Jurnal Analisa 9 (2) (2023) 162-174
http://journal.uinsgd.ac.id/index.php/analisa/index
p-ISSN : 2549-5135 e-ISSN : 2549-5143

The Influence of Batak Culture Problem Based Learning Models to Junior High School Students' Computational Thinking Ability

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Received: 11 September 2023 ; Accepted: 16 Desember 2023 ; Published: 30 Desember 2023

Doi: 10.15575/ja.v9i2.29523

Abstrak

Penelitian ini bertujuan untuk mengetahui apakah terdapat perbedaan berpikir komputasi siswa dengan model pembelajaran berdasarkan masalah-berbasis budaya Batak (PBM-B3) dengan konvensional). Penelitian ini merupakan penelitian eksperimen semu. Model yang digunakan dalam penelitian ini adalah model Pembelajaran Berdasarkan Masalah-Berbasis Budaya Batak dengan subjek penelitian 46 orang siswa kelas VIII di SMP Advent 2 Medan. Objek dalam penelitian ini adalah kemampuan berpikir komputasi siswa pada materi sistem persamaan linear dua variabel (SPLDV). Hasil penelitian menunjukkan bahwa terdapat perbedaan kemampuan berpikir komputasi antara siswa yang diberi pembelajaran berdasarkan masalah berbasis budaya batak dengan siswa yang diberi pembelajaran langsung. Secara deskriptif diperoleh rata-rata postes eksperimen 1 adalah 86,96, sedangkan eksperimen 2 adalah 78,04. Berdasarkan indeks gain ternormalisasi, diperoleh bahwa pada uji coba II terjadi peningkatan kemampuan berpikir komputasi siswa sebesar 0,25.

Kata kunci: Pembelajaran Berdasarkan Masalah, Budaya Batak, Kemampuan Berpikir Komputasi

Abstract

This research aims to determine whether there are differences in students' computational thinking with conventional problem-based learning models based on Batak culture (PBM-B3). This research is a quasi-experimental research. The model used in this research is a problem-based learning model based on Batak culture with research subjects of 46 class VIII students at SMP Advent 2 Medan. The object of this study is students' computational thinking skills in the matter of a system of two-variable linear equations (SPLDV). The results of the research show that there are differences in computational thinking abilities between students who were given learning based on problems based on Batak culture and students who were given direct learning. Descriptively, the average post-test for experiment 1 was 86.96, while experiment 2 was 78.04. Based on the normalized gain index, it was found that in trial II there was an increase in students' computational thinking abilities of 0.25 (criterion "medium").

Keywords: *Problem-Based Learning Model, Batak Culture, Computational Thinking Ability*

1. INTRODUCTION

Entering the 21st century, which is called the digital century, where technological developments are increasingly advanced and developing very rapidly. In the 21st century, some people use devices that can integrate with computers and the internet. The rapid development of technology makes all countries compete in technological development (Kemendikbud, 2013).

One of the abilities needed in the 21st century is the ability to think computationally or Computational Thinking (Wing, 2016). Computational Thinking It is not only used by computer experts, every individual needs this ability. Computational thinking is a way for someone to formulate a problem by breaking down the problem into small parts so that they are easier to manage and solve (Retnawati, 2018).

Computational Thinking first introduced by Seymour Papert in the 80s(Tekege, 2017). Then it was popularized by a professor in computer science (Wing, 2016). Computational thinking skills are the thinking processes involved in formulating problems and expressing solutions in such a way that computers, humans or machines can work effectively (Waterman, K. P., Goldsmith, L., Pasquale, 2020). In this case, CT is a skill needed to help solve problems faced by individuals in everyday life. Computational thinking skills aim to solve problems and develop solutions to solve similar problems if necessary (Kardawati, S. Suparman., dan Astutik, 2020).

