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The Effect Of Cooperative Learning of Type Think Pair Share Based on Mandailing Culture To Mathematical Problem Solving Ability Of The Students at MSS Ali Imron Medan

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ABSTRACT

The aimed of the research are: (1) to analyze the effect of Cooperative Learning of Type Think Pair Share Based on Mandailing Culture (TPSM) to mathematical problem solving ability (MPSA), (2) to analyze the effect of mathematical initial ability (IMA) to MPSA of the students, (3) to analyze effect of interaction between TPSM and IMA to mathematical problem solving ability of the students. The instrument used to measure MPSA of the students is MPSA test. Type of the test is essays test. MPSA data is analyze through Analysis of Variance (ANOVA). Findings of the research are: (1) there is the effect of TPSM to MPSA of the students, (2) thre is the effect of IMA to to MPSA of the students, (3) there is significant effect of learning approach (TPSM, conventionl approach) and IMA (high, medium, low) to MPSA of the students. Another finding is th time available is not enough to conduct learning trough TPSM, but it can be overcome by good time management. Another one, learning through TPSM make the students become aware to their own culture.

Keywords: Cooperative Learning Learning Model Type Think Pair Share, Mathematical Problem Solving Ability, Mandailing Culture

BACKGROUND

Today it is no longer possible to avoid the effects of globalization, therefore education is obliged to prepare a new generation that is able to face the global challenges. Globalization requires human resources that are ready and competitive, creative, hard worker, good in problem solving to live well in as an individual or as a citizen of a nation. Education is one of the right tool to build high quality human resources so that it can advance a country and mathematics education is one part of national education that has an important role to foster students' thinking skills.

Based on the 2015 TIMSS evaluation report on junior high school students, Indonesia scored 397 and was ranked 46 of 51 countries involved in TIMSS, meaning that Indonesian students were only able to answer 4% of the questions correctly. And based on the 2015 PISA, Indonesia received a score of 386 and was ranked 69th out of 76 countries (PPPPTK, 2015). The TIMSS and PISA results illustrate that Indonesian students' mathematical problem solving abilities (MPSA) that involve knowledge, application and reasoning are still very low at the international level.

Furthermore, data on students' mathematical problem-solving ability is obtained from the initial MPSA test results for grade VII students of Ali Imron Middle Secondary School. From the students' answers, it can be seen that students do not understand the problem, lack control over problem solving strategies, weak in performing calculations, so seldom arrive at the correct solution. While, students who reach the right solution, do not conduct an examination of the final answers that have been obtained, in the sense that they do not make conclusions according to the initial problem, even though if this is done it allows students to be more robust in understanding mathematical concepts related to the problem.

This must be overcome by using a learning model that activates students in learning activities that build mathematical problem solving skills, and familiarize students to answer non-routine questions. According to Mataka, et.al. (2014), teachers need effective teaching strategies to grow MPSA students. For this purpose, the teacher can use various approaches, strategies, techniques or models of student-centered learning and constructivism-based. Constructivism learning allows students to build knowledge for themselves based on what they do (Widodo, 2004).

Regarding mathematical problem solving, Ozsoy, Kuruyer and Cakiroglu (2015) state that with mathematical problem solving steps students can expect understanding such as writing what is known, what is asked, and what is needed to solve problems, explaining problems with their own words, summarizing problems, drawing problem schemes, using appropriate mathematical operations, obtaining solutions, to checking the accuracy of solutions.

In the cooperative model, students are faced with a problem in real life that will attract students to work together in solving problems so that it will improve students' academic results. One type of cooperative learning is the type of think pair share (TPS). According to Arends (2004), the TPS type cooperative learning model is structured and in its implementation strongly emphasizes cooperation between students in solving problems independently (Think), pairing (Pair), then presentation in front of the class (share).

