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The Effect of The Implementation of PBL & Inquiry Models on The Mathematical Literacy Ability

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***Abstract*:**
The learning techniques applied during the independent curriculum era require learning innovations that will be applied in learning, one of which is by implementing the PBL learning model and also the *Inquiry model*, where the application usually uses the direct instruction model. *This* study explains how the influence of students' mathematical literacy skills with the material taught, namely algebraic forms, with the learning model applied in each predetermined experimental class. *True Experimental Design* is a learning method used by researchers, *Pretest-Posttest Control Group Design* is the data obtained used by researchers. The results of the study found that the application of the *inquiry learning model* tends to provide a greater tendency towards students ' mathematical literacy skills compared to PBL and direct learning. In accordance with the results of the one-way ANOVA test and Tukey's follow-up test. The significant results obtained from the similarity test showed an increase in students' mathematical literacy skills, namely 0.727> 0.05. The hypothesis was found H_1 accepted, with the results of the difference in the average influence of students' mathematical literacy test scores on the application of PBL, inquiry, and *direct instruction learning models*.

Keywords: Mathematical Literacy; PBL, Inquiry.

Introduction

The universal science that underlies several disciplines is mathematics. An important role in advancing the way humans think mathematically is also part of mathematics, as is the case in the development process in the field of technology and information (Isti'adah, 2020). Starting from school basic to college, the basis of learning which is the basis of science that is very useful in everyday life, both in all majors and non-mathematics study programs (Yulis Tyaningsih et al., 2022). The use of language in mathematics is an absolute part of being able to communicate, with the aim of getting meaningful use of language in mathematics, which is also a rule to prove a mathematical truth that is stated in the rules of language, or commonly called mathematical literacy(Rosari & Dewi, 2022)

Thus, mathematical literacy is a person's effort to be able to solve problems through understanding how to apply mathematics in everyday life, as well as communicating the results obtained based on the thoughts obtained regarding problems found in everyday life. According to the results Lestari & Effendi, (2022)found in one of the Junior High Schools (SMP) that it is still categorized as quite low with a percentage score of students having high mathematical literacy, which is 13%, with a medium category of 60% and a low category of 27%. This happens because students have not been able to meet the aspects of mathematical literacy indicators.

Mathematical literacy is an important part that a person needs to have in order to be able to understand the meaning in everyday life. (Hapsari, 2019).According to (Fatwa et al., 2019)a person's ability to formulate problems, solve problems and evaluate the results of a phenomenon, this is said to be an understanding of mathematical literacy. According to OECD (2023)mathematical literacy, it is an important thing for a person which includes the ability to formulate, solve problems according to facts and concepts and mathematical procedures, as well as a person's ability to evaluate results and interpret the results into everyday life.

Researchers conducted observations on students of SMP Negeri 7 Muaro Jambi by giving initial ability test questions to students, the questions were contextual questions with a study of algebraic material consisting of one story question containing indicators of mathematical literacy. According to Setyawan, (2017)the material, algebra is one of the problems that allows for students' representational abilities related to with contextual problem solving and also presenting a concept in the form of a mathematical model. According to Rahmadani, (2019)the application of the PBL model, it can be implemented when students are able to explore their potential in thinking critically and systematically which is able to solve problems related to everyday life.

The results of the observation found that students' answers still did not meet the syntax of mathematical literacy skills, as can be seen in the following image:

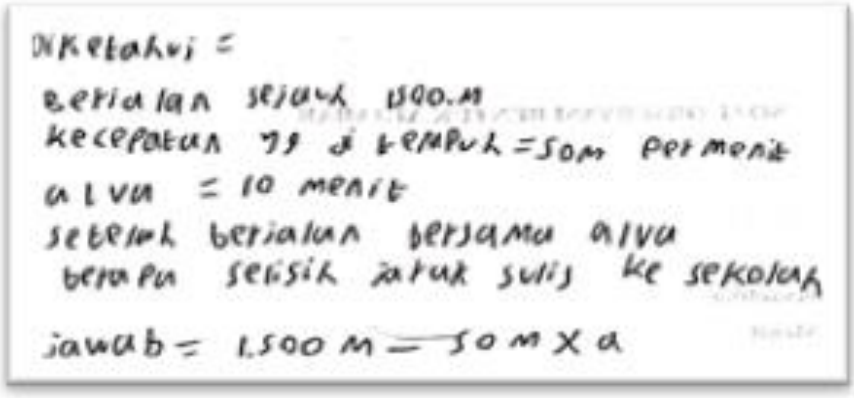

Figure 1. Students' answers to the indicators for formulating problems mathematically

It can be observed that the students' answers to the first indicator are still often confused in answering the problems given, only writing down several aspects that can be formulated mathematically. However, students are able to form a mathematical model but with the help of the teacher, so they can form their mathematical model $1.500m - 50m \times \alpha$.