However, in reality, students' mathematical computational thinking abilities still need to be considered, this can be seen from research conducted with research subjects consisting of 389 class VIII students of State Middle Schools in Ciamis Regency who came from 13 schools in the high, medium and high categories. low level (Ratna., 2017). Categorization of school levels is based on the average national mathematics exam scores in the last three years. The research results showed that of the 389 students who were research subjects, their problem solving abilities were at low criteria. Apart from that, based on research conducted by Muhammad Rijal Kamil at one of the Cikampek 1 Middle Schools, it showed that of 25 students, 48% were in the low category, 16% were in the sufficient category, and 36% were in the moderate category. in the good category (Kamil., 2021).

To determine the computational thinking abilities of the research sample, initial observations were first carried out at the research target school. From the results of initial observations carried out by researchers on Class VIII junior high school students to see computational thinking skills, it can be seen in the following picture :

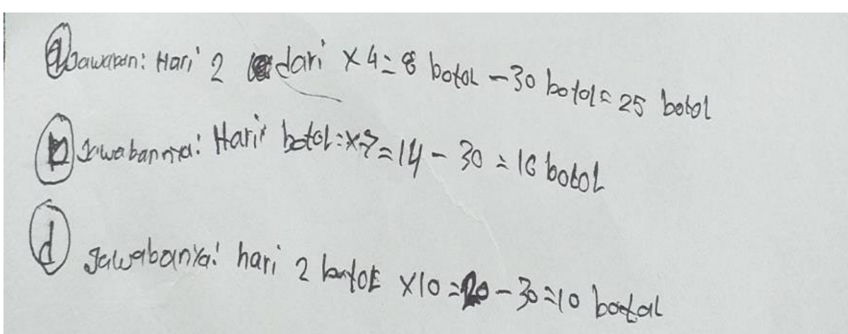

Figure 1. One of the Student Answer Results

The answer presented in Figure 1. has a very basic error, namely a calculation error at the beginning of the work. This student cannot explain the logical steps to solve the problem and cannot find a solution. For the question above, if an error occurs in the first step, then the next step may also experience an error. So that errors occur in the final results of problem solving.

Based on the results of the researcher's interview with the mathematics study teacher at Advent 2 Medan Middle School, it was stated that there were still many students who, when given questions/problems with higher thinking abilities, such as questions about the application of mathematics in everyday life, found it difficult/unable to work on these questions, so students were only given questions. -routine questions (basic understanding).

One of the materials taught in class VIII is material regarding systems of two-variable splenic equations. The material on systems of lienar equations in two variables is closely related to problems encountered every day, apart from that in the material on systems of lienar equations in two variables there are not too many special theorems that must be studied.

Previous research suggests that problem-based learning helps students to think, to solve problems and to improve their thinking abilities by building real or similar situations related to the concepts that must be learned (Basu, S., Biswas, G., Sengupta, P., Dickes., Dickes, A., Kinnebrew, J. S., Clark, 2016). Based on the results of this research, of course in problem-based learning teachers must organize the class with this model which can provide opportunities for this. In this case, teachers must strive for a teaching and learning process that shows the process of developing problem solving abilities in students.

Through the problem-based learning model, efforts to improve thinking performance are carried out systematically by focusing on the problem-solving learning process (Lubis, A., dan Harahap, 2017). Of course, activities like this will provide great opportunities for all students to carry out creative activities in learning mathematics. In this way, students will develop more in computational thinking (Muhammad, 2020).

Learning using a problem based learning model based on Batak culture provides encouragement to students not only to think concretely, but more than that to think about abstract and complex ideas (Masamah, 2017). In other words, learning using a problem based learning model based on Batak culture trains students to have the skills to understand concepts and solve problems (Happy, N. & Widjajanti, 2014). Such a learning process has a positive impact on the development of problem-solving abilities and helps students develop intellectual discipline and the skills needed to arouse curiosity and seek answers to their curiosity (Farib, P.M., Ikhsan, M., & Subianto, 2019).

This problem-based learning model is also closely related to real life, where students can express their opinions about what they know in their daily lives, habits and culture (Sinaga, 2007b). With cultural knowledge inherent in each student, it is hoped that students can further explore their knowledge to improve students' computational thinking abilities (Rakhmawati, 2016).