However, in addition to depending on the learning approach or model, the achievement of MPSA students through the learning process is also influenced by students' initial mathematical abilities (IMA). IMA is also used as a basis for grouping students into three categories, namely high, medium, and low categories for the benefit of implementing TPS type cooperative learning. In addition, IMA is used to see the interaction with the learning factors of MPSA students.

Another factor that influences the achievement of MPSA is the culture in the student community. Therefore, the learning carried out must display regional characteristics, in accordance with the mandated 2013 Curriculum that "Indonesian education must be rooted in national culture to build the life of the nation today and in the future". Thus, the research question is whether the TPS-type cooperative learning oriented to Mandailing culture (TPSM) has a significant influence on improving students' mathematical problem solving abilities.

THEORETICAL FRAMEWORK

Mathematical problem solving ability is the ability of students to solve mathematical problems by paying attention to the process of finding answers based on problem solving steps. According to Polya (1987), when a person solves a problem he will go through the following steps: (1) understanding the problem, (2) Planning a settlement / choosing an appropriate settlement strategy, (3) carrying out the solution using a planned strategy, and (4) re-check the correctness of the answers obtained.

Cooperative learning model type Think Pair Share (TPS) is a learning model by referring to the following five main steps and integrating it into Mandailing culture, namely: (1) Preparation; (2) Explain the model applied; (3) Giving Topics; (4) Formation of groups; (5) Thinking individually; (6) Pairing; (7) Sharing (sharing) through presentations in front of the class to convey the results of the discussion to other groups; (8) Giving rewards in the form of values both individually and in groups. Cooperative learning type think pair share is expected to improve mathematical problem solving skills provided that the steps in the learning process are fully implemented.

The integration of Mandailing culture is mainly the integration of traditional Mandailing house building patterns, Mandailing traditional ceremonies, and the typical Mandailing food types on mathematical problems that students have solved.Integrasi budaya lain, seperti budaya Aceh pada pembelajaran dapat meningkatkan kemampuan pemecahan masalah matematis siswa Middle Secondary School (MSS) (Aufa, et.al., 2016).

RESEARCH METHOD

This study was categorized in quasi-experimental research, conducted at Ali Imron Middle School in Medan. The study population was all seventh grade students of Ali Imron Medan Medan, while the sample was 32 students of class VII-1 as the TPSM class and class VII-2 as the control class. The design used in this study is the Pretest Posttest Control Group Design as in Table 1 below.

Table 1. Research design

Group	IMA	Treatment	Post Test
Experiment	O_1	X_1	O_2
Control	O_1	-	O_2

Note:

X_1 = Cooperative Learning of Type Think Pair Share Based on Mandailing Culture (TPSM).
O_1 = Pre-test
O_2 = Post-test

In the experimental class that implements Cooperative Learning of Type Think Pair Share Based on Mandailing Culture (TPSM), students are encouraged to complete mathematical questions in their groups. The questions students must solve consist of questions that require them to think and carry out the stages of problem solving as mentioned by Polya (1987). In each mathematics learning session, students are encouraged to be able to solve MPSA questions in a structured description type. Questions like this are made with the intention that the goal of increasing student MPSA can be achieved.

Grouping students is based on students' initial mathematical abilities (IMA). The students 'initial mathematical abilities are students' mathematical knowledge and skills before the experiment begins. IMA scores were obtained through the IMA test consisting of 20 multiple choice questions taken from the National Examination (UN) questions. The questions in UN are

choosed because these questions have the characteristic valid. IMA questions were followed by students in the experimental class and control class.

At all of the session of implementation of TPSM, the questions that must be completed by students are designed to be related to Mandailing culture, especially culture related to ornaments on traditional Mandailing homes, Mandailing food, and traditional Mandailing ritual traditions. By linking the MPSA questions students are expected to more easily understand the problem and be challenged to solve it. Before the mathematics learning session ends, students present the results of the problem solving in front of the class. Other students give questions, criticisms, and suggestions. The teacher moderates the course of the discussion until conclusions are drawn on the mathematical topics learned on that day.

