implementing Student Facilitator and Explaining (SFAE) Learning Model on Student Learning Outcomes Assisted by Dakonmatika Learning Media

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ABSTRACT

Students' motivation to study mathematics was essential for improving their learning outcomes in the subject. Integrating the cooperative learning model of Student Facilitator and Explaining (SFAE) with the Dakonmatika learning media represents an innovative blend of group learning and the traditional Indonesian game of Dakon or Congklak. This research aims to determine the effect of using the SFAE learning model assisted by Dakonmatika media on students' mathematics learning outcomes. The study employs a quantitative method with a Quasi-Experimental design in the form of The Nonequivalent Pretest-Posttest Control Group Design. The subjects of this study were 54 students from Muhammadiyah 2 Elementary School in Sorong City, divided into two classes: an experimental class of 29 students and a control class of 25 students. The research findings indicated that, based on the previously described data analysis and discussion of the multiple linear regression test, a significance value of 0.019 < 0.05 was obtained. According to the decision-making criteria, H0 was rejected. Moreover, from the t-test table, the calculated value (2.477) was greater than the table value (2.05553), meaning that t_calculated > t_table. It implied that the application of the SFAE learning model with the assistance of Dakonmatika media has a significant impact on the mathematics learning outcomes of fifth-grade students at Muhammadiyah 2 Elementary School in Sorong City. The implication of this study showed that the integration of the Student Facilitator And Explaining (SFAE) learning model with daconmatics media has great potential in improving the quality of mathematics learning in schools.

Keywords: *Learning Model, Student Facilitator and Explaining, Learning Media, Dakonmatika*

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INTRODUCTION

Meaningful learning enables students to remember the material taught more easily, especially Mathematics, in line with the research findings by (Purwati, 2023). A teacher's choice in learning process and use of tasks mathhematics are also major determinants of the nature and quality of students' learning (Clark et al., 2023; Clarke & Roche, 2018; Stigberg et al., 2024). Therefore, as future teachers, we must facilitate students who are not accustomed to formal thinking to understand abstract concepts. The hope is that students' perception of Mathematics as a difficult subject can

gradually change. According to the PISA (Program for International Student Assessment) data from 2015 (OECD, 2016; Törmänen, 2022), there was an improvement in mathematics competence with a score of 386, up from 375 in 2012. However, compared to the global average of 490, this achievement is still below standard (Aripin & Purwasih, 2017). Additionally, according to PISA as cited by (Rohim & Rahmawati, 2020; Radišić, 2021), the score for Indonesian students' mathematics achievement was 397 points, placing Indonesia 45th out of 50 countries. This indicates that Indonesian students need reinforcement in integrating information, drawing conclusions, and generalizing knowledge to other contexts. At the elementary school level, the curriculum emphasizes the importance of students beginning to think abstractly and concretely.

The result observations in schools show low mathematics learning outcomes among elementary students, evident from their minimal interest in learning. In practice, the teaching process still predominantly uses lecture methods, without integrating teaching methods and mathematics learning media. However, merging teaching models with learning media has been proven to positively impact the improvement of students' learning outcomes and motivation, as found by (Puspitasari et al., 2022; Plessis, 2020; Janah et al., 2019), and (Purwandari & Wahyuningtyas, 2017).

The development of teaching concepts shows a paradigm shift from a teacher-centered approach to one that focuses on student activities (student-centered). This, as revealed by (Muliarta, 2018; Sartika et al., 2020; Hulu & Telaumbanua, 2022), encourages students to actively participate in building knowledge, attitudes, and behaviors, which ultimately improve their learning outcomes (Wang, 2021; Xhomara, 2022).

Some of the teaching methods often used include lectures, games, assignments, and question-and-answer. According to (Hoerudin, 2023), The Student Facilitator and Explaining active learning model is a cooperative educational activity that teachers can incorporate to minimize the prevalence of traditional lecturing. This model has been proven to improve students' problem-solving abilities, as revealed by (Tahir, 2020). (Permata et al., 2019) found that the SFAE model had a positive impact on students' mathematical communication abilities, and (Isnaini & Sari, 2022) reported that the SFAE model supported by PowerPoint media received a positive response from students.

