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IMPLEMENTATION OF PROJECT-BASED SCIENCE LEARNING ON CRITICAL THINKING SKILLS OF ELEMENTARY SCHOOL STUDENTS

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ABSTRACT

This study was motivated by the low critical thinking skills of students due to the use of traditional methods such as lectures. The purpose of this study is to determine the critical thinking skills of grade 5 students in science lessons before and after the application of project-based learning, describe its implementation, and identify the inhibiting and supporting factors. The method used was mixed methods with sequential explanatory design. The sample consisted of 60 students, divided into control and experimental classes of 30 students each. Research instruments included tests (quantitative), as well as interviews, observations, and documentation (qualitative). Quantitative data analysis used normality test, homogeneity, paired sample t-test, and independent sample t-test, while qualitative analysis used Miles and Huberman model. The results showed the average pretest score of the experimental class was 73.70 and the control class was 58.07. After the implementation of project-based learning, the posttest score of the experimental class increased to 84.10, while the control class to 67.83. This shows that project-based learning effectively improves students' critical thinking skills. The inhibiting factors include time constraints, resources, teacher ability, and student resistance, while the supporting factors include resource availability, teacher involvement, and collaboration between teachers and students. The implications of this study suggest that elementary school teachers need to consider implementing project-based learning as an alternative to traditional lecture methods in science education. This approach not only improves students' critical thinking skills but also encourages active participation, cooperation, and a deeper understanding of scientific concepts.

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1. INTRODUCTION

Indonesian education is currently having a difficult time keeping up with the times. The necessity of continuing to help students build 21st century abilities is one of the significant trends impacting the field of education. Critical thinking, creativity, collaboration, and communication are the four primary competencies that comprise these capabilities (Sari & Atmojo, 2021). The ability to gather knowledge and resolve conflicts by asking oneself questions is known as critical thinking (Hakim et al., 2024). According to Ahmatika in Putri et al., (2021) critical thinking is a cognitive ability or strategy that empowers goal-setting. According to Diva & Purwaningrum, (2023) critical thinking skills include the capacity for logical analysis. Because critical thinking is one of the skills that need actions to be examined, analyzed, and evaluated before a decision is made, a person with a high level of critical thinking ability finds it difficult to make decisions. Additionally, critical thinking abilities are essential to pupils' cognitive growth. Students will be better able to develop other abilities like creativity, problem-solving, and teamwork if they have a more organized and methodical way of thinking.

Critical thinking ability is an important skill that must be developed since elementary school, because it is the basis for students' cognitive development (Rasyidi, 2024). Thinking in a structured and systematic way helps students develop creativity, problem-solving and collaboration skills, which are very relevant in facing the challenges of the 21st century. The significance of critical thinking skills is also reflected in international assessments such as the Programme for International Student Assessment (PISA), organized by the Organisation for Economic Co-operation and Development (OECD). The PISA 2022 results show that although Indonesia's ranking has increased by 5-6 positions compared to PISA 2018, the average score in science literacy has decreased. Indonesia's science literacy score was 383 points, well below the OECD average of 485 points. Furthermore, only 34% of Indonesian students reached the minimum proficiency level in science, compared to an average of 76% in OECD countries. This low percentage shows that strengthening critical thinking skills, especially in science lessons, is still a big challenge for education in Indonesia (OECD, 2023). The indicators of critical thinking skills are put forward by Ennis in (Wijayanti & Siswanto, 2020) which include indicators of providing simple explanations, indicators of building basic skills, indicators of inferring, indicators of providing advanced explanations, and indicators of strategies and tactics.

Critical thinking abilities are developed through a variety of teaching and learning activities, including group discussions, problem-solving, experimentation, and discovery (Faujiah et al., 2024). One of the subjects that involves a lot of experiments, discoveries, problem-solving, and discussions is natural science (IPA). Learning science can enhance and strengthen critical thinking abilities. Science, according to Depdiknas (2003), is a methodical approach to studying nature with the goal of mastering facts, concepts, and principles as well as discovery activities conducted to actualize a scientific attitude (Wulandari & Mudinillah, 2022). Three elements make up science education: science as a process, science as a product, and attitude (Fahrurrozi et al., 2022). Understanding science and technology is largely facilitated by scientific education. According to Hidayati et al., (2021) science teaches students how to think critically and creatively, solve problems that are applicable to daily life, and educate scientific facts and concepts. According to Muhazir & Amelia, (2024), for students to be effectively engaged in science classes, learning must be delivered in an engaging manner. Accordingly, Adawiyah et al., (2025) highlighted how crucial it is to provide an enjoyable and engaging learning environment for scientific instruction in elementary schools. The goal of this approach is to increase students' interest in and comprehension of scientific ideas. This method fosters the growth of critical thinking abilities and problem-solving skills while giving pupils a more practical understanding of complex scientific ideas.