In the control class, each student learns mathematics sessions by listening teacher explaination about mathematical topic in sequence, then watching the teacher solve mathematical problems. Then students work on the teacher's instructions to solve mathematical problems that are similar to the mathematical problems taught by the teacher so that the way to solve the problem is the same as the one exemplified by the teacher. The questions instructed by the teacher to be resolved by students are questions that do not require the stages of solving the problem proposed by Polya, the questions tends to be categorized routine problems

In this study, data analysis begins with descriptive analysis, which is calculating the average, standard deviation, maximum value and minimum value of the data on mathematical problem solving abilities (MPSA). The next stage is inferential analysis for MPSA data, namely the normality test and variance homogeneity test, then two-way ANOVA analysis. All calculations use the help of SPSS 20.0 software and Microsoft Excel.

RESULT AND DISCUSSION

Analysis of the data presented is an analysis of MPSA data and IMA respectively, analysis of the interaction between learning factors and IMA on MPSA. The description start with the description of mathematical initial ability.

Description of Mathematical Initial Ability

The initial mathematical ability test (IMA) was carried out at the beginning of the study. The IMA test is carried out to classify students into high, medium and low groups. The grouping of student IMA is done through calculating the mean of the test and standard deviation. The IMA grouping is based on the following criteria: IMA scores ≥ (X) SD + SD are grouped in the high category, $\bar{X}$-SD <IMA score <$\bar{X}$ + SD are grouped in the medium IMA category, while students who have $\bar{X}$-SD ≤ IMA grouped into low IMA categories. After students are grouped according to IMA, the results of IMA data analysis both from the experimental class and the control class can be seen in Table 2 below.

Table 2. Statistic of Mathematical Initial Ability (IMA)

Group	IMA	$\bar{x}$	s	Min	Max
Experiment	High	90.83	4.92	85	100
	Medium	67.75	8.50	50	80
	Low	39.17	5.85	30	40
Control	High	90.83	3.76	85	95
	Medium	67.63	9.77	50	80
	Low	36.43	8.02	25	40

Table 2 above shows that the mean and standard deviation of the experimental class for students with high category IMA is 90.83 and 4.92; for the medium category of 67.75 and 8.50; and the low category for 39.17 and 5.85. While, in control class, the mean and standard deviation of the students with high IMA were 90.83 and 3.76; the mediumIMA was 67.63 and 9.777; and the low IMA was 36.43 and 8.02. Figure 1 presents an average diagram of the IMA score for both the experimental class and the control class.

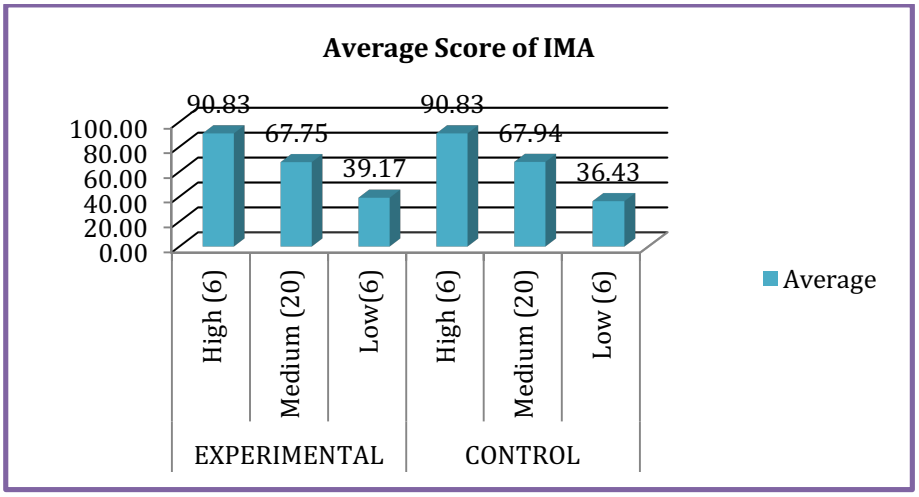

Figure 1. Average Score of Mathematical Initial Ability

Figure 1 above shows that: in the experimental class the MPSA average of the students with high IMA; with medium IMA was IMA is 67.75; with low IMA is 39.17. In control class: MPSA of the students with high IMA was 90.83; with medium IMA was 67.63; with low IMA was 36.43.