Indonesia has very high cultural diversity. Even more so in the North Sumatra area. Batak culture in North Sumatra is still divided, namely: Toba, Simalungun, Karo, Pakpak and Nias. However, researchers focused their research on Toba Batak culture. The researcher chose the Toba Batak culture because the research conducted at Advent 2 Middle School in Medan was predominantly Toba Batak.

The existence of differences in cultural backgrounds (multicultural culture) has an influence on the learning process. Previous research stated that there were a number of elementary schools in Kudus where the students were a mix of students of Javanese descent and ethnic Chinese descent. Students of ethnic Chinese descent only want to mix with their peers (Sinaga. C. V. R, 2020). This can be seen during the learning process when the teacher asks students to do assignments in groups (Siregar, R dan Ramadhani, 2021). Therefore, the researcher intends to open students' minds that Indonesia's diverse culture is something to be grateful for, not to be differentiated and closed off. The introduction of Toba Batak culture to non-Batak students will also make them understand that this culture is a beautiful and interesting work.

This research aims to analyze students' computational thinking abilities by applying a problem-based learning model based on Batak culture (PBM-B3), because based on the results of initial observations of students' computational thinking, it is low, which has an impact on the low initial ability test results in class VIII at Adventist Middle School. 2 Terrain.

Based on the description above, better learning efforts are being made, namely by implementing problem-based learning and mathematics learning models that can analyze the influence of students' computational thinking abilities at Advent 2 Middle School Medan. Next, research was carried out by determining the research title: "Covariance Analysis of the Influence of the Batak Culture Problem-Based Learning Model (PBM-B3) on Computational Thinking Abilities by Considering Students' Initial Abilities at Advent 2 Middle School Medan".

2. METHOD

This type of research is a quasi-experiment (quasi experiment) with the aim of finding out how to improve students' computational thinking abilities based on problem-based Batak culture (PBM-B3) with students who received regular learning (Budiyono, 2009). It is said to be a quasi-experiment because the factors that influence the research subjects cannot be completely controlled. This research was carried out at Advent 2 Medan Middle School Class VIII. This research activity was carried out in the first semester of the 2023/2024 academic year. The research sample was chosen randomly (Cluster Random Sampling) (Arikunto, 2017). To be assigned to the experimental group and control group from class VIII. The random selection stage is possible because it is based on information from the school principal and the distribution of students in each class is evenly heterogeneous. This is in accordance with opinion (Russefendi, 2006). One way to select a representative sample of the population is a simple random method, that is, if each member of the population has an equal chance of being selected.

The research procedure consists of three stages, namely: (1) preparation stage, (2) implementation stage and (3) data analysis stage.

2.1 Research Design

This research is included in quasi-experimental research. The design was carried out in three stages, namely: (1) Stage of developing learning tools and research instruments, (2) Stage of testing learning tools and research instruments, (3) Stage of carrying out experiments and data processing (Fauza, 2020). The research design used in this research is Pretest Posttest Control Group Design. Thus, this type of research is quasi-experimental research. The research design is presented in Table 1 as follows :

Table 1. Research Design

Class	Pretest	Treatment	Postes
Experiment (Problem Based Learning)	T1	X1	T2
Control (Typical Learning)	T1	X2	T2

The picture of the research procedure can be seen in Figure 2 below:

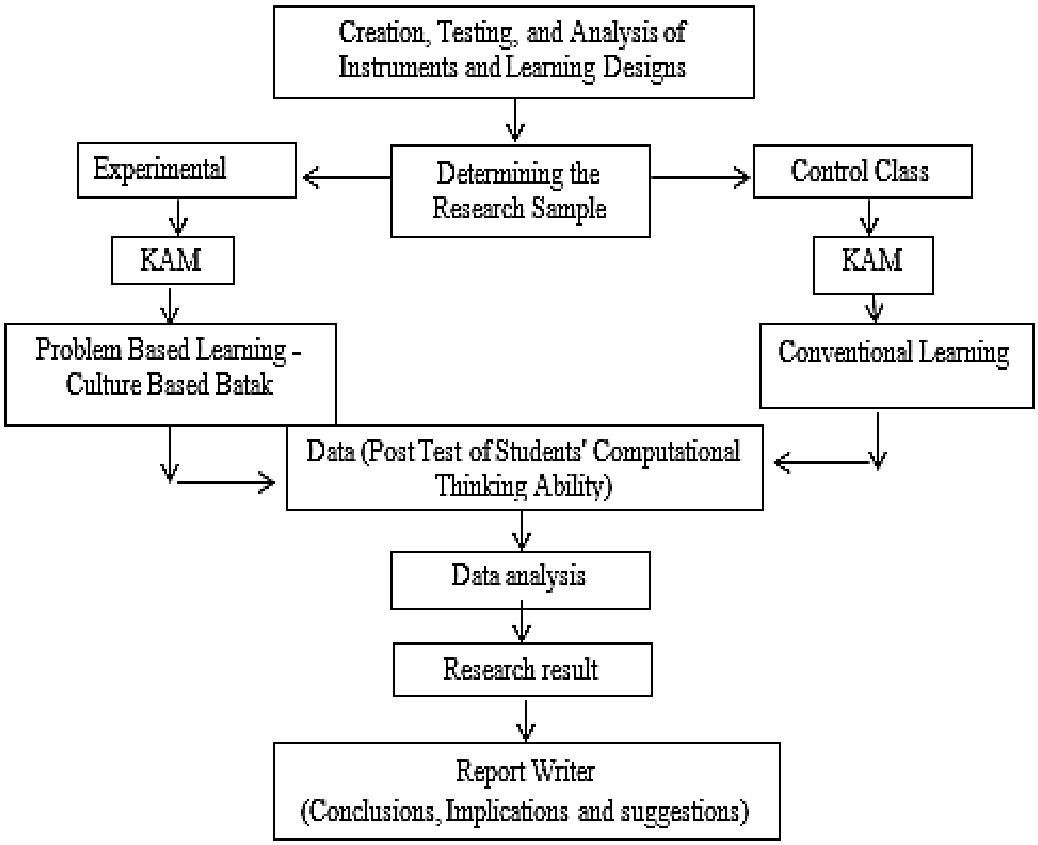

Figure 2. Research Procedure

2.2 Inferential Statistical Analysis

Inferential statistics is a technique used to analyze sample data and apply the results to the population (Sugiyono, 2015). Based on the problem formulation, it will be analyzed using ANAKOVA inferential statistics. This inferential statistical analysis is used to test the first and second hypotheses in this research. The data analyzed in this research are the pretest results (students' initial abilities) as accompanying variables and the posttest results (final abilities) as the dependent variable.

The mathematical model for covariance analysis is expressed as follows:

$$Y_{ij} = \mu + \tau_i + \beta\left(X_{ij} - \bar{X}\right) + \epsilon_{ij;}$$

$$i = 1,2,\ldots,n;\ j = 1,2,\ldots,m;$$

3. RESULTS AND DISCUSSION

The data obtained and analyzed in this research is in the form of pretest and posttest scores on students' mathematical computational thinking abilities.

3.1 Pretest Results of Students' Computational Thinking Ability

Grouping, pretest levels of computational thinking abilities can be seen in the following table:

Table 2. Pretest Assessment Categories of Mathematical Computational Thinking Ability for Students in Problem-Based Learning Classes Based on Batak Culture

No	Value Interval	The number of students	Percentage	Assessment Category
1	80 < SKBK ≤ 100	1	4,34%	Very high
2	60< SKBK ≤ 80	9	39,34%	Tall
2	40 < SKBK ≤60	11	47,82%	Currently
4	20 < SKBK ≤ 40	2	8,6%	Low
5	0≤ SKBK ≤ 20	0	0%	Very low