Previous research shows that the Student Facilitator and Explaining (SFAE) learning model, as an innovative approach that encourages active learning, yields better results compared to conventional methods such as lectures (Zahra et al., 2017). This encourages researchers to conduct studies applying the SFAE model supported by dakonmatika media to improve elementary students' learning outcomes. This explanation encourages researchers to conduct observations and teaching experiments using various tools or learning media. To make mathematics interesting and understandable to students, various methods and media need to be used. Previous finding stated that to achieve a discovery, students must be able to connect the mathematical ideas they have (Guo & Kong, 2023), optimizing learning media (Azevedo et al., 2024; Dahou et al., 2023; Huang et al., 2023; Javed et al., 2024), and used approprate methods. This includes familiarizing students with discovery-based learning and representing information or knowledge (Melinda & Zainil, 2020). The use of dakonmatika media in the topics of Greatest Common Divisor and Least Common Multiple is expected to improve students' learning outcomes.

Dakonmatika, as explained by (Maulidiyah, 2015), is a concrete tool made from objects around that can be modified for mathematical learning. Dakonmatika, a new innovation in mathematical learning described by (Sinaga et al., 2022), combines traditional games with mathematical learning. Dakonmatika is not only to be an interesting learning media but also help preserve traditional games like dakon/congklak, and improve students' mathematics learning outcomes. This study is innovative in combining the SFAE learning model with the traditional Congklak game (Dakonmatika).

This research uses a quantitative method with a Quasi-Experimental Design in the form of The Nonequivalent Pretest-Posttest Control Group Design. The population in this study consists of 62 fifth-grade students from SD Muhammadiyah Kota Sorong, with two classes taken for the research. The sample selection in this study was carried out using the Simple Random Sampling technique. This technique is conducted randomly and gives equal rights to the selected samples.

METHOD

In this study, a quantitative research methodology would be applied. The specific experimental design being utilized is the Quasi Experimental Design, which adopts the format of the Nonequivalent Pretest-Posttest Control Group Design (Sugiyono, 2018; Hong, 2010). The population in this study consists of fifth-grade students of SD Muhammadiyah Sorong City, totaling 62 students taken from two classes. The sampling in this study was conducted using the Simple Random Sampling technique. This technique was randomly applied, providing rights to the selected samples. As a result, class V A consisted of 35 students, and class V B consisted of 27 students. Two classes were selected, with the experimental class taught using the Student Facilitator and Explaining (SFAE) learning model assisted by dakonmatika media, while the control class was taught using the SFAE learning model without such assistance.

The data collection instrument used is the student learning outcomes test sheet. The research instrument was first validated and tested for reliability. Subsequently, the gathered data were analyzed through descriptive statistical analysis focusing on student learning outcomes, along with the observation of student and teacher activities. Furthermore, the data were analyzed using inferential statistical analysis through a prerequisite test in the form of the N-Gain test used to see the improvement in student abilities, providing information about student achievement levels. The subsequent analysis aimed to ascertain if the variance in learning outcomes between the experimental and control groups followed a normal distribution, employing SPSS 24.0 for the Kolmogorov-Smirnov test. According to the criteria, data are considered normally distributed if the significance level is greater than 0.05. Subsequent data analysis used the Homogeneity test to determine whether the variance of the data from the analyzed sample was homogeneous or not. Testing the homogeneity of data variance and ANOVA used the SPSS 24.0 program. Additionally, this research utilized regression analysis to assess whether the Student Facilitator and Explaining (SFAE) learning model, supported by dakonmatika learning media, had any impact on student learning outcomes. The research implementation procedure can be seen in Figure 1 below.

Figure 1: Research Implementation Procedure

Furthermore, the data analysis technique for testing the hypothesis employs the t-test (paired sample T-Test). The statistical hypothesis under examination stipulates that if the significance value is less than 0.05, or the t-calculated is greater than the t-table, then the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. On the other hand, if the significance value is greater than 0.05, or the t-calculated is less than the t-table, then the null hypothesis (H0) is accepted and the alternative hypothesis (H1) is rejected.