Description of Mathematical Problem Solving Ability of the Students

From the score data of mathematical problem solving abilities (MPSA), then analyzed to find out the differences in students' mathematical problem solving abilities taught with cooperative model learning type think pair share oriented to Mandailing culture and students taught with ordinary learning (conventional approach) based on the IMA that students get. Summary of the results of the analysis of mathematical problem solving abilities, based on the IMA that students get is presented in Table 3 below.

Table 3. MPSA Average Based on Learning Approach and IMA

Group	IMA	MPSA			
		$\bar{X}$	s	Min	Max
Experiment	High	89.74	6.51	79	98
	Medium	81.83	7.53	67	96
	Low	68.59	11.26	58	79
Control	High	74.04	7.95	60	83
	Medium	69.62	9.66	52	80
	Low	73.63	5.22	69	82

Table 3 shows that the mean and standard deviation of mathematical problem solving abilities of the experimental class with high student IMA is 89.74 and 6.51, while 81.83 and 7.53 and medium are 68.59 and 11.26. As for the mathematical problem solving ability of the Control class with high IMA of students, the mean and standard deviation are 74.04 and 7.95, while 69.62 and 9.66 and Low are 73.63 and 5.22.

The following is a data diagram of the average students' mathematical problem solving abilities based on the learning factors in Figure 2 below:

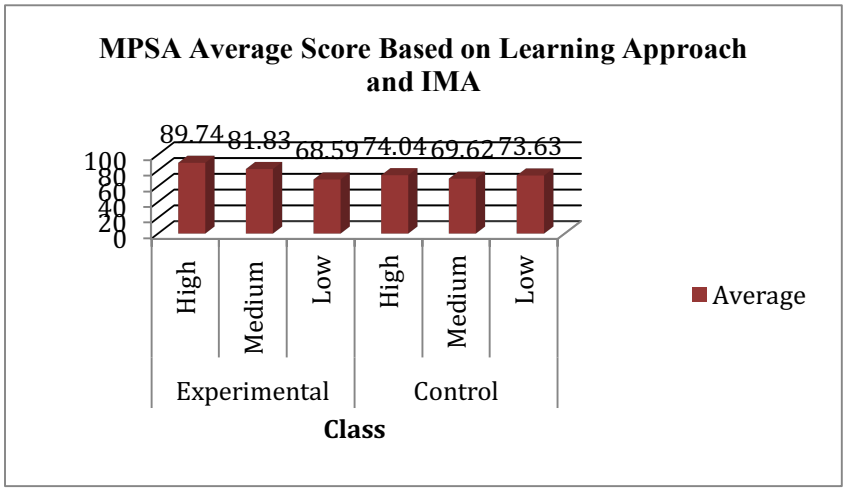

Figure 2. MPSA Average Score Based on IMA

Hipotesis yang akan diuji dalam penelitian ini adalah sebagai berikut.

Hipotesis Statistik 1:
$H_0: \beta_1 = \beta_2$
H_a : paling tidak ada satu *j*, bukan H_0

Hipotesis Statistik 2:
$H_0: \alpha_1 = \alpha_2 = \alpha_3$
H_a : paling tidak ada satu *i*, bukan H_0

Hipotesis Statistik 3:
H_0: $(\alpha\beta)_{ij} = 0$:
H_a: minimal ada satu $(\alpha\beta)_{ij} \neq 0$

Hasil perhitungan manual ANAVA Dua Jalur rangkumannya tersajikan pada Tabel 3. berikut.

