Integrated Science Education Journal
Vol. 5, No. 2, May 2024, pp. 82~90
ISSN: 2716-3725, DOI: 10.37251/isej.v5i2.985

The Effect of Problem Based Learning (PBL) Model Based on Local Wisdom to Improve Students' Critical Thinking Skills

Sri Anika Cahayu[1], Jodion Siburian[1], Afreni Hamidah[1]
[1]Department of Science Education, Science Education, Universitas Jambi, Jambi, Indonesia

Article Info

Article history:

Received Feb 23, 2024
Revised Apr 02, 2024
Accepted May 20, 2024
OnlineFirst May 31, 2024

Keywords:

Critical thinking skills
Local wisdom
Problem based learning

ABSTRACT

Purpose of the study: The purpose of this study was to determine the effect of problem-based learning (PBL) model based on local wisdom in making lemang kancung beruk to improve students' critical thinking skills.

Methodology: The research method is a quasi-experimental form of non-equivalent pretest-posttest control group design with non-probability sampling technique-purposive sampling. The data collection techniques used critical thinking skills tests with FRISCO indicator essay tests and observation sheets. Technical data analysis used Analysis of covariance (Ancova) test and quantitative descriptive approach used SPSS 20 program.

Main Findings: The research results of the Ancova hypothesis test show that the corrected model sig value is 0.000 <0.05, then H_0 is rejected and H_1 is accepted, This means that the problem-based learning (PBL) model based on local wisdom in making lemang *kancung beruk* has a significant and moderate effect on improving students' critical thinking skills.

Novelty/Originality of this study: The novelty of this research is the implementation of problem-based learning (PBL) model based on local wisdom of Kerinci-Sungai Penuh area in science learning. The limitations in the study are the competencies measured in the integrated essay test and the subject matter is the science material of substances and their changes in class VII.

Corresponding Author:
Sri Anika Cahayu,
Department of Science Education, Science Education, Universitas Jambi, Jambi, Indonesia
Jl. Raden Mattaher No.21, Jambi City, Jambi 36123
Email: sricahayu61@guru.smp.belajar.id

1. INTRODUCTION

Indonesia is a developing country, in line with this, various fields need to be optimized, one of which is education. In the 21st century, education is the most important part as a place to improve the quality of human resources [1]. The world of education is required to be able to implement 21st century learning [2]. The 21st century learning system is a learning where the curriculum developed requires schools to change the learning approach [3]. The curriculum of independent learning comes as an answer to the tight competition of human resources globally in the 21st century [4]. The new essence of the independent curriculum refers to the local content approach, which is adapted to include cultural elements or the potential of regional local wisdom [5]. The 21st century learning strategy embraces critical thinking learning, problems to get solutions and the end result in the form of products that emphasize project-based and problem-based learning [6].

Many competencies are required to be mastered in 21st century learning. The competencies that need to be mastered are 4C, namely critical thinking, collaboration, communication, and creativity [7]. In fact, in the field, the ability of 4C is not optimal, the impact of non-optimal 4C ability can cause students to be less able to

master the material. One of the most visible of the 4C abilities in everyday life that has not been optimized is critical thinking. Critical thinking is one of the 4C competencies of the various competencies needed in the 21st century [8]. Therefore, it is necessary to train critical thinking skills, especially those related to local content so that they can solve real-life problems.

Based on the results of observations of researchers at Junior high school 6 Sungai Penuh. 4C thinking skills, especially critical thinking, are still not optimal. This can be seen when given a problem to students, students have not been able to fully focus, have not been able to provide reasons, inference, understand the situation, explain conclusion and overview. That is what affects student scores which are classified as low. Efforts can be made to train critical thinking skills, one of which is by familiarizing students to solve problems. The problem-based learning (PBL) learning model can be used as an alternative to train students' critical thinking skills.

The PBL model is a problem-based learning model that emphasizes real problems that encourage students how to learn and how to collaborate and interact in groups to solve the problems they face [9]. This is supported by Astuti's research (2019) that the learning model that can improve critical thinking skills is the PBL model [10]. As for local content so that learning material is more contextualized, changing abstract material to be more real, local wisdom bases can be used. This is because the problem-based learning model provides problems related to solving real-life problems [11]. This is in line with Avitrananda's research (2020), which states that the implementation of PBL based on local wisdom can improve critical thinking skills, because students have prior knowledge about the local wisdom of the area, so that students become active in the learning process and students can think critically [12].