From the table of pre-test results on students' computational thinking skills, it is found that the number of students who got very low scores was 0 people or 0%, 2 people got low scores or 8.6%, and 11 people got medium category scores or 11 people who got low scores or 8.6%. 47.82%, 9 people with a high category score or 39.34%, and 1 person with a very high category score or 4.34%. For more details, see the following image:

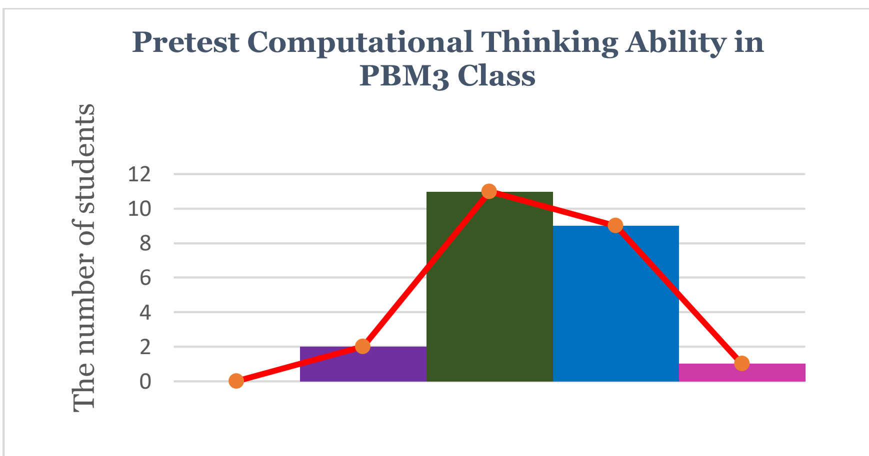

Figure 3. Number of Students in Each Category of Pretest Assessment of Computational Thinking Ability of Students in Problem Based Learning Class Based on Batak Culture

From the table, it is obtained that the average pretest percentage of students' computational thinking abilities in the problem-based learning class based on Batak culture is in the "medium" category, namely 59.70. The grouping of pretest results for mathematical computational thinking abilities in direct learning classes can be seen in the following table:

Table 3. Category of Pretest Assessment of Mathematical Computational Thinking Ability of Direct Learning Class Students

No	Value Interval	The number of students	Percentage	Assessment Category
1	80 < SKBK ≤ 100	2	8,6%	Very high
2	60< SKBK ≤ 80	10	43,47%	Tall

2	40 < SKBK ≤60	11	47,82%	Currently
4	20 < SKBK ≤ 40	0	0%	Low
5	0≤ SKBK ≤ 20	0	0%	Very low

From the pre-test table for computational thinking skills in the direct learning class, it was found that the number of students who got very low scores was 0 people or 0%, those who got low scores were 0 people or 0%, and those who got medium category scores were 11 people or 0%. 47.82%, 10 people with high category scores or 43.47%, and 2 people with very high category scores or 8.6%. For more details, see the following image:

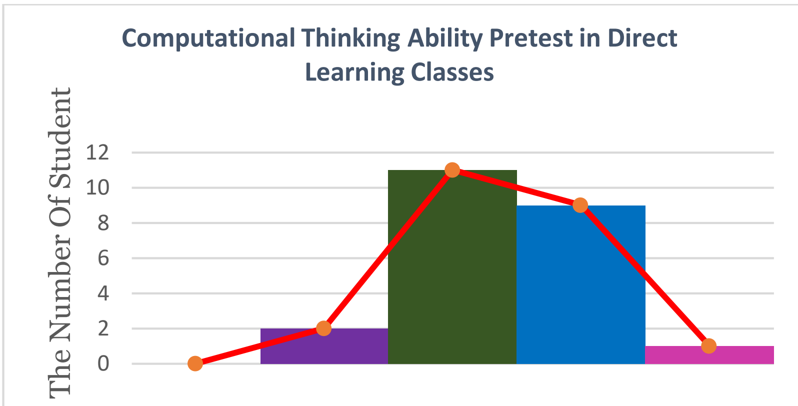

Figure 4. Number of Students in Each Category of Pretest Assessment of Computational Thinking Ability for Direct Learning Class Students

From table 3, the average pretest percentage of students' computational thinking abilities in the direct learning class is in the "medium" category, namely 6.65. The post-test grouping of mathematical computational thinking abilities can be seen in the following table.