In actuality, science education still frequently employs a traditional teaching approach, specifically the lecture technique. Traditional primary school instruction that is dominated by the instructor results in little student participation, which lowers pupils' proficiency and critical thinking abilities (Noviani et al., 2021). This is corroborated by Nabila & Suryanti, (2024) assertion that science education occurs solely through the teacher's lecture approach, with no involvement from the students. Because to the school's inadequate infrastructure and facilities, teachers exclusively use printed instructional materials and no learning media. Students appeared less excited about the material during the learning process as a result. Many pupils in the class struggle to understand the subject as a result of this. Many pupils are too busy chatting with their pals to listen to the teacher when they are engaged in learning activities. As a result, students' critical thinking abilities suffered. This is reinforced by Ramadhani et al., (2023) in his research, It is well recognized that pupils still struggle with critical thinking. Based on observational evidence pertaining to critical thinking abilities, about 60% of pupils continue to have a poor attitude toward critical thinking. According to the observation data, a significant number of pupils continue to be passive and silent while being taught, daydream frequently, and show no interest in learning.

According to the findings of observations conducted by researchers at SDIT Zaid Bin Tsabit in grade 5, students' poor critical thinking abilities are caused by the fact that traditional teaching methods, specifically the lecture approach, are used more frequently in the classroom. According to research by Fadila et al., (2023) students are more likely to be passive and just pay attention to the teacher's explanations when teachers do not always employ models and media in the teaching and learning process. Only one or two pupils actively respond to questions, demonstrating the kids' poor critical thinking abilities. Additionally, teachers speak for the majority of class time, with pupils only listening or responding seldom. According to the opinion (Abdullah, 2025) many students still struggle with information analysis, methodical problem solving, and the development of logical and data-based solutions. This is because of the still-conventional teaching methodology, in which the instructor primarily serves as a source of knowledge and pupils only absorb and retain information without having the chance to delve deeply into ideas. Students' comprehension of science concepts is consequently constrained as they are less able to relate science to everyday life. One of the best ways to address issues with students' critical thinking abilities is to implement the project-based learning (PjBL) model. This method is being used more and more in the context of 21st century education, where the ability to think critically is crucial. Project Based Learning (PjBL), according to Istiqomah et al., (2023) is a cutting-edge learning approach that employs projects and activities as a learning medium. This allows students to actively participate in the learning process and problem-solving exercises, as well as collaborate in groups to create a worthwhile product.

Students' critical thinking abilities can be greatly enhanced by implementing project-based learning methods in scientific classes (Nurkumala et al., 2024). This is consistent with research findings by (Verawati et al., 2024) which showed that project-based learning improved students' critical thinking abilities by 41.75%. Furthermore, a study by (Dewi et al., 2023) verified that employing a project-based learning paradigm enhanced students' critical thinking abilities. Project-based learning has been shown to be successful in enhancing students' critical thinking abilities when studying science. However, the majority of them employed Classroom Action Research (PTK) or a strictly quantitative technique. The methodology employed in this study is innovative; it combines sequential explanatory design with mixed techniques. Another distinctive feature of this study is that, in addition to statistically assessing the growth in critical thinking abilities, it thoroughly examines the process of introducing project-based learning into the classroom, taking into account both the enabling and impeding elements that affect its effectiveness. As a result, both in terms of quantitative findings and qualitative comprehension of the learning process, this study offers a more thorough and comprehensive picture. Given this context, researchers are eager to learn more about how project-based science learning affects grade 5 SDIT Zaid Bin Tsabit students' critical thinking abilities, how project-based science learning is implemented in grade 5, and what factors encourage and hinder its use. By using a mixed methods approach, which systematically integrates quantitative and qualitative data to obtain a holistic picture, this research contributes to a more thorough understanding of the efficacy of project-based learning. To help teachers, principals, and curriculum developers create more successful learning strategies at the primary school level, this research also offers comprehensive contextual information about the implementation in the field and the factors that affect its success.

2. METHOD

This research uses a mixed methods approach with a sequential explanatory model because this approach allows researchers to gain a more thorough understanding of the problem being studied. The initial stage was carried out with quantitative methods to measure and identify general patterns of data, which were then continued with qualitative methods to explain and deepen the findings. The choice of this approach is based on the need to obtain data that is not only statistical, but also contextual, so that the research results become more comprehensive, valid and objective. Descriptive, comparative, and associative quantitative data can be obtained through the use of quantitative methodologies. In the meantime, quantitative data that has been acquired early on might be supported, deepened, expanded, or even weakened and canceled by qualitative approaches (Sugiyono, 2018). Tests of students' critical thinking abilities administered both before and after the project-based learning intervention were used to collect data at the quantitative stage. At the qualitative stage, information was gathered via observations, interviews, and documentation to show how project-based learning was implemented and to pinpoint the elements that helped and hindered the learning process. The study design that will be used is as follows (Sugiyono, 2018):

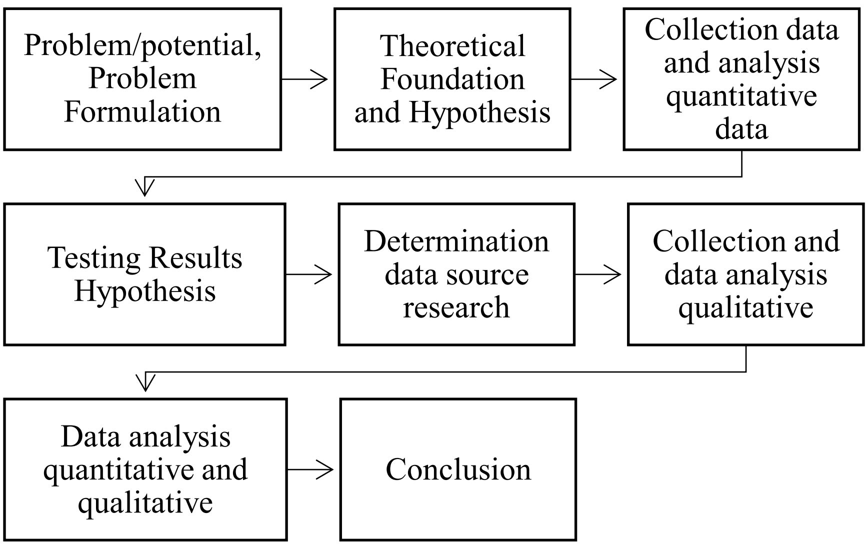

Figure 1. Sequential Explanatory Research Design

According to the features of the sequential explanatory mixed approach, which uses quantitative methods in the first stage of the research and qualitative methods in the second, Figure 1 illustrates this. First, quantitative data collection is done, followed by quantitative data analysis. After that, collect qualitative data and conduct a qualitative analysis of the information gathered. Additionally, the findings of both quantitative and qualitative data are merged and examined together in order to determine how the two types of information relate to one another and whether they support, enhance, deepen, broaden, or contradict one another. To ascertain the differences between the control and experimental classes, quantitative research employing a nonequivalent control group design, a design in which two groups are not chosen at random are given a pretest and a posttest (Sugiyono, 2018).

This study was carried out during the even semester of the 2024–2025 school year at SDIT Zaid Bin Tsabit, which is situated in Bogor City. The investigation was implemented from February to May 2025, a period of four months. This school was selected as the research site because it offers researchers sufficient access for data collection and has student characteristics that align with the study's goals. There were 87 pupils in the 5th grade at SDIT Zaid Bin Tsabit who made up the study's population. The researcher selected a sample of 60 pupils from this population, dividing them equally into two classes of 30 students each. Purposive sampling combined with nonprobability sampling was the sample strategy employed. This method was used because the researcher established specific criteria for selecting the sample, specifically that each class was equal in terms of the number of pupils. This consideration is made in order to improve the validity and reliability of the comparison between groups and to acquire more balanced data.

Both quantitative and qualitative methods were used to gather the data for this investigation. Tests in the form of description questions were used to collect quantitative data, and observations, interviews, and documentation were used to collect qualitative data. A description test sheet, interview guide, observation sheet, and documentation format were among the tools utilized. All 15 items in the description test have been shown to be valid and reliable after testing for validity and reliability. By contrasting the findings of observations, interviews, and documentation, triangulation of sources and methodologies was done to guarantee the validity of qualitative data. To make sure the data satisfied the presumptions of parametric statistics, t-tests were used in quantitative data analysis procedures, which were preceded by normality and homogeneity tests. The paired sample t-test and the independent sample t-test were then the two types of t-test that were employed. The independent sample t-test was used to calculate the average difference between the control class and the experimental class, which are two independent groups, while the paired sample t-test was employed to quantify the difference in pretest and posttest scores in each class. To guarantee the accuracy of the results, SPSS 26.0 for Windows was used for all statistical analyses.

3. RESULTS AND DISCUSSION

The findings demonstrated that SDIT Zaid Bin Tsabit 5th grade students' critical thinking abilities were enhanced by project-based science instruction. An rise in the experimental class's average posttest score and a difference between the experimental and control classes' average posttest scores serve as proof of this. where the experimental class posttest's average score is higher than the control class posttest's average score. The increase in the average value is presented in diagram form in Figure 1 and Figure 2.