The local wisdom taken in this study is the making of lemang kancung beruk, which is wrapped using a semar bag (Nepenthes sp) which is served at the kenduri sko traditional event [13]. Lemang *kancung beruk* is the local wisdom of the Kerinci region which is a specialty of the Lempur area from glutinous rice wrapped in a semar bag (Nepenthes sp), this food has been passed down from generation to generation and is usually eaten using crimson sauce [14]. The genus Nephentes has several species based on their different characteristics and morphological characteristics, namely *Nephente gracilis, Nephente mirabilis, Nephentes rafflesiana* and *Nephentes ampullaria* [15]. Not all types of Nephentes can be used as a container for lemang *kancung beruk,* only the genus *Nephentes ampullaria* which is flask-shaped or ovoid can be used as a container for making lemang *kancung beruk*. Lemang is identical to being cooked in bamboo and then burned [16]. However, lemang *kancung beruk* has a difference, the way to wrap this lemang is unique because it uses a semar bag and then cooked by steaming. Lemang *Kancung Beruk* was chosen because the process of making lemang is closely related to the science of substances and their changes in class VII junior high school regarding the form of substances from ingredients, changes in the form of substances and physical and chemical changes in the process of making lemang *kancung beruk.*

Based on this background, it is necessary to conduct research to see how the effect of problem-based learning (PBL) model based on local wisdom in making lemang *kancung beruk* to improve students' critical thinking skills. Therefore, researchers are interested in conducting research with the title "The Effect of Problem Based Learning (PBL) Model Based on Local Wisdom to Improve Students' Critical Thinking Skills". The urgency of this research is that it can improve students' critical thinking skills and can also preserve and introduce the local wisdom of the local area which is almost lost to the next generation.

2. RESEARCH METHOD

This research method is a quasi-experimental type of non-equivalent form with prettest and posttes control group design. The population in this study were all students of junior high school 6 Sungai Penuh, the research sample was class VII and the research subjects were class VII A and VII B with a total of 36 students, 18 students each from class VII A as an experimental class and class VII B as a control class. The sampling technique in the study was purposive sampling.

Table 1. Pretest-Posttest Control Group Desain

Class	Pretest	Treatment	Postest
Experimental	T_1	X	T_2
Control	T_3	-	T_4

The data collection techniques used critical thinking skills tests with FRISCO indicator essay tests and observation sheets. According to Ennis' theory (2011) critical thinking indicators are classified into five parts, which are abbreviated as FRISCO: F (Focus), R (Reason), I (Inference), S (Situation), C (Clarity), O (Overview) [17]. Student critical thinking skills score categories in Table 2. The instruments in the study consisted of two essay tests and observation sheets for the implementation of the syntax of the learning model that had been validated by a professional lecturer. The lattice of critical thinking skills in Table 3.

Technical data analysis used Analysis of covariance (Ancova) and quantitative descriptive approach used SPSS 20 program. Analysis of Covariance (Ancova) is a statistical method that combines the principles of analysis of variance (Anova) with control variables referred to as covariates. The purpose of Ancova is to compare the means of two or more groups, controlling for the influence of one or more selected covariate variables. Covariate variables are variables that are believed to have a potential influence on the dependent variable, but are not included in the research design as independent variables [18]. Ancova data analysis has prerequisite tests which are the normality test, homogeneity test, and linearity test. Ancova test criteria if the sig> 0.05 then H_0 is accepted, which means there is no effect of problem-based learning (PBL) model based on local wisdom to improve students' critical thinking skills and if the sig <0.05 then H_0 is rejected, which means there is an effect of the problem-based learning (PBL) model based on local wisdom to improve students' critical thinking skills.

Table 2. Category of Student Critical Thinking Skills Score

Interval Value	Category
80-100	Very Critical
60-79	Critical
40-59	Quite Critical
20-39	Less Critical
0-19	Uncritical