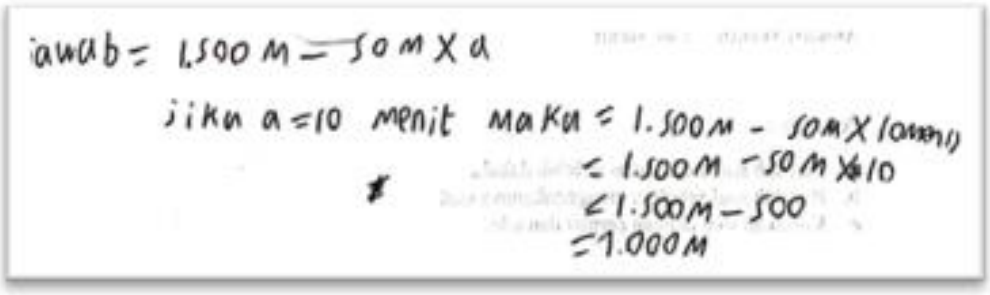

Figure 2. Students' answers to indicators of the use of mathematical concepts and procedures

Presented in Figure 2 regarding the next steps, students also still seem confused to solve it, but when directed, students are able to run until they find the desired solution. However, students still have not applied the mathematical concept according to the procedure where students have not been able to substitute the value of α which is used as a symbol to be substituted.

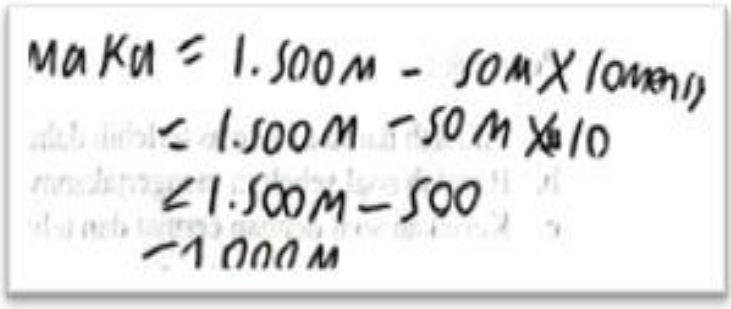

Figure 3. Students' answers to the indicators of interpreting and evaluating mathematical results.

Meanwhile, in the third indicator, Figure 3 explains that students are able to find the results obtained but have not evaluated the results obtained in everyday life by explaining the results of the 1,000 m value, what is the accumulation of the value in the question asked in the question.

Learning that is presented in the form of problems and is oriented towards students who are required to tend to be more active is found in the PBL model (Meilasari et al., 2020). In fact, this PBL model has characteristics with heterogeneous learning, can construct students' critical thinking and is able to provide opportunities to communicate about the ideas obtained.(Rahmalia & Ansari, 2020).

According to Ramlin et al., (2019)*inquiry* learning can encourage students to find mathematical theories , train students to find a factual discovery in accordance with the learning desired by students, and students are able to receive and knowledge

through communication. So, learning is more meaningful and students always can know the benefits of learning mathematics, and are able to solve contextual problems using mathematical concepts. According toUlandari et al., (2019) The *Inquiry* model is a learning process that is more played by students to be able to formulate problems, investigate and solve problems themselves. In addition, this Inquiry learning model can also involve all students in creating new things such as processing information or data obtained to be processed in the form of mathematical data, and related to student life. This learning also focuses on aspects affective , cognitive , and psychomotor So, with this Inquiry learning model, learning can be more meaningful(Faberta et al., 2019).

The purpose of this study is to determine the differences in the influence of the application of PBL and *inquiry models* in improving the mathematical literacy skills of class VII students of SMP N 7 Muaro Jambi.

Research Methods

This research is quantitative, with an experimental method, in the form of *Trues Experimental Design* . According to Sugiyono, (2016)*Cluster Random Sampling* is the sampling technique used . *The clusters random sampling* technique is a method of sampling by determining the sample population which is seen through all the grades of class VII students of SMP 7 Muaro Jambi and observations are made for each indicator of mathematical literacy, so that researchers can determine the steps for taking randomly. In this study, three groups were used, namely two groups, namely samples (R) and for the two experimental groups given treatment (X). While in the third group, namely the control group, no treatment was given. Each number of groups, namely class VII C totaling 32 students, class VII D there are 23 students and in class VII E there are 23 students.