Table 3. Output of MPSA test

Source	SS	df	MS	*Fo*	F_{count}	*R*
IMA (α)	705.16	2	352.58	4.91	3.156	0.1089
Learning approach (β)	1479.56	1	1479.56	20.61	4.01	0.2345
Interaction αβ	839.239	2	419.619	5.844	3.156	0.1315
Within	4164.605	58	71.804			
Total	7188.558	63	2323.558			

Based on Table 3 above, the first statistical hypothesis, the value of F_0 ((β) is 20.61, if this value of F_0 (β) is confirmed to the F_{table} value at α = 5%, then F_0 (β) is greater than F_{table}, that is 20.61> 4, 01. It is concluded that there is enough evidence to reject H_0.This means that there is an influence of the learning model on students 'mathematical problem solving ability. The magnitude of the influence of the learning model on students' mathematical problem solving ability is 0.2345 or 23.45%.

The second statistical hypothesis, obtained by the value of F_0 (α) is 4.91, if the value of F_0 (α) is confirmed to the F_{table} value at α = 5%, then F_0(α) is greater than F_{table}, that is 4.91> 3.156. It

was concluded that there was enough evidence to reject H_0. This means that there is an effect of the initial ability of mathematics (IMA) on students' mathematical problem solving abilities (MPSA). The influence of initial mathematical ability (IMA) on students' mathematical problem solving ability is 0.1089 or 10.89%.

The third hypothesis, the value of F_0 (αβ) is 58.44, if this value of F_0(αβ) is confirmed to the F_{table} value at α = 5%, then F_0(αβ) is greater than F_{table}, that is 588.44> 3.156. This means that there is a shared influence given by the learning model and IMA on students 'mathematical problem-solving abilities. The influence is shared by the learning model and IMA on the students' mathematical problem solving ability is 0.1315 or 13.15%. The confirmation results using SPSS 20 presented in Table 4 below.

Table 4. Tests of Between-Subjects Effects: Two way ANOVA of MPSA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3023.953[a]	5	604.791	8.423	.000
Intercept	280474.145	1	280474.145	3906.133	.000
IMA	730.338	2	365.169	5.086	.009
Learning approach	713.580	1	713.580	9.938	.003
IMA * Learning approach	879.756	2	439.878	6.126	.004
Error	4164.605	58	71.804		
Total	377068.430	64			
Corrected Total	7188.558	63			
a. R Squared = ,421 (Adjusted R Squared = ,371)					

Based on ANAVA test results in Table 4, it can be seen that the significance value of the learning model is 0.003 smaller than 0.05. So, it can be concluded that there is an influence of the learning model on students' mathematical problem solving abilities. And the information obtained is that the IMA significance value is 0.009 smaller than 0.05 so it can be concluded that there is an effect of Mandailing IMA on students' mathematical problem solving abilities. then the significance value of the learning model and IMA 0.004 is smaller than 0.05. So it can be concluded that there is a joint influence between learning models (TPSM, conventional approach) and IMA (high, medium, low) on students' mathematical problem solving abilities. More specifically, there is an interaction between students 'learning and IMA models of students' mathematical problem solving abilities, and it is presented in Figure 2 below.