Table 3. Critical Thinking Skills Question Grid

Critical thinking indicators	Indicator question		Question
F (*Focus)*	1.1	Describe the characteristics of the form of substances appropriately	1
Focusing the question or issue identify information and problems	1.2	Comparing the states of matter of the objects presented	2
R (*Reason*)	2.1	Argue the types of changes in the form of substances	3
Analyzing arguments, express an opinion based on relevant facts or evidence	2.2	Provide arguments about changes in the form of substances from the examples of changes presented	4
I *(Inference*)	3.1	Conclude the types of changes in the form of substances.	5
Make a reasoned or convincing conclusion	3.2	Summarize the characteristics of the results of substance changes.	6
S (*Situation)*	4.1	Comparing experimental results of examples of changes in substances	7
understand the situation in thinking, use information that is appropriate to the problem	4.2	Categorize the chemical changes of a substance from the displayed problem	8
C (*Clarity*)	5.1	Provide further explanation of the concept of substance density	9
Provide further explanation of the meaning or terms used.	5.2	Provide further explanation of the principle of substance density	10
O (*Overview*)	suring the density of a substance		11
Reviewing, checking, or correcting the problem results thoroughly	e decisions on the results of experiments on lensity of substances		12

3. RESULTS AND DISCUSSION

This research was conducted at junior high school 6 Sungai Penuh, Jambi in the first semester of the 2023/2024 school year in class VII. The implementation of this research takes place for 4 meetings with the same material, namely substance and its changes.

3.1. Data on Critical Thinking Skills

The results of the experimental class critical thinking skills percentage in Figure 1 show an increase in pretest and posttest scores. The very critical category from pretest to posttest 0% to 83.33%, critical category 0% to 16.67%, quite critical 77.78% to 0%, less critical 22.22% to 0% while the lowest 0% in the uncritical category. This shows an increase in critical thinking skills with the treatment of PBL models based on local wisdom.

The results of the acquisition of the percentage of critical thinking skills of the control class in Figure.2 also have an increase from pretest to posttest scores. The category is very critical from 0% to 16.67%, and the highest category is critical in the posttest score of 77.78% from the pretest score of 0%, quite critical 66.67% to 5.56%, less critical 27.78% to 0%, while the lowest in the category is not critical 0%. This also shows that there is an increase in critical thinking skills with the direct learning (DL) learning model.

Based on the KBK criteria in Figure.1 and Figure.2, it shows that both learning models have increased critical thinking skills from pretest and posttest scores. However, the comparison between the two learning models applied, shows that the experimental class of the PBL model based on local wisdom in making lemang kancung beruk is very critical category than the direct learning (DL) model.

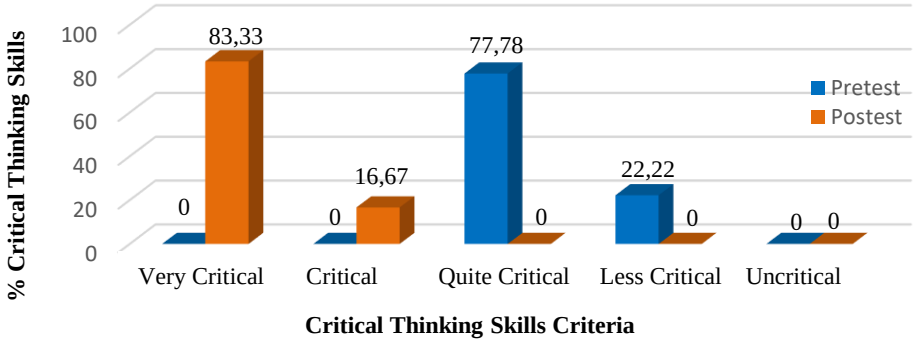

Figure 1. Category Diagram of KBK Experimental Class

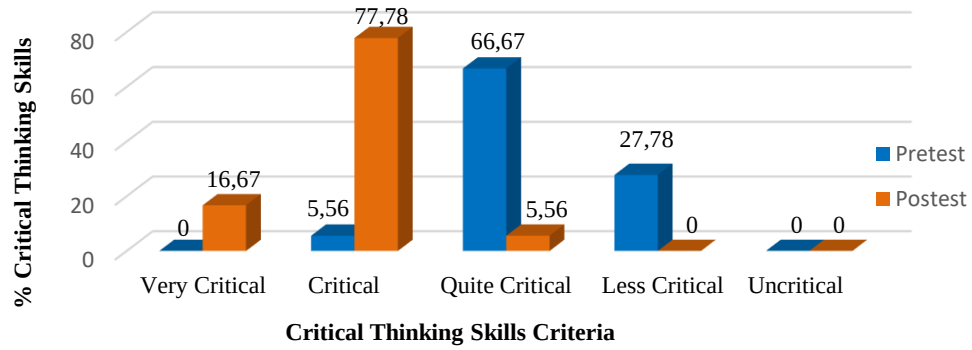

Figure 2. Category Diagram of KBK Control Class

3.2. Data Analysis Prerequisite Test

3.2.1 Pretest Data Analysis

Based on the data normality test Table.3 obtained pretest control class value sig. = 0.171 (columnogorov-smirnov test). The value of 0.171>0.05 means that the pretest control class data comes from a normally distributed population. While the sig. value of the experimental class pretest 0.096>0.05 means that the experimental class pretest value is normally distributed. So it can be concluded that the pretest data of both classes comes from a normally distributed population.