Table 4. Posttest Assessment Categories of Mathematical Computational Thinking Ability of Students in Problem Based Learning Classes Based on Batak Culture

No	Value Interval	The number of students	Percentage	Assessment Category
1	80 < SKBK ≤ 100	14	60,86%	Very high
2	60< SKBK ≤ 80	9	39,13%	Tall
2	40 < SKBK ≤60	0	0%	Currently
4	20 < SKBK ≤ 40	0	0%	Low
5	0≤ SKBK ≤ 20	0	0%	Very low

From the post-test results table on students' computational thinking skills, it is found that the number of students who got very low scores was 0 people or 0%, those who got low scores were 0 people or 0%, and those who got medium category scores were 0 people or 0%. , who had a high category score were 9 people or 39.13%, and 14 people who had a very high category score or 60.86%. For more details, you can see in the picture the results of the post-test on students' mathematical computational thinking abilities in the problem-based learning class based on Batak culture.

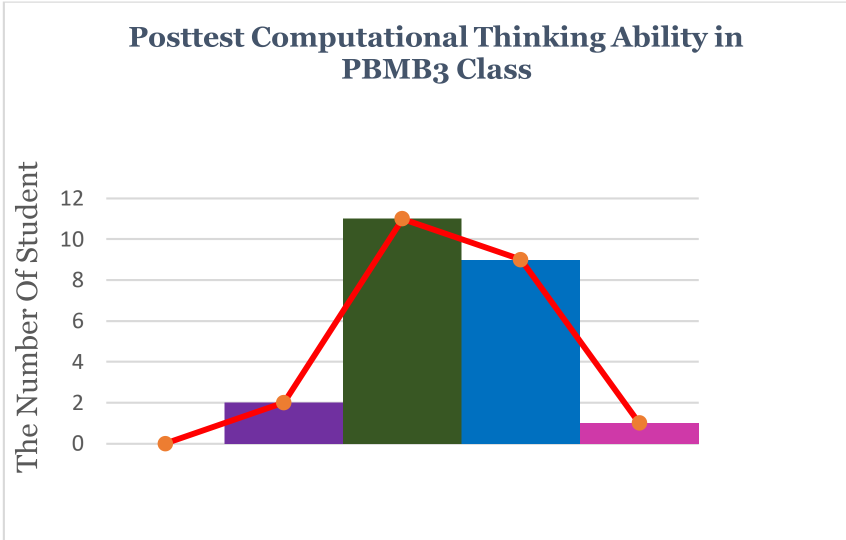

Figure 4. Number of Students in Each Post-Test Assessment Category for Computational Thinking Ability of Students in Problem-Based Learning Classes Based on Batak Culture

From table 4, the average post-test percentage of students' computational thinking abilities in the problem-based learning class based on Batak culture is in the very high category, namely 89.96. The results of the post-test on direct learning class mathematical computational thinking abilities can be seen in the following table:

Table 5. Posttest Assessment Categories of Mathematical Computational Thinking Ability of Direct Learning Class Students

No	Interval Nilai	The number of students	Percentage	Assessment Category
1	80 < SKBK ≤ 100	10	43,47%	Very high
2	60< SKBK ≤ 80	9	39,13%	Tall
2	40 < SKBK ≤60	2	8,6%	Currently
4	20 < SKBK ≤ 40	2	8,6%	Low
5	0≤ SKBK ≤ 20	0	0%	Very low

From the post-test table on computational thinking skills in the direct learning class, it was found that the number of students who got very low scores was 0 people or 0%, 2 people got low scores or 8.6%, and 2 people got medium category scores. or 8.6%, 9 people with high category scores or 39.13%, and 10 people with very high category scores or 43.47%. For more details, see the following image:

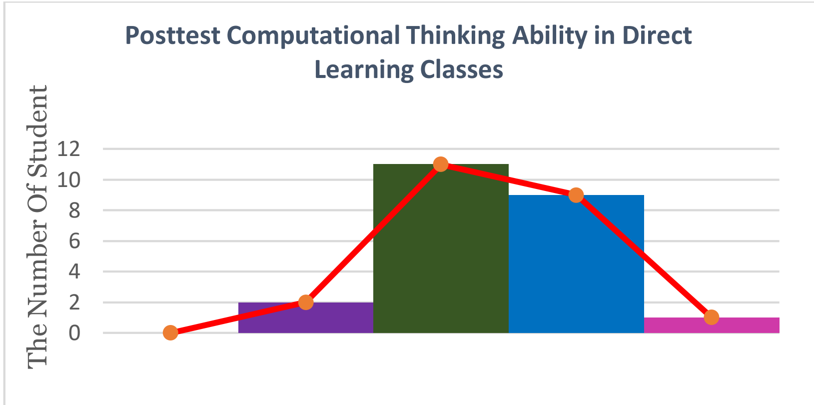

Figure 5. Number of Students in Each Category of Post-Test Assessment of Computational Thinking Ability for Direct Learning Class Students

From the table, the average post-test percentage of students' computational thinking abilities in the direct learning class is in the "medium" category, namely 78.04. In this case, for the posttest results for experimental class I and experiment 2, there is an average difference, namely experiment 1 is 89.96 and experiment 2 is 78.04. This shows that there is a difference in the average test results of students' computational thinking abilities in experimental classes 1 and 2 of 11.92.

Test the differences between the two regression models of problem-based learning classes based on Batak culture and direct learning classes using analysis of variance using F statistics. To test the differences between the two models, the following hypothesis is formulated:

$H_o : \theta_1 = \theta_3$ dan $\theta_2 = \theta_4$ (both regression models are the same)
$H_o : \theta_1 \neq \theta_3$ dan $\theta_2 \neq \theta_4$ (the two regression models are not the same)

The results of calculating the difference test and coefficient of commutation thinking ability of students in learning classes based on Batak culture-based problems and direct learning using SPSS 16 are briefly described in the following table:

Table 6. Covariance Analysis for Alignment of Two Computational Thinking Ability Regression Models

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6332.533	1	6332.533	94.677	.132
	Residual	2942.967	44	6.886		
	Total	9275.500	45			
a. Dependent Variable: POSTES						
b. Predictors: (Constant), PRETES						

Table 7. Covariance Analysis of the Similarity of Two Regression Models on Students' Computational Thinking

Coefficients[a]						
Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	24.351	6.097		3.994	.000

PRETES	.951	.098	.826	9.730	.132
a. Dependent Variable: POSTES					

From the ANAKOVA or F test, for computational thinking skills, problem-based learning model classes based on Batak culture and direct learning model classes were obtained F* = 3,994 based on the table F, For $a = 5\%$ obtained $F_{(1-a;n-2)} = F_{(0,95;1;21)}$. Because F* < $F_{(0,95;1;21)}$ and the probability is smaller than 0.05 then H0 is rejected and Ha is accepted. This means that the two linear regression models are not the same or different.

Based on the research results presented previously, it shows that there is an influence on students' computational thinking abilities between students who are given problem-based learning based on Batak culture and direct learning. The results of this research are strengthened by the findings (Sinaga, 2007a) shows with a problem-based learning model based on Batak culture that the percentage of many students who have a minimum level of mastery is 90% of the 40 students who took the test. This percentage shows students' achievement of classical learning completeness. Interesting things also found in this research are that the learning strategy using the Dalihan Na Tolu social interaction pattern can change students' learning behavior from previously passively receiving knowledge to actively collaborating, discussing, asking questions with friends and helping each other solve problems. So that students get used to capturing and analyzing the results of their friends' thoughts.