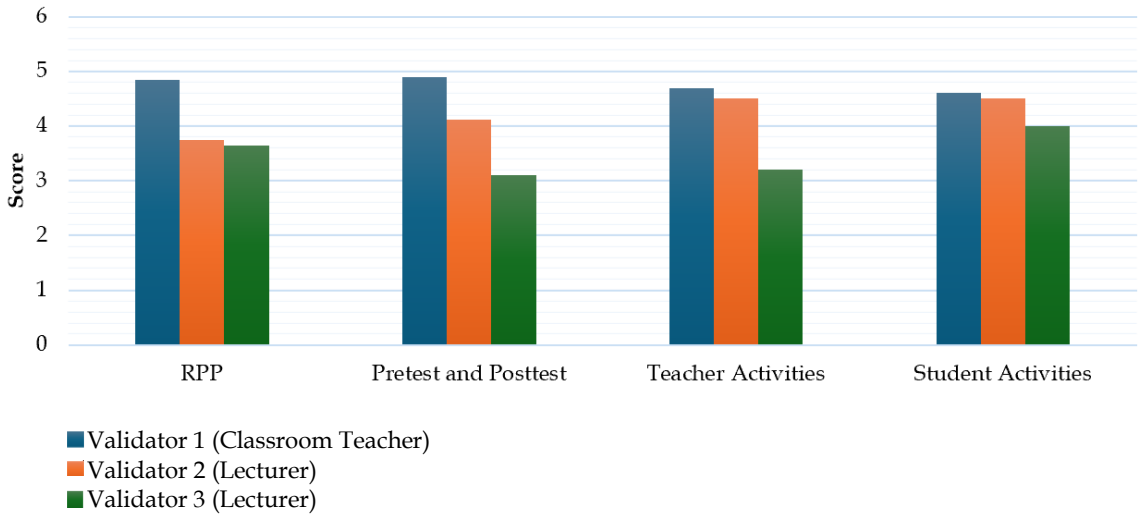
RESULT AND DISCUSSION

This study is a Quasi Experimental Design research involving two classes, V A and V B at SD Muhammadiyah 2 Sorong City, where the SFAE learning model supported by dakonmatika media was applied.

Validation of Learning Devices and Instruments

The outcomes of validating the Lesson Plan (RPP), Pretest and Posttest Question Sheets, Student Activity Observation Sheet, and Teacher Activity Observation Sheet in this research are illustrated in Figure 2 presented below:

Figure 2: Validation Results of Learning Devices and Research Instruments



The validation results in Figure 2 show that the validation scores for the Lesson Plan (RPP) from validators 1, 2, and 3 are 4.85, 3.75, and 3.65, respectively, with an average maximum score of 4.08. Therefore, the RPP is declared valid and can be applied with minor revisions (valid) according to the validators' suggestions. Meanwhile, the validation scores for the pretest and posttest questions from validators 1, 2, and 3 are 4.89, 4.11, and 3.11, respectively, with an average maximum score of 4.11. Therefore, the research instrument can be applied with minor revisions (valid) according to each validator's suggestions. Consequently, the learning devices and research instruments can be used for research.

Question Validity Analysis

The validity test results from the experts conducted on the instrument validity test yielded an average value of 4.11. This value falls within the score range of 4<X, categorized as Very Valid (Arsyad & Fathurrahman, 2019). Based on this, with the category of very valid, it can be concluded that the questions used to test the students' learning outcomes are very valid for use.

Data on observed student activities

Table 1 below presents the results of the observation of student activities in the experimental class.

Table 1. Observation Results of Student Activities in the Experimental Class

	Meeting 1	Meeting 2	Meeting 3
Average	22,4	23	24
Persentase	75%	77%	81%

Based on Table 1, data on the activeness of students in the experimental class during meetings 1, 2, and 3 was obtained. In meeting 1, the average student activeness was 22.4 with a percentage of 75%. In meeting 2, the average student activeness increased to 23 with a percentage of 72%. This increase also occurred in meeting 3, with an average of 24 and a percentage of 81%. Therefore, the engagement of students in the experimental class throughout the teaching and learning process, which involved the application of the SFAE learning model supported by dakonmatika media, falls into the good category. Meanwhile, Table 2 presents the observation results of student activities in the control class.