Table 4. Prestest Data Normality Test Results

Class		Test of Normality Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
Class VII- B	Control	.172	18	.171
Class VII-A	Experiment	.187	18	.096

Based on data calculations with SPSS Table.4, the significance value (sig) based on the mean, median, median and df and the average of the pretest data values of the control and experimental classes is greater than the α value (0.05) with a mean sig value of 0.518>0.05, median sig = 0.457>0.05, median and df sig value 0.457>0.05 and based on the average sig value 0.520>0.05, so it can be concluded that both variances are homogeneous.

Table 5. Pretest Homogeneity Test Results

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Data Pretest	Based on Mean	.426	1	34	.518
	Based on Median	.567	1	34	.457
	Based on Median and with adjusted df	.567	1	33.303	.457
	Based on trimmed mean	.423	1	34	.520

Table 6. Linearity Test Results of Pretest Data

			Sum of Squares	Df	Mean Square	F	Sig.
Class * Data Pretest	Between Groups	(Combined)	.858	7	.123	.422	.880
		Linearity	.003	1	.003	.009	.924
		Deviation from Linearity	.856	6	.143	.490	.810
	Within Groups		8.142	28	.291		
	Total		9.000	35			

Based on the results of data processing with SPSS in Table.5, the sig value is greater than the α value of 0.05 or 0.810> 0.05, so the relationship between the control class pretest data variables and the experimental class is linear.

3.2.2 Postest Data Analysis

Based on the data normality test in Table.6, the sig value of the posttest control class = 0.182 (columnogorov-smirnov test). The value of 0.182>0.05 means that the posttest control class data comes from a normally distributed population. While the sig. value of the experimental class postest 0.146>0.05 means that the experimental class postest value is normally distributed. So it can be concluded that the postest data of both classes comes from a normally distributed population.

Table 7. Posttest Data Normality Test Results

Kelas		Test of Normality Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
Class VII- B	Control	.182	18	.119
Class VII-A	Eksperimen	.146	18	.200*

Table 8. Posttest Homogeneity Test Results

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Data Postest	Based on Mean	2.431	1	34	.128
	Based on Median	2.291	1	34	.139
	Based on Median and with adjusted df	2.291	1	31.615	.140
	Based on trimmed mean	2.632	1	34	.114

Based on data calculations with SPSS Table.7, the significance value (sig) based on the mean, median, median and df and the average of the posttest data values of the control and experimental classes is greater than the α value (0.05) with a mean sig value of 0.128>0.05, median sig 0.139>0.05, median and df sig value 0.140>0.05 and based on the average value sig 0.114>0.05, so it can be concluded that both variances are homogeneous.

Table 9. Linearity Test Results of Postest Data

			Sum of Squares	df	Mean Square	F	Sig.
Kelas * Data Postest	Between Groups	(Combined)	6.943	10	.694	8.438	.000
		Linearity	5.390	1	5.390	65.501	.000
		Deviation from Linearity	1.553	9	.173	2.097	.070
	Within Groups		2.057	25	.082		
	Total		9.000	35			

Based on the results of data processing with SPSS above, it appears that the sig value is greater than the α value of 0.05 or 0.070> 0.05, so the relationship between the control class posttest data variables and the experimental class is linear. Judging from the analysis of the prerequisite tests of normality, homogeneity and linearity tests of pretest and postest data, the Ancova hypothesis test is fulfilled.

3.2.3 Hypothesis Test

The ancova test is used to test whether there is a difference in the average critical thinking skills of students from 2 classes, namely the control class with the direct learning (DL) learning model and the experimental class PBL model based on local wisdom in making lemang kancung beruk. Analysis of the average pretest and posttest results with covariates is the pretest score can be seen in Table.9.

