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The Influence of The Project Based Learning Model on Students' Critical Thinking Skills In The Science Subject of Grade V of UPTD SD Negeri 124401 Pematangsiantar

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ABSTRACT

This study aims to determine the effect of the Project Based Learning (PjBL) model on the critical thinking skills of fifth grade students in Natural and Social Sciences (IPAS). The type of research used is quantitative with an experimental method, using a one-group pretest-posttest design. The research subjects were 24 fifth grade students at State Elementary School 124401 Pematangsiantar. The research instrument is a critical thinking essay test that has been validated by experts. The results of the study showed a significant increase in students' critical thinking skills after implementing the PjBL model. The students' average pretest score was 52.5, which increased to 85.33 on the posttest. The N-gain calculation produces a score of 0.70 which is in the high category. This proves that the PjBL model is effective in improving students' critical thinking skills. The implication of this research is that teachers can utilize PjBL as an alternative learning model to improve the quality of students' critical thinking at UPTD SD 124401 Pematangsiantar.

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1. INTRODUCTION

Education in the era of globalization and the Industrial Revolution 4.0 requires students to have high-level thinking skills, which are not only limited to mastery of knowledge, but also include the ability to analyze information, evaluate arguments, and make decisions logically and rationally. One of the main skills needed is critical thinking skills, which is part of the four pillars of 21st century skills, namely Critical Thinking, Creativity, Communication, and Collaboration (4C) [1]. In this context, basic education has a strategic role in instilling critical thinking skills from an early age, as an important foundation for students to face complex and dynamic challenges in the future.

A learning model is a framework that provides a systematic overview for implementing learning to help students learn in achieving certain goals [2]. Suprihatiningrum [1] stated that a learning model is a

conceptual framework that describes learning procedures systematically to manage students' learning experiences so that certain desired learning objectives can be achieved. The Project Based Learning Model is a learning model that provides opportunities for students to manage learning in class by involving project work [3].

The Project Based Learning model explores and develops the academic abilities possessed by students [4]. The Project Based Learning Model is an approach that places projects at the core of the learning process, where students are actively involved in designing, investigating, solving problems, and creating products based on real problems. Thomas [5], the characteristics of project-based learning are as follows: 1) Centrality; 2) Driving question; 3) Constructive investigation; 4) Autonomy; 5) Realism.

Critical thinking skills are the ability to think effectively which can help students to analyze, evaluate, and make decisions about what to do [6]. Critical thinking skills are one of the life skills that need to be developed through the educational process [7]. Critical thinking skills are life skills that need to be developed through education so that students can become individuals who are able to face challenges in a more analytical and rational manner. Watson and Glaser [8] stated that the components of critical thinking include: 1) Drawing conclusions; 2) Assumptions; 3) Deduction; 4) Interpreting information; 5) Analyzing arguments.

Critical thinking indicators are special characteristics or abilities that show a person is able to think critically when facing problems or information. Critical thinking indicators consist of six main [9] aspects which can be seen in the table 1 :

Table 1. Critical Thinking Indicators

Aspect	Indicator
Interpretation	The ability to understand, explain, and give meaning to the information or problems encountered. For example, understanding what is meant in a text or data and being able to explain it again clearly.
Analysis	The ability to identify relationships between statements, concepts, or information. For example, being able to see cause-and-effect relationships or breaking down the important parts of a problem.
Inference	The ability to draw logical conclusions based on available data or information. For example, making reasonable guesses or predictions from existing facts.
Evaluation	The ability to assess the credibility, relevance, and strength of arguments or information. For example, distinguishing between valid and invalid information based on available evidence.
Eksplanation	The ability to provide logical explanations and reasons for conclusions or opinions made. For example, explaining the thought process used to arrive at a decision.
Self-Regulation	The ability to monitor and control one's own thought processes to remain focused, directed, and effective. For example, reflecting on ways of thinking and correcting errors in the thinking process.

Science is a subject that aims to facilitate students in understanding the relationship between natural sciences and social sciences, so that students can apply this knowledge in everyday life in a more practical and useful way [10]. Novak [11] the Independent Curriculum is designed to support the development of the Pancasila Student Profile, namely a generation that is faithful, critically reasoning, independent, creative, and able to collaborate and contribute to community life.

2. RESEARCH METHOD

Quantitative research can be interpreted as a research method based on the philosophy of positivism [12]. This study uses a pre-experimental design with a one group pretest-posttest design. Where learning is measured after treatment is given to the sample. The reason researchers chose this design is because it can show differences in student learning outcomes before and after treatment. Before the treatment is carried out, research subjects will be given a pretest to evaluate students' initial understanding of the science subject. The pretest is used as a comparison tool with the posttest results after treatment is given. After the pretest is completed, the subject receives treatment using the Project Based Learning model. The Project Based Learning model will be adapted to the material to be studied and presented interactively to facilitate understanding of the concepts of science lessons. After the treatment was completed, the subjects were given a posttest that was the same as the pretest because the questions that the researcher would give as a pretest were the same questions as for the posttest, but the questions were randomized by the researcher. This design can be described as follows:

Table 2. One Group Pretest-Posttest Design Research Design

Subject	Pretest	Treatment	Posttest
Class V UPTD SDN 124401 Pematangsiantar	O ₁	X	O ₂

3. RESULTS AND DISCUSSION

3.1. Results

Instrument Trial Results

Content validity testing is carried out to determine the extent to which the developed test items are in accordance with the basic competencies and indicators that have been determined. Validation of this instrument was carried out by two validators using the Aiken's V formula. The results of the content validity calculations for each question item are presented in Table 3 below.

Table 3. Results of Content Validity Test

Question	Appraiser		S1	S2	Σs	n(c-1)	V	information
	1	2						
1	4	4	3	3	6	6	1	High
2	4	4	3	3	6	6	1	High
3	4	4	3	3	6	6	1	High
4	4	4	3	3	6	6	1	High
5	4	4	3	3	6	6	1	High
Mean	20	20	15	15	30	30	1	High

It can be seen that all questions obtained an Aiken's V value of 1 in the high category. This shows that the five questions developed have met the valid criteria, so they are suitable for use as research instruments.

Construct Validity Results

In addition to the content validity test, this research instrument also underwent a construct validity test. Construct validity aims to determine the extent to which the questions prepared are in accordance with the theory, concepts and ability indicators being measured. The assessment was carried out by two validators using a predetermined assessment scale, then analyzed using the Aiken's V formula. The results of the construct validity calculations for each question item are shown in Table 4 below.

Table 4. Construct Validity Results

Question	Appraiser		S1	S2	Σs	n(c-1)	V	Ket
	1	2						
1	4	4	3	3	6	6	1	Valid
2	4	4	3	3	6	6	1	Valid
3	4	4	3	3	6	6	1	Valid
4	4	4	3	3	6	6	1	Valid
5	4	4	3	3	6	6	1	Valid
Mean	20	20	15	15	30	30	1	Valid

All questions received an Aiken's V value of 1 with a valid category. This shows that the five questions are in accordance with the construct being measured and can be declared suitable for use in research.

Language Validity Test Results

In addition to testing the content and construct validity, this research instrument was also tested in terms of language validity. The language validity test aims to assess the clarity, readability, and appropriateness of language use in each question item so that it is easy for students to understand. The assessment was carried

out by two validators using predetermined criteria, then analyzed using the Aiken's V formula. The results of the language validity test are presented in Table 5 below.

Table 5. Language Validity Test Results

question	Appraiser		S1	S2	Σs	n(c-1)	V	Ket
	1	2						
1	4	4	3	3	6	6	1	Valid
2	4	4	3	3	6	6	1	Valid
3	4	4	3	3	6	6	1	Valid
4	4	4	3	3	6	6	1	Valid
5	4	4	3	3	6	6	1	Valid
Mean	20	20	15	15	30	30	1	Valid

All questions received an Aiken's V value of 1 with a valid category. This shows that the five questions have used clear language, easy to understand, and in accordance with writing rules, so it is suitable for use in research.

Pretest and Posttest Results Of Students' Critical Thinking Skills

To determine the increase in students' abilities after being given treatment, initial and final tests were carried out. The pretest results are used to determine students' initial abilities, while the posttest results are used to determine students' abilities after learning. A visual comparison of students' pretest and posttest scores can be seen in Figure 1 below.

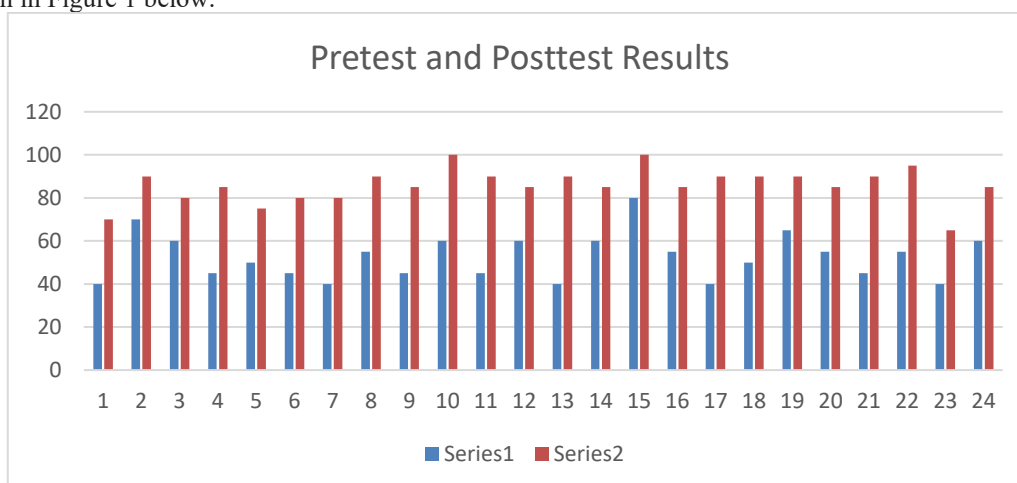


Figure 1. Pretest and Posttest Comparison Chart

There is an increase in student scores. This can be seen from the graph above that before the action was taken, the average student score was below the KKTTP, namely 70, with the highest score being 80 and the lowest being 40. However, after the action was taken, there was an increase in the average value above the KKTTP, namely 70 with the highest value being 100 and the lowest value being 65.

Uji N- Gain

After conducting the Pretest and Posttest, the researcher input data on the results of the students' critical thinking abilities into the SPSS 26 application to obtain the N-Gain value. The results obtained will later serve as a benchmark for the effectiveness of the Project Based Learning model on the critical thinking skills of fifth-grade students at SDN 124401 Pematangsiantar. In the subject of Natural Sciences, N-Gain can be calculated using the formula:

Table 6. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ngain score	24	.42	1.00	.7097	.15040
ngain persen	24	41.67	100.00	70.9718	15.04038
Valid N (listwise)	24				

Based on table 6 above, the average N-Gain test result obtained was 0.7097, which means the N-Gain score is greater than 0.70, which means the N-Gain test of this study is categorized as moderate. Therefore, the level of effectiveness of the use of the Project Based Learning model on the critical thinking skills of fifth-grade students of SDN 124401 Pematangsiantar is at a high level. This test is obtained from a comparison between the Pretest score and the Posttest score which can be obtained by students during the learning process.

3.2. Discussion

This research was conducted in August 2025. The population used was grade V of SDN 124401 Pematangsiantar with a sample of 24 grade V students. This study aims to determine the Effect of the Project Based Learning Model on Critical Thinking Skills of Grade V Students of SDN 124401 Pematangsiantar in the Science Subject of the 2025/2026 Academic Year with a total of 24 students. Before conducting the research, the researcher first conducted a Trial of the Question Instrument using two expert validators, namely 1 lecturer and 1 teacher. The questionnaire consisted of five essay-style questions. Validator testing was conducted to determine the validity of the content, construct, and language of the questions. The results were analyzed using Aiken's V formula.

After knowing the valid questions, the next step was for the researcher to use valid questions to test the experimental class of the research, namely SDN 124401 Pematangsiantar, the aim was to determine the initial abilities of students before the Project Based Learning model was applied to critical thinking skills. Based on the pretest results, the average value of students' critical thinking skills was 52.5 with the highest score of 100 and the lowest score of 40. There were 2 students who scored above the KТП and 22 students scored below the KТП. Through the existing percentage, it can be said that the level of students' critical thinking skills before using the Project Based Learning model is relatively low. After knowing the results of the students' Pretest scores, the researcher then applies the Project Based Learning model. After the material is delivered using Project Based Learning, the researcher will give a Posttest to fifth grade students. From the data that has been collected, the researcher will analyze whether or not there is an effect of the Project Based Learning model on the critical thinking skills of fifth grade students. Based on the Posttest results, the average value of students' critical thinking skills is 85.33 with the highest score of 100 and the lowest score of 65. There were 24 students who scored above the minimum competency criteria (KКТП) and 1 student who scored below the KКТП. Therefore, after using the Project-Based Learning model, students' critical thinking skills improved compared to before using the Project-Based Learning model.

After conducting the n-gain test, the pretest and posttest met and met high criteria, with the n-gain score reaching $0.71 > 0.70$. It can be concluded that the Project-Based Learning model has a positive effect on students' critical thinking skills in the science subject.

4. CONCLUSION

Based on the research results and discussion, it can be concluded that the Project-Based Learning model has an effect on the critical thinking skills of fifth-grade students at SDN 124401 Pematangsiantar. This is evident in the results of students' critical thinking skills, which obtained an average pretest score of 52.5. After treatment using the Project-Based Learning model, the average posttest score was 85.33. Based on the data analysis results after the pretest and posttest, the N-Gain value was 0.70, classified as high and effective. Therefore, it can be concluded that the Project-Based Learning model has a positive effect on the critical thinking skills of fifth-grade students at SDN 124401 Pematangsiantar in the 2025/2026 academic year.

REFERENCES

- [1] Mutmainnah, *Model pembelajaran berbasis proyek dalam meningkatkan keterampilan abad 21*. Deepublish, 2024.
- [2] S. Apsoh, A. Setiawan, and M. Marsela, "Pengaruh Model Project Based Learning Terhadap Kemampuan Berpikir Kritis Siswa," *JUPEIS J. Pendidik. Dan Ilmu Sos.*, vol. 2, no. 3, pp. 174–185, 2023.
- [3] L. Manurung, R. P. Napitupulu, and R. K. Simarmata, "Pengaruh Model Pembelajaran Problem Based Learning (PBL) terhadap Hasil Belajar Siswa pada Subtema 1 Kelas V di UPTD SDN 122337 Jl. H. Adam Malik," *Innov. J. Soc. Sci. Res.*, vol. 3, no. 2, pp. 4117–4131, 2023.
- [4] D. Nababan, A. K. Marpaung, and A. Koresy, "Strategi pembelajaran Project Based Learning (PJBL)," *J. Pendidik. Sos. dan Hum.*, vol. 2, no. 2, pp. 706–719, 2023.
- [5] V. Melinda and M. Zainil, "Penerapan model Project Based Learning untuk meningkatkan kemampuan komunikasi matematis siswa sekolah dasar (studi literatur)," *J. Pendidik. tambusai*, vol. 4, no. 2, pp. 1526–1539, 2020.
- [6] M. R. Padmakrisya and M. Meiliasari, "Studi literatur: keterampilan berpikir kritis dalam matematika," *J. Basicedu*, vol. 7, no. 6, pp. 3702–3710, 2023.

- [7] S. Sutamrin and K. Khadijah, "Analisis Kemampuan Berpikir Kritis dalam Project Based Learning Aljabar Elementer," *Equal. J. Ilm. Pendidik. Mat.*, vol. 4, no. 1, pp. 28–41, 2021.
- [8] Y. Yulianti, H. Lestari, and I. Rahmawati, "Penerapan model pembelajaran RADEC terhadap peningkatan kemampuan berpikir kritis siswa," *J. Cakrawala Pendas*, vol. 8, no. 1, pp. 47–56, 2022.
- [9] A. R. Rachmantika and W. Wardono, "Peran kemampuan berpikir kritis siswa pada pembelajaran matematika dengan pemecahan masalah," in *PRISMA, Prosiding Seminar Nasional Matematika*, 2019, vol. 2, pp. 439–443.
- [10] Suyanto, *Menjelajah dunia IPAS: Pendekatan terpadu antara IPA dan IPS untuk pembelajaran kontekstual*. Bumi Aksara, 2012.
- [11] N. S. Sukmadinata, *Pengembangan kurikulum: Teori dan praktik*. Remaja Rosdakarya, 2010.
- [12] Sugiyono, *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta, 2019.