Based on the data taken as representatives of students of SMP N 7 Muaro Jambi in class VII have the same average value so that it will be applied the same but the application of different learning models, it is concluded that this study will be carried out in groups to see the effect of the application of learning models on mathematical literacy skills. Thus, the *Cluster Random Sampling Technique* was chosen in this study, because the research conducted is a group study, which is randomly randomized and taken as a sample. However, observations have been made in advance that all classes have the same average value.

From the several stages that have been explained, the researcher chose three classes to be used for the research, namely the classes that became the sample of the research group, namely class VII C, VII D and class VII E. Each sample group will be given different model treatments. In class VII C, the *inquiry model is applied* , in class VII E, the PBL model is applied, while VII D as the control class is applied with the direct instruction *model* .

As for the materials for this study, using several preparations including a mathematical literacy ability test instrument in the form of descriptive questions as

many as 2 descriptive questions. Then the learning implementation observation sheet instrument containing two instruments 1. Implementation of teacher learning activities; 2. Implementation of student learning activities.

Testing the population is normally distributed and homogeneous or not is done first. If then the data is normally distributed homogeneously and then it is continued by selecting the research group that will later be given a *pretest-posttest test* and the data obtained is reprocessed to see the data obtained from the *pretest-posttest* of students' mathematical literacy abilities is normal and homogeneous or not. After that, the one-way ANOVA test and continued with the *Tukey Post-Hoc test.*

Results and Discussions

This test is carried out if you want to see whether the data is normally distributed or not. The results of this normality test are carried out in a limited manner only on the experimental class and the control class, which were tested only on three classes used as research, which was done in order to apply the two models that wanted to be measured simultaneously but implemented in different classes. This study only measured the mathematical literacy of students at SMP N 7 Muaro Jambi.
The results of the normality test measurements are shown in Table 1 below :

Table 2. Test Normality of *Pretest of* Mathematical Literacy Ability

Test of Normality			
	Kolmogorov-Smirnov [a]		
Class	**Statistics**	**df**	**Sig.**
Experiment 1 (PBL)	.122	23	.200 *
Experiment 2 (*Inquiry*)	.133	32	.164
Control (*Direct Instruction*)	.156	23	.149

Table 3. Test Normality of *Posttest of* Mathematical Literacy Ability

Test of Normality			
	Kolmogorov-Smirnov [a]		
Class	**Statistics**	**df**	**Sig.**
Experiment 1 (PBL)	.178	23	.057 *
Experiment 2 (*Inquiry*)	.113	32	.200 *
Control (*Direct Instruction*)	.174	23	.069

As seen in table 2, *the pretest of* students' mathematical literacy skills, the significance value is > 0.05 where each of the significance results of the two experimental learning models and the control class has a significance above 0.05. Like the PBL experimental class, the significance value is 0.200, then the *inquiry experimental class* with a significance of 0.164 and finally there is the *direct instruction control class* with a significance of 0.149. So, it can be concluded that H_1 rejected and the result is

H_0 accepted, namely the average *pretest score for* mathematical literacy skills in the PBL model class, the *Inquiry model class* , and the direct learning model is normally distributed at the average class score.

Based on Table 3, *the posttest* of students' mathematical literacy skills also has a significance value > 0.05, so H_0 *is* accepted, and H_1 *is* rejected. It can be concluded that the *posttest value data* of mathematical literacy ability for experimental class I, experimental class II, and control class are normally distributed.

Table 4. Test *Pretest* Homogeneity

Test of Homogeneity of Variance

Levene Statistics	df1	df2	Sig.
1,594	2	75	.210

Table 5. Test *Posttest* Homogeneity

Test of Homogeneity of Variance

Levene Statistics	df1	df2	Sig.
1,822	2	75	.169

Based on table 4, the decision-making criteria, with a significance value of 0.210 > 0.05, thenH_0 accepted, namely the variance oriented to each group is homogeneous. So the conclusion is, the *pretest scores* of the three classes have a homogeneous or the same variance of mathematical literacy ability *pretest data.*

Meanwhile, in table 5, the decision-making criteria, with a significance value of 0.169 > 0.05, are H_0accepted and H_1rejected , namely the data variance of the three groups is homogeneous. So if concluded, the *posttest value* in each class has the same *posttest data variance* of mathematical literacy ability.