Table 10. Results of Ancova Hypothesis Test

Tests of Between-Subjects Effects

Dependent Variable: Postest Kemampuan Berpikir Kritis

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2799.755[a]	2	1399.877	24.957	.000	.602
Intercept	4638.096	1	4638.096	82.688	.000	.715
Pretest	14.554	1	14.554	.259	.614	.008
Learning Model	2777.386	1	2777.386	49.515	.000	.600
Error	1851.022	33	56.092			
Total	231593.445	36				
Corrected Total	4650.776	35				

a. R Squared = .602 (Adjusted R Squared = .578)

Based on Table.9. SPSS output of Ancova test shows that the sig value for the learning model = 0.000, which means it is smaller than the α value of 0.05 or the sig value of 0.000 <0.05, so it can be concluded that H_0 is rejected and H_1 is accepted, which means that the application of problem-based learning (PBL) model based on local wisdom in making lemang kancung beruk has a significant effect on students' critical thinking skills. This statement indicates that the Ancova assumption has been met.

In accordance with Table.9, the effect size test uses the Ancova test which is seen in the Corrected Model column which is known to be Partial Eta Squared of 0.600 with a Sig. value of 0.000. This shows that the local wisdom-based PBL learning model has a moderate effect on students' critical thinking skills. In line with the opinion of Cohen (2002), if the effect size measurement number ranges from 0.51-1.00, it means that it has a moderate effect size [20].

The results of the Ancova hypothesis statistical test obtained that the sig value = 0.000, which means it is smaller than the α value of 0.05 or the sig value of 0.000 <0.05, H0 is rejected and H1 is accepted so it can be concluded that there is a significant difference between the effect of the use of PBL models based on local wisdom on making lemang kancung beruk on students' critical thinking skills. The increase in students' critical thinking skills in the local wisdom-based PBL model is supported by several theories that reveal some of the advantages of the local wisdom-based PBL model over other learning models, namely problem orientation by presenting several cases and phenomena at the beginning of learning, students deepen knowledge about what is already known and what needs to be known to solve the cases presented, the emphasis of learning is completed through group work as an increase in student experience in cooperation activities and relationships in groups. [21]. In addition, the PBL model that is associated with the use of local local wisdom in the manufacture of lemang kancung beruk junior high school science material substances and their changes can increase knowledge, increase learning outcomes of students' critical thinking skills. This is because local wisdom-based learning is oriented towards the integrity of the culture or traditions of the community, more contextualized in learning materials [22].

The things that cause PBL models based on local wisdom are better in improving students' critical thinking skills than learning with direct learning (DL) models, namely problem-based learning models emphasize real-world problems as a context for students to learn about critical thinking and problem-solving skills, local wisdom-based learning makes students more active and easy to interact because it is close to the concept of learning and the surrounding environment. In addition, the material presented is not far from what is often seen or done in everyday life, so that it can provide new experiences in learning. This is also in line with Kartika's research (2022), that critical thinking skills using the wisdom-based PBL model provide a significant difference in influence compared to learning in students who use other learning models [23]. The results of other studies also show that the application of PBL plays an important role in improving student skills which is identical to involving students actively tends to encourage students to improve their critical thinking skills [24].

The results of essay questions using six indicators of students' critical thinking skills according to Ennis (2011), which is the FRISCO indicator, obtained the average percentage of posttest indicators of critical thinking skills [17]. The percentage diagram (%) of critical thinking skill posttest indicators shows that the results of the experimental class FRISCO indicators are higher than the control class. The results of data analysis show that the highest critical thinking skills facts on the FRISCO indicators of the experimental class are on the focus and reason indicators (93%), the high focus and reason indicators in the study were influenced by the readiness and proficiency of the teacher to turn on the learning atmosphere to stay focused and interested. In addition, the high percentage of mastery of students' KBK questions on focus and reason indicators can be caused by several factors including the application of learning strategies that are in accordance with student needs, learning based on local wisdom, learning innovations utilizing technology and material substances and their changes related to everyday life [25]. According to Nur (2023), the focus and reason indicators can be improved in the local wisdom-based PBL learning process at the problem orientation stage and the stage of organizing students in learning [26].

The next critical thinking skills indicator is followed by inference and situation (89%), inference is that students are able to conclude the results of observations from an experiment, consisting of making reasonable and convincing conclusions. In the application of the local wisdom-based PBL model in the experimental class, the inference indicator is given a discourse in the form of learner worksheet, students are asked to completelearner worksheet in groups, concluding the results of observations. According Nur (2023) This indicator can be improved in the learning process of PBL based on local wisdom at the stage of developing individual or group experiences [26].