Table 2. Observation Results of Student Activities in the Control Class

	Meeting 1	Meeting 2	Meeting 3
Average	20	21,7	22
Percentage	68%	72%	74%

Based on Table 2, data on the activeness of students in the control class across three meetings were obtained. There was an increase in student activeness in each meeting. The average student activeness in meeting 1 was 20 with a percentage of 68%, which increased to 21.7 with a percentage of 72% in meeting 2, and in meeting 3, it increased again to an average of 22 and a percentage of 74%.

Data from the observation of teacher activities

Observational data on teacher management activities in the experimental class, utilizing the SFAE learning model with dakonmatika media support, and in the control class using the SFAE model alone, were recorded by an observer or mentor teacher. The activities of students in the experimental class are detailed in Table 3 below:

Table 3. Observation Results of Teacher Activities in the Experimental Class

	Meeting 1	Meeting 2	Meeting 3
Average	4,14	4,47	4,84
Percentage	82,8%	89,5%	96,8%

The data from the observation of teacher activities shown in Table 3 above indicates that the activities of the teacher in meetings 1, 2, and 3 of the experimental

class had percentages of 82.8%, 89.5%, and 96.8%, with average scores of 4.14, 4.47, and 4.84, respectively. As a result, the teacher's involvement in the teaching and learning process, facilitated by the SFAE learning model with the support of dakonmatika media, is classified as excellent. The observation of student activities in the control class is detailed in Table 4 below:

Table 4. Observation Results of Teacher Activities in the Control Class

	Meeting 1	Meeting 2	Meeting 3
Average	4,26	4,57	4,67
Percentage	85,3%	91,4%	93,3%

Based on Table 4, data for meetings 1, 2, and 3 show the activities of the teacher in the control class with respective percentages of 85.3%, 91.4%, and 93.3%, and average scores of 4.26, 4.57, and 4.67 during the teaching and learning process with the application of the SFAE learning model, categorized as excellent.

N-Gain (Normalized Gain)

The acquisition of N-Gain results for students in both the experimental and control classes from the pretest and posttest can be seen in the table 5 below:

Table 5. Acquisition of N-Gain Results

Class	Criteria (Jumlah Siswa)		
	High ≥ 0,70	Midle 0,30 < N-gain<0,70	Low ≤ 30
Experiment	29 Student	6 Student	0
Control	2 Student	25 Student	0

Table 5 indicates that the N-Gain values obtained in the experimental class, with a total of 29 students, fall under the high criterion, and 6 students achieved scores within the medium criterion. Meanwhile, the N-Gain results in the control class show that 2 students achieved high criteria, and 25 students fell under the medium criterion. Therefore, this suggests that the experimental class had a higher category interpretation compared to the control class, indicating an improvement in the ability from the pretest-posttest results of students in the experimental class. This demonstrates that the difference in improvement of the pretest-posttest abilities of students using the SFAE learning model with dakonmatika media assistance is better than the pretest-posttest results of students using the SFAE learning model alone.

Student Learning Outcomes

The learning outcomes of students in the experimental class, taught using the SFAE learning model with the assistance of dakonmatika media, are described based on the analysis of pretest and posttest data. The data processing results on the mathematics learning outcomes of the students yielded a data recapitulation as shown in Figure 3 below:

Figure 3. Percentage of Learning Outcomes of Students in the Experimental Class

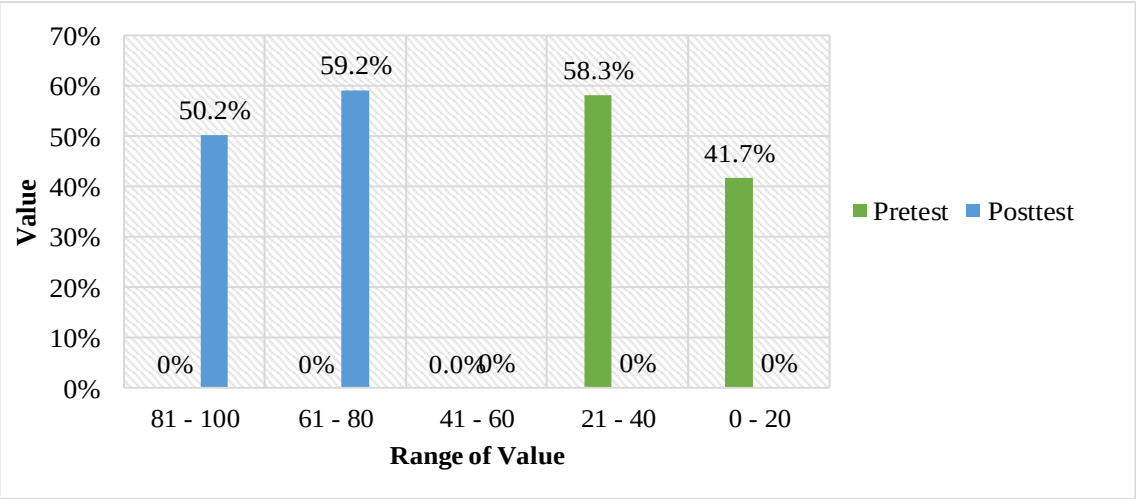


Figure 3 shows that the initial ability of students that can be seen in the pretest results is 41.7% of students are in the range of grades 0-20 with the category of not good and 58.3% of students are in the range of grades 21-40 with the category of not good. While the posttest results showed that 59.20% of students were in the range of 61-80 scores with good categories and 50.2% of students were in the range of 81-100 scores with very good categories. This shows that student learning outcomes before and after the SFAE learning model was applied with the help of dakonmatics media there was a significant increase, namely by 59.2% of students with a range of values of 61-80 and by 50.2% of students with a range of values of 81-100.

Figure 4. Percentage of Learning Outcomes of Students in the Control Class

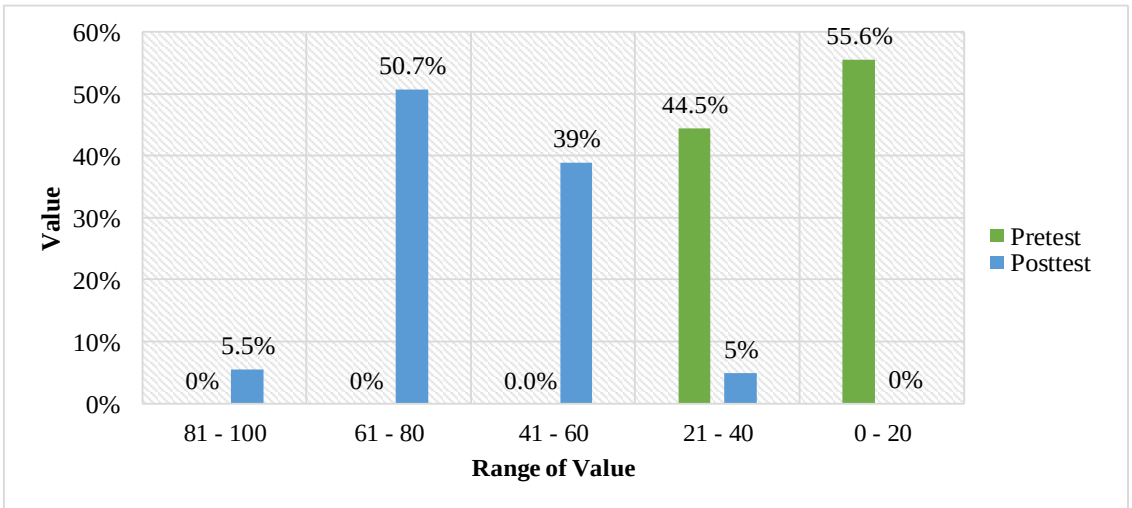


Figure 4 shows that the initial ability of students in the control class, as observed from the pretest results (initial test), indicates that 55.6% of the students were categorized as not good and 44.5% were categorized as less good. Meanwhile, the posttest results (final test) show that 5% of students were in the less good category, 39% were categorized as fairly good, 50.7% were categorized as good, and 5.5% were in the very good category. This indicates that there was a significant improvement in student learning outcomes before and after the treatment through the application of

the SFAE learning model, with 50.7% of students achieving a score range of 61-80 and 5.5% achieving a score range of 81-100. Meanwhile, student learning outcomes in the control class were taught using the SFAE learning model described based on pretest and posttest data analysis. The results of data processing on students' mathematics learning outcomes obtained a recapitulation of data as shown in figure 4 below:

Results of Inferential Statistical Analysis

Normality Test Data Results

The normality test of data is used to determine whether the data are normally distributed or not. The normality test was conducted using the SPSS 24.0 program for the pretest and posttest questions, as seen in Table 6 below:

Tabel 6 Tests of Normality

		Kolmogorov-Smirnov[a]		
	Class	Statistic	df	Sig.
Student Learning Outcomes	Pre-Test Experiment (SFAE with dakonmatika media assistance)	.114	35	.200*
	Post-Test Experiment (SFAE with dakonmatika media assistance)	.114	35	.200*
	Pre-Test Control (SFAE)	.132	27	.200*
	Post-Test Control (SFAE)	.133	27	.200*

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on Table 6, it is observed that the normality tests for the pretest and posttest in both the Experimental and Control classes show a normal distribution. This is determined based on the level of significance. It is seen in the Kolmogorov-Smirnov significant (Sig.) values, with the pretest value being 0.200 > 0.05 and the posttest value also being 0.200 > 0.05. The data are considered normal because they meet the criterion of > 0.05, allowing the testing of homogeneity and hypothesis to proceed.

Results of the Test for Equality of Variances (homogeneity)

The test for homogeneity of data is conducted to determine whether two or more sample data groups come from populations with homogeneous (equal) variances. The test for homogeneity of data was conducted using the SPSS 24.0 program for the posttest questions in the experimental and control classes, as shown in Table 7 below:

Table 7. Test of Homogeneity of Variance

	Levene Statistic	df1	df2	Sig.
Student Learning Outcome	2.741	1	60	.103

Based on Table 7, it is observed that the significant value for the posttest is 0.103. This data meets the criterion of 0.103 > 0.05. Therefore, it can be declared that the sample data come from populations with homogeneous variances. In other words, the variances in the two groups are homogeneous.

Hypothesis Testing

The hypothesis test using the comparison analysis of the T-test with 2 samples (Paired Sample T-Test) is used to determine whether the independent variables included in the SFAE learning model with dakonmatika media assistance and the SFAE learning model have a significant difference in the dependent variable. The T-test was conducted using the SPSS 24.0 program for the experimental and control classes, as shown in Table 8 below:

Table 8 Paired Samples Test

	$t_{account}$	Df	Sig. (2-tailed)
Pair 1 Post-Test Experiment - Post-Test Control	7.537	26	.000

Table 8 indicates that the significance level for the paired sample t-test is 0.000. Given that this significance value is less than 0.05, in line with the criteria for decision-making, the null hypothesis (H0) is rejected. Consequently, this suggests a significant difference in student learning outcomes between the application of the SFAE learning model with the support of dakonmatika media and the use of the SFAE learning model alone in mathematics education.

The t-test table referenced above yielded a t-value of 7.537 for the posttest. This positive t-value falls within the rejection region for H0, indicating that the average learning outcomes for students in the experimental class exceed those in the control class. The critical t-value was obtained by consulting the t-distribution table, considering the degrees of freedom or df (n-k) and the significance level (α), where in this study, the critical t-value for degrees of freedom (df) = n – k = 26 and α = 0.05 is 2.05553. From the data above, it's apparent that t_calculated (7.537) > t_table (2.05553) because t_calculated > t_table, which means there is a significant difference in the mathematics learning outcomes of fifth-grade students of SD Muhammadiyah 2 Kota Sorong using the SFAE learning model with dakonmatika media assistance compared to the SFAE learning model alone.

DISCUSSION

In this study, six learning sessions were conducted, consisting of three face-to-face meetings in the experimental class and three in the control class. In the first meeting of each class, a pretest was given to determine the initial abilities of the students before treatment, and a posttest at the end of the session. The same questions were used for both pretest and posttest, which had been validated by experts. The pretest and posttest aimed to identify differences in students' knowledge and understanding of the LCM and GCD materials with the assistance of dakonmatika media and the SFAE learning model both before and after the application of the learning model.