Assumption test in this study, will be tested at the end of the study using the *Tukey test* , but previously will use the one-way ANOVA test . This test is carried out with the help of *software* 26, using a confidence level of 95%. If the value $Sig > 0{,}05$ is $H_o$accepted , then, it means that the average test of the research group is the same. If $Sig < 0{,}05$then $H_1$is rejected . Then, the average test of the research group is different. The results of the assumption test are presented in table 7 below:

Table 6. One-Way ANOVA Test

ANOVA					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	81,486	2	40,743	10,052	.000
Within Groups	304.001	75	4.053		
Total	385,487	77			

The significance of the one-way Anova test results is 0.000 (0.000 <0.05). Which means the significance value is <0.05 so that the assumption is reject $H_0$and accept H_1. Thus, the three sample groups have significant differences. The *Post-Hoc* follow-up test

(follow-up test) uses the *Tukey test.* To see the similarities in the average application of the three learning models, see table 9 below:

Table 7. Mean Equality Test

Tukey HSD [a,b]			
Class	**N**	**Subset for alpha = 0.05**	
		1	**2**
Control Class (Direct Instruction)	23	16.96	
Experimental Class 1 (PBL)	23		18.91
Experimental Class 2 (Inquiry)	32		19.34
Sig.		1,000	.727

Table 6 above explains the value of the average mathematical literacy ability test by applying the *direct instruction model* , meaning that the average test value is the same, or does not have a significant difference. While the average mathematical literacy ability test value in the PBL model and the *inquiry model* does not have a significant difference but has a significant difference to the control class . This means that the average student test score is the same or there is no difference. However, there is a significant difference between the average student ability test score in the *inquiry model* and the *direct instruction learning model* .

The results of this study showed that the *inquiry* learning model provides more students, because the *inquiry learning model* provides space to conduct experiments and discoveries in groups, so that students can solve problems more freely. It was found that , which was taught using the *Inquiry* learning model , increased mathematical literacy skills, in terms of its application, the model gives children more freedom to find and experiment with fellow group members, and the results of the findings they use as material to solve problems. This can explain that, learning that is taught to improve students' mathematical literacy skills, is better using the *inquiry model* compared to PBL and *direct instruction* .

Proven by the results of *the pre-test* and *post-test* of students who have increased in such a way towards class VII C which applied the *inquiry model* where students are able to solve their own problems by making several discoveries with discussion partners in their groups. It can also be seen in Table 6 the similarity test of students' mathematical literacy skills that experienced a significant increase was *inquiry* with a score of 19.34. This is also in line with research resultsRamlin et al., (2019) explains the research results obtained from the application of the Inquiry learning model, which further improves students' mathematical literacy skills, if aligned with students who carry out direct learning (direct instruction). The same thing applies to the Ulandari et al., (2019)*inquiry* learning model which has a group learning technique, which involves all members to solve problems applied by the teacher, so that there are fewer passive students in learning.

Based on the results of the description above, if summarized, the results are rejected and H_1 accepted, which means that there is a difference in terms of the influence of the average score of students' mathematical literacy ability tests on the application of PBL, *inquiry,* and *direct instruction learning models.*

Conclusions and Suggestions

Oriented towards The results of this study found that there was an influence of the application that was able to provide a level of mathematical literacy skills of students using the *inquiry learning model. This inquiry* learning was able to provide progress in students' mathematical literacy with syntax adjustments in the learning model, if compared to the PBL learning model and the *direct instruction model* . The results of the mathematical literacy ability test also showed that there were significant differences that occurred in each learning model. However, the learning model provided more significant changes with an average *pretest result* of 9.50 and when *the posttest* became 19.34. When compared to the PBL learning model, all average *pretest scores* were 10.00 and when *the posttest became 18.91, and the direct instruction* class with an average *pretest score* of 9.30 when *the posttest* became 19.96.

Suggestions for further researchers, provide appropriate learning models to students to be able to see the abilities to be measured, and adjusted to the learning that is usually done in schools, so that the learning can be seen as renewed. If further researchers use the same model as this study, try to provide something new that can see the results of mathematical literacy skills in more detail. Then the implications for teachers at the school or teachers who are currently experiencing confusion about how to improve students' mathematical literacy, can use the research findings from this study as a source that helps implement more effective learning, and try to switch to a learning model that is more preferred and interactive for students and teachers in everyday life. Such as, starting to give students the opportunity to search, express themselves, conduct their own experiments, and then have a discussion together to provide the right solution, accompanied by the discovery of their own experiments when they are trying to solve their own problems, it will help children to be more prepared and mature in learning to deal with their problems that must be solved independently.

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