The situation indicator is the ability of students to predict the results of observations on an experiment [27]. This indicator is presented by understanding the situation of the state of mind to help clarify the case or problem through understanding the relevant terms and parts. In line with Lidiawati (2022) that the situation indicator is the ability to predict the results of observations [28]. The application of the local wisdom-based PBL model in the experimental class, the situation indicator is carried out by the teacher by explaining the experiment, observation or field situation visited, students will predict the results of observations related to substance material and its changes in making lemang *kancung beruk*.

The last two indicators are clarity (85%) testing students' ability to identify types of substance changes, and overview (81%) emphasizing the ability of students to be able to verify, make decisions or conclusions as a whole from what they think. In applying the PBL model based on local wisdom in the experimental class, the clarity indicator makes observations, observations in the field, classifies the types of changes in substances from what is observed and then presents. While overview, question and answer, discussion about what was presented, and making conclusions from decisions thoroughly related to the material.

The overview indicator has the lowest score of the six indicators. This is due to several factors including overview seen from the learning syntax in the closing stage, where student focus and concentration are reduced. Another factor is that some students do not carry out checking and checking activities from start to finish. So that some experience problems in making decisions or conclusions as a whole from what is observed. In addition, students' memory capacity to remember learning from four meetings is limited, they remember more sub-chapters than the whole at once. This is in line with Setiana's research (2020), showing that the overview indicator is the lowest indicator of FRISCO, the reason is because based on the questionnaire analysis of the overview of the FRISCO critical thinking skills indicators in her research, students understand the material subchapters more than the material as a whole or make a comprehensive decision from what is done [29].

The high criteria for students' critical thinking skills in the experimental class in the very critical category were also influenced by several factors, including the implementation of the local wisdom-based Problem-based learning (PBL) learning model which was well implemented based on the observers' observations. Observation is one way to see the implementation of the learning model of teacher and student activities in the learning process [30]. So that critical thinking skills are very important in the learning process because this ability provides opportunities for students to learn through problem solving by connecting some knowledge with real life concepts [31]. The novelty of this research is the implementation of problem-based learning (PBL) model based on local wisdom of Kerinci-Sungai Penuh area in science learning. The limitations in the study are the competencies measured in the integrated essay test and the subject matter is the science material of substances and their changes in class VII.

4. CONCLUSION

The conclusion in this study is that there is an effect of the local wisdom-based Problem Based Learning model to improve students' critical thinking skills. The results of data analysis using Ancova test significance corrected model sig 0.000 < 0.05, so it can be concluded that H_0 is rejected and H_1 is accepted, which means that the application of problem-based learning (PBL) model based on local wisdom in making lemang kancung beruk

has a significant and moderate effect on students' critical thinking skills seen from the results of the effect size test with a sig value of 0.600 > 0.000. This statement indicates that the Ancova assumption has been met.

ACKNOWLEDGEMENTS

The author would like to thank the Head of junior high school 6 Sungai Penuh Yafri Juned, M.Pd who has allowed and given flexibility to researchers to research students so that it can be useful for the implementation of learning in the future. Thank you also to the observer teachers Mrs. Revny Natalia, S.Si and Mr. Amperianadi, S.Pd and the documentation team from the school Mrs. Leni Hestusi, S.Kom and Mr. Fakhruddin, S.Sos who have helped the implementation of this research. Thank you to all parties involved in this research who cannot be mentioned one by one.

REFERENCES

[1] R. Husain and A. Kaharu, "Facing the 21st Century: Challenges for Early Childhood Education Teachers in Bone Bolango District,"*Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, vol. 5, no. 1, pp. 85–92, May 2021, doi: 10.31004/obsesi.v5i1.527.

[2] F. Kiraga, "Literature Review: Efforts To Improve Creative Thinking Ability In Science Learning," *Integrated Science Education Journal*, vol. 4, no. 2, pp. 77–83, May 2023, doi: 10.37251/isej.v4i2.330.

[3] S. Senjawati, "The Classroom Teacher's Role in Improving Students' Understanding of Science Learning through Ethnoscience-Based Learning". *Integrated Science Education Journal*, vol. 1, no. 2, pp. 46–50, May 2020, doi: 10.37251/isej.v1i2.78.

[4] E. A. M. Castro, "Analysis of Problem Solving Ability of First Middle School Students in Learning Science," *Integrated Science Education Journal*, vol. 4, no. 2, pp. 43–53, May 2023, doi: 10.37251/isej.v4i2.329.