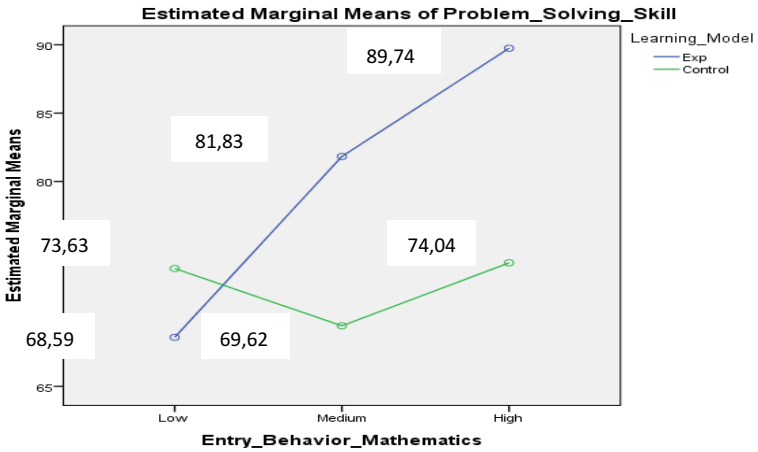

Figure 3. Interaction of Learning Approach and IMA to MPSA

From Figure 3 above, it can be seen that students MPSA average score in experiment class; the students with high IMA was 89.74, with medium IMA was 81.83, with low IMA was 68.69. While in conventional learning class: the students with high IMA was 74.04, with medium IMA was 69.62, with low IMA was 73.63. Based on the research findings and the results of the data analysis above, several factors related to this study will be elaborated, namely the effect of learning model factors and students IMA to students' mathematical problem solving abilities.

Analysis of Learning Approach towards MPSA

Cooperative learning is based on constructivist theory (Lang & Evans, 2006). This learning arises from the concept that students will find it easier to find and understand difficult concepts if they discuss with their friends. Based on the research data that has been described previously that the cooperative learning model gives a positive influence in the form of increasing problem solving abilities. This reinforces previous studies that use cooperative learning models to improve some mathematical abilities. Among them are the results of research by Amalia, Surya and Syahputra (2017), which states that problem solving skills will develop quickly if students gain new experiences from learning activities. This problem solving ability is needed by students as a provision in solving mathematical problems and problems found in everyday life.

The cultural oriented innovation of the Think Pair Share (TPS) type cooperative model is a strategy to instill the idea that mathematics is not a concept that comes suddenly but has existed and become part of the student's life itself. Research conducted by Aristyawan, Suryadi, Herman and Rahmad (2014) which also proves that the culture associated with learning is able to improve students' abilities. This can be seen in his article stating that the model of implementation of culture based learning ... must emphasize on the effectiveness of a positive character that reflects the cultural values of the nation and promotes the cognitive aspect of students, which means that the application of culture-based learning not only can improve students' cognitive but also build positive character for students. therefore, the integration of cultural values in learning is felt important and must be re-started to be applied in elementary and secondary schools. Therefore, the culture-based Think Pair Share (TPS) type of cooperative learning process can be an instrument for students to get to know mathematics not just limited to factual concepts that are taken for granted, but obtained through constructive thinking processes and in accordance with local cultural wisdom.

Based on the results of data analysis, the average post-test score of the experimental class was 80.83 while in the control class 71.21. This shows that the average score of the post-test in the experimental class is higher than the control class. This supports the results of research by Ling, Ghazali, and Raman, (2016) entitled "The Effectiveness Of Cooperative Learning On Mathematics Student Think Pair Share (TPS)." This research states that TPS type cooperative learning approaches can improve mathematics learning achievement and increase students' self-confidence.

Furthermore, based on the results of inferential statistical analysis through ANOVA, the findings are as follows: there is a significant difference in problem solving ability between students taught by the Think Pair Share type cooperative model based on the usual Mandailing and Learning culture. Mathematical problem solving ability (MPSA) of students taught through the TPS type cooperative model based on Mandailing culture is higher than the MPSA students taught through ordinary learning. This shows that the cooperative learning model of the Mandailing-oriented Think Pair Share type has a greater influence in improving mathematical problem solving abilities. This can be said for several reasons, one of which is due to the characteristics of TPS-type cooperative learning based on Mandailing culture. These

characteristics include learning learning by the local culture of students so as to provide opportunities for students to think individually or in pairs, to share the results of their thinking in solving mathematical problems. The results of this study support the results of Saragih, Napitupulu, and Fauzi (2017) research entitled "Developing Learning Models Based on Local Culture and Instrument for Mathematical Higher Order Thinking Ability". Their research concludes that local culture-based learning models are effectively used in teaching and learning mathematics for junior high school students.