Then continued with research by (Gozali, I., Syamsuri., Nindiasari, H., & Fatah, 2022) shows that the test results for the level of students' computational thinking abilities using the Problem Based Learning (PBL) learning model, the most dominant level of students' computational thinking abilities is in the medium category. So it can be said that the learning process is carried out well according to the indicators of computational thinking ability.

Furthermore, the results of the analysis of the computational thinking ability test can be concluded that students with high abilities can be categorized as good in each indicator. The highest achievement was in the abstraction indicator at 97.5% and the lowest was in the pattern recognition indicator at 50% (Ali, D., Nurhanurawati., Noer, 2022). In contrast to the findings by (Nuraisa, D., Azizah, A.N., Nopitasari, 2019) that students are only able to reach the decomposition and pattern recognition stages. Students still have not evaluated the results of their work in solving problems.

There are several indicators of students' computational thinking abilities, namely decomposition, pattern recognition, algorithmic thinking, pattern generalization and abstraction. Decomposition refers to the skill of breaking down complex problems into simpler problems (Angelia, C., Voogt, J., Fluck, A., Webb, M., Cox, M., Malyn-Smith, J., 2016). (Bernard, 2015) defines problem decomposition as a way of thinking about components or parts. These parts can then be understood, completed, developed, and evaluated separately. This makes complex problems easier to solve, new situations easier to understand, and large systems easier to design. In other words, reducing the complexity of a problem makes understanding easier (Sinaga. C. V. R, 2020). This indicator is also always used in solving mathematical problems, especially questions with high-level thinking skills. When describing a problem, the data is converted into a simpler form, so that it is not too complicated. Therefore, the ability to present data, represent data, and read data correctly is required.

In pattern recognition, there is grouping of sets of objects, tasks, or information (Asbell-Clarke, J., Rowe, E., Almeda, V., Edwards. T., Bardar, E., Gasca, S., Baker, R.S., Scruggs, 2021). Pattern recognition is also closely related to data representation capabilities (Waterman, K. P., Goldsmith, L., Pasquale, 2020). When the data has been presented optimally, it will be easier to see the patterns. In-depth learning analysis is necessary regarding the patterns that emerge among students compared to existing patterns that are expected to emerge (Basu, S., Biswas, G., Sengupta, P., Dickes., Dickes, A., Kinnebrew, J. S., Clark, 2016). Patterns are general representations of mathematics. Mathematics is sometimes defined as the science of patterns.

Algorithmic thinking means finding solutions (Das, K. P., & Wilkinson, 2017). This indicator defines procedures that can be reused to solve a series of problems (Asbell-Clarke, J., Rowe, E., Almeda, V., Edwards. T., Bardar, E., Gasca, S., Baker, R.S., Scruggs, 2021). Additionally, this indicator requires problem-solving skills related to designing a step-by-step solution to a problem and, therefore, differs from coding (Selby, C., Dorling, M., Woolard, 2015). To solve problems requires planning problem solving procedures before moving on to solving the problem.

Generalization is related to concluding that this component is the key to solving and failing a problem. Generalization can only take place well if other processes are carried out correctly. The description of the indicators above is still general and can be used in many subjects. One strategy to improve computational thinking skills is to apply learning models. Theoretically, problem-based learning based on Batak culture has several advantages compared to direct learning, which if these advantages are maximized in classroom implementation, it is very possible for the learning process to be better.

4. CONCLUSION

Based on the results of data analysis and research findings during learning based on problems based on Batak culture with an emphasis on computational thinking skills, the researchers reached the following conclusions: There are differences in computational thinking abilities between students who were given learning based on problems based on Batak culture and students who were given direct learning. Descriptively, the average of the first and second experimental posttests was different. The n-gain value of the students' computational thinking ability test results in the first experimental class was higher than in the second experimental class so there was a difference in the increase in computational thinking ability in the first and second experimental classes.

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