[5] N. Nurdeni, Y. B. Bhakti, E. Alfin, G. Marhento, and P. Purwanti, "Ability of Junior High School Students with Ethnoscience Learning," *Jurnal Pendidikan dan Konseling*, vol. 4, no. 3, pp. 9779–9807, 2022. doi: 10.31004/jpk.v4i3.2343.

[6] F. P. N. Fahrozy, D. M. Irianto, and D. T. Kurniawan, "Ethnoscience as a Contextual and Environmental Learning Effort for Primary School Learners," *Edukatif : Jurnal Ilmu Pendidikan*, vol. 4, no. 3, pp. 4337–4345, May 2022, doi: 10.31004/edukatif.v4i3.2843.

[7] B. Trilling and C. Fadel, *Partnership for 21st Century Skills* , 1st ed. United Stated of Amerika: Jossey Bass, 2012.

[8] S. Zubaidah, "21st Century Skills: How to Teach and Assess them," Biology Education FKIP Riau Islamic University, 2018.. doi: 10.31004/reseach.v4i3.456.

[9] R. A. Utami and S. Giarti, "The Effectiveness of Problem Based Learning (PBL) and Discovery Learning Models in View of Critical Thinking Skills of 5th Grade Students," *PeTeKa (Jurnal Penelitian Tindakan Kelas dan Pengembangan Pembelajaran)*, vol. 3, no. 1, pp. 1–8, 2020, doi: 10.31604/ptk.v3i1.1-8.

[10] T. P. Astuti, "Problem Based Learning Model with Mind Mapping in 21st Century Science Learning," *Proceeding of Biology Education*, vol. 3, no. 1, pp. 64–73, Sep. 2019, doi: 10.21009/pbe.3-1.9.

[11] K. Hadi, D. Dazrullisa, H. Hasruddin, and B. Manurung, "The Effect of Teaching Materials Based on Local Value Integrated by Character Education through PBL Models on Students' High Order Thinking Skill," *Britain International of Humanities and Social Sciences (BIoHS) Journal*, vol. 1, no. 2, pp. 213–223, Oct. 2019, doi: 10.33258/biohs.v1i2.54.

[12] K. S. Avitrananda, M. Kusuma, and M. A. Fatkhurrohman"Implementation of Problem Based Learning Based on Local Wisdom of Kaligua Tea Plantation in Improving Students' Critical Thinking Ability," *JPMP: Jurnal Pendidikan MIPA Pancasakti*, vol. 4, no. 2, pp. 114–122, 2020, doi: 10.31604/jpmp.v3i1.2345.

[13] J. Mutiara and L. Fridayati, "A Study of Lemang Kancung Beruk in Dusun Baru Village, Lempur, Kerinci Regency," *Jurnal Pendidikan Tata Boga dan Teknologi*, vol. 3, no. 1, pp. 75–80, 2022, doi: 10.2403/80sr379.00.

[14] A. Helida, Z. EAM, H. Hardjanto, Y. Purwanto, and A. Hikmat, "The Ethnography of Kerinci," *KOMUNITAS: International Journal of Indonesian Society and Culture*, vol. 7, no. 2, pp. 283–296, 2015, doi: 10.15294/komunitas.v7i2.4837.

[15] N. Lestariningsih and D. Setyaningsih, "Explorative study of tropical pitcher plants (Nepenthes sp.) types and insects that trapped inside in Sebangau National Park Palangka Raya Central Kalimantan," in *Journal of Physics: Conference Series*, Institute of Physics Publishing, 2017. doi: 10.1088/1742-6596/795/1/012062.

[16] E. S. Sari and Hudaidah, "Eid Traditions in Kemang Village, Musi Banyuasin Regency, South Sumatra," *JURNAL SAMBAS (Studi Agama, Masyarakat, Budaya, Adat, Sejarah)*, vol. 3, no. 2, pp. 172–180, 2021, doi: 10.15674/sambas.v7i2.4567

[17] R. H. Ennis, *The Nature of Critical Thinking : An Outline of Critical Thinking Dispositions and Abilities.* Champaign University of Illinois, 2011.

[18] H. Hair, A. Anderson, T. Tatham, and B. Black, *Multivariate Data Analysis*, Fifth Edition. NewJersey: Prentice-Hall International, Inc., 1998.