The results of the normality test for the pretest and posttest in the experimental class showed significance values of 0.200 and 0.200, respectively. Given that these significance values exceed 0.05, it is concluded that the distribution of the class is normal. Besides being normally distributed, the class must have homogenous variances. The result of the homogeneity test was 0.103. Given that the significance value exceeds 0.05, it is concluded that the experimental class originates from a consistent sample. Based on the N-Gain formula, in the experimental class, 29 students achieved high criteria, and 6 students achieved medium criteria. Meanwhile, in the control class, 2 students achieved high criteria, and 25 students achieved medium

criteria. This indicates that the experimental class achieved a higher category interpretation relative to the control class, signifying an enhancement in abilities as evidenced by the pretest to posttest results in the experimental group. This indicates that the improvement in the pretest-posttest abilities of students using the SFAE learning model with dakonmatika media assistance is better than those using the SFAE learning model alone.

Data in the study showed that the use of the Student Facilitator And Explaining (SFAE) learning model with the help of dakonmatics media contributed significantly to the improvement of students' mathematics learning outcomes, as evidenced by the t-count value (7.537) which exceeded the t-table (2.03335). This finding is in line with the results of research by (Eristiani et al., 2020) which found that rotary media can improve student learning outcomes. Similarities in the use of SFAE models are also found in the research of (Zahra et al., 2017), which revealed an increase in mathematics learning achievement through imagination box props. Meanwhile, research by (Ardianik, 2015; Morel, 2021) and (Hernayati, 2022) shows that dakonmatics effectively improves the ability and understanding of mathematical concepts. This result is reinforced by findings from (Mariatun et al., 2023) and (Wardah & Arifin, 2022; Thanheiser, 2023; Islam, 2022; Conrick, 2020), which indicate that SFAE applications can improve student motivation and learning outcomes in the context of geography and economic activities. This research supports the effectiveness of the combined SFAE learning model with dakonmatics in improving the quality of mathematics learning, enriching the discourse on the integration of active learning methods and innovative learning media in mathematics education.

On the other hand, research by (Gompi et al., 2022; Emanet, 2021; Mollman, 2020; Trust, 2023), shows that the SFAE model is more effective than conventional learning in improving mathematics learning outcomes of grade VII students. (Setiadi et al., 2019) found that the Team Games Tournament (TGT) model with dakonmatics media on FPB and KPK materials was also able to improve the learning outcomes of grade IV students.

The implication of this study is that the integration of the Student Facilitator And Explaining (SFAE) learning model with daconmatics media has great potential in improving the quality of mathematics learning in schools. This finding is in line with cooperative learning theory that emphasizes the importance of active student involvement through facilitation activities and peer teaching, as stated by (Zahra et al., 2017; Garrels, 2022; Shin, 2021) and (Gompi et al., 2022). Daconmatics media has also proven effective in improving the understanding of mathematical concepts, according to the research of (Ardianik, 2015; Hernayati, 2022; Jung et al., 2023; Ruiter et al., 2023), and (Setiadi et al., 2019), which shows that the use of innovative media helps students understand the material better through visualization and game-based learning. Thus, educators need to consider using a combination of SFAE and daconmatics to create a more interactive, meaningful, and effective learning environment, especially on math topics that students often find difficult.

To expand on the findings of this study, further research can be done with some more specific directions. One is to explore the effectiveness of the combination of SFAE and daconmatics at other educational levels, such as high school or higher education. In addition, a variety of other innovative learning media can be tried to test whether similar results can be achieved with different tools. Research can also examine the influence of this approach in the development of soft skills, such as communication skills, leadership, and problem solving. Longitudinal studies to assess the long-term

impact of these models on learning outcomes and student attitudes towards mathematics also provide valuable insights for educators.

CONCLUSION

Based on the results of the study, it was found that the Student Facilitator And Explaining (SFAE) learning model with the help of dakonmatics media proved effective in improving mathematics learning outcomes, but there were several weaknesses and limitations found. First, this approach demands good facilitation skills from teachers, so if teachers are less skilled in managing groups or providing clear guidance, their effectiveness may decrease. Second, not all students have the same level of ability to lead discussions or provide explanations to their peers, which can lead to inequalities in learning outcomes. Finally, access to dakonmatics media and other supporting materials is still limited in some schools with minimal resources, thus constrained by implementation.

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AUTHOR CONTRIBUTIONS STATEMENT

RBA, SMH, and ZA played key roles in this study, including conceptual planning, design, and implementation of the research. Meanwhile, MF and MSK and ES were involved in data processing and the preparation of the final report.

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