Interaction between Learning Approach and IMA to MPSA of the Students

Interaction is the mutual influence of two or more independent variables affecting the dependent variable. Glass & Hopkins (1996) states that "interaction occurs when an independent variable has different effects on a dependent variable at various levels of another independent variable". In this case what is being studied is the collaboration between learning models (cooperative and contextual) with gender on students' mathematical problem solving abilities.

Based on the results of the third hypothesis testing it can be concluded that there is an interaction between students' learning and IMA models on students' mathematical problem solving abilities, meaning that there is a shared influence between students' learning models and initial mathematical abilities (IMA). In this study, high initial ability students in the experimental class had an average value of 89.74 higher than the control class of 74.04. So it can be concluded that the cooperative learning model type think pair share Mandailing culture oriented is suitable for students who are highly IMA in improving students' mathematical problem solving abilities. Moderate ability students in the experimental class have an average value of 81.83 higher than the control class of 69.62. So it can be concluded that the cooperative learning model type think pair share with Mandailing culture orientation is suitable for students with moderate IMA to improve students' mathematical problem solving abilities. Whereas average MPSA for students with low IMA in the experimental class was 68.59, lower than the average value in the control class of 73.63. So it can be concluded that students with low initial mathematics abilities at TPSM class get worse achievement compare to the students at conventional learning models. Thus, TPSM only suitable to be implemented to the class with high and medium mathematical initial ability (mathematical initial knowledge and skills ability).

This result is in accordance with the research conducted by Minarni, Napitupulu, Husein (2016) which concluded that there were significant differences in mathematical problem-solving abilities between groups of students with high and low initial abilities. This means that the initial mathematical abilities of students have an influence on mathematics learning outcomes. Therefore, in the TPSM learning strategy, students from high IMA are better than students from moderate IMA and low IMA in MPSA. Similar research has been produced by Odeyemi (2014) entitled "Effects of music and prior instructional strategies on students 'knowledge" achievement in mathematics "states that students' initial mathematical abilities can improve mathematics learning achievement. Therefore, it was concluded that the interaction of the learning model and the initial mathematical ability had an effect on students' mathematical problem solving abilities.

There are interesting findings in this study, namely the time available to implement Cooperative Learning of Type Share Based Think Pair on Mandailing Culture (TPSM) is not enough. Luckily the clever teacher made effective time on the next study session until the last session of this study. Other findings, students become more concerned with Mandailing culture.

CONCLUSION

Based on the results of the research data analysis on students' mathematical problem solving abilities who learn through the cooperative learning model of Mandailing Culture-oriented Think Pair Share, the following conclusions are obtained:

1. There is a significant influence of Cooperative Learning of Type Think Pair Share Based on Mandailing Culture (TPSM) on the mathematical problem solving ability of Ali Imron Middle School students in Medan.
2. There is a significant effect of students' initial mathematical ability (IMA) on the mathematical problem solving ability of Ali Imron Middle School students in Medan.
3. There is a significant simultaneous influence (interaction) between the learning model and the initial mathematical ability (IMA) on the mathematical problem solving ability of Ali Imron Junior High School students in Medan.

SUGGESTION

Based on the conclusions described above, in implementing Cooperative Learning of Type Think Pair Share Based on Mandailing Culture (TPSM), it is recommended that teachers be able to provide various views and problems related to the topic being taught and can present various apperceptions to students, encourage students to respecting Mandailing culture and keeping Mandailing's culture to be sustainable. This will have an impact on each student to be able to know the application of mathematical topics that he has learned in their lives. Cooperative Learning of Type Think Pair Share Based on Mandailing Culture (TPSM) requires a relatively large amount of time, so in implementing the teacher it is expected that the time can be effective.

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