[19] N. Putri, "The Effect of Problem Based Learning Model on Students' Critical Thinking Ability in Economics Class XI IIS at SMAN 3 Surabaya," *JUPE*, vol. 6, no. 3, pp. 236–241, 2018, doi: 10.236/jupe.v7i2.347.

[20] L. Cohen, L. Manion, and K. Morrison, *Research methods in education*. New York: Taylor & Francis Group, 2002, doi: 10.4324/9780203224342

[21] L. S. Sari, J. Jonata, and P. Handayani, "Implementation of Local Wisdom Problem Based Learning Model to Improve Critical Thinking Ability of Elementary / MI Students," *Journal of Innovation Research and Knowledge*, vol. 1, no. 9, pp. 841–847, 2022, doi: 10.56997/kurikula.v7i1.706

[22] I. K. Mahardika, N. N. Izza, W. Dharmawan, and A. L. Nisa, "The Effect of Practicum-Based Problem Based Learning (PBL) Learning Model on Critical Thinking Ability of Class VIII Students in Science Learning at SMPNegeri 9 Jember," *Jurnal Ilmiah Wahana Pendidikan*, vol. 8, no. 24, pp. 393–399, 2022, doi: 10.5281/zenodo.7494501.

[23] S. Kartika, M. Muhaimin, and Z. Zurweni, "The Implementation and Effect of Problem-Based Learning Based on Local Wisdom Toward Students' Communication and Critical Thinking Abilityon Temperature and Heat Topic," *JPPPF (Jurnal Penelitian danPengembangan Pendidikan Fisika)*, vol. 8, no. 1, pp. 165–174, 2022, doi: 10.21009/1.

[24] H. Hardiantiningsih, S. Istiningsih, and Hasnawati, "The Effect of Problem Based Learning (PBL) Learning Model on Students' Critical Thinking Ability," *Journal of Classroom Action Research*, vol. 5, no. 2, pp. 297–303, 2023, doi: 10.29303/jcar.v5i2.3737.

[25] N. Fadilla, L. Nurlaela, T. Rijanto, S. R. Ariyanto, L. Rahmah, and S. Huda, "Effect of problem-based learning on critical thinking skills," in *Journal of Physics: Conference Series*, IOP Publishing Ltd, Mar. 2021, pp. 1–5. doi: 10.1088/1742-6596/1810/1/012060.

[26] S. F. Nur, F. Arsih, M. Fadillah, and R. Anggriyani, "The Effect of the Application of Problem Based Learning (PBL) Learning Model with Ethnoscience Approach on Critical Thinking Skills of Students on Environmental Change Material," *Jurnal Pendidikan Tambusai*, vol. 7, no. 2, pp. 16312–16322, 2023, doi: 10.16322/tambusai.v3i2.632

[27] D. B. Cahyono, C. Roini, and M. N. Tamalene, "Habitat Characteristics of Semar Pockets (Nepenthes sp) on Halmahera Island," *Techno: Jurnal Penelitian*, vol. 8, no. 1, pp. 233–241, Sep. 2019, doi: 10.33387/tk.v8i1.1089.

[28] L. Lidiawati, I. D. Pursitasari, and L. Heliawati, "Critical Thinking Skills and Self-Regulated Learning Of Students during the Covid-19 Pandemic," *EduChemia (Jurnal Kimia dan Pendidikan)*, vol. 7, no. 1, p. 1, Jan. 2022, doi: 10.30870/educhemia.v7i1.10627.

[29] D. S. Setiana, N. Nuryadi, and R. Santosa "Analysis of Mathematical Critical Thinking Ability in Terms of Overview," *JKPM (Jurnal Kajian Pendidikan Matematika)*, vol. 6, no. 1, pp. 1–12, 2020. https://doi.org/10.30998/jkpm.v6i1.6483

[30] S. Mariam, Rusmansyah, and M. Istyadji, "Improving Critical Argumentation Skills And Self Efficacy Of Students With Inquiry Based Learning Models In Materials Of Buffer Solution," *Journal of Chemistry And Education*, vol. 3, no. 2, pp. 64–73, 2019, doi: 10.20527/jcae.v3i2.341

[31] E. Destianingsih, A. Pasaribu, and I. Ismet, "The Effect of Problem Based Learning Model on Students' Problem Solving Ability in Physics Learning Class XI at SMA Negeri 1 Tanjung Lubuk," *Jurnal Inovasi dan Pembelajaran Fisika*, vol. 3, no. 1, pp. 15–21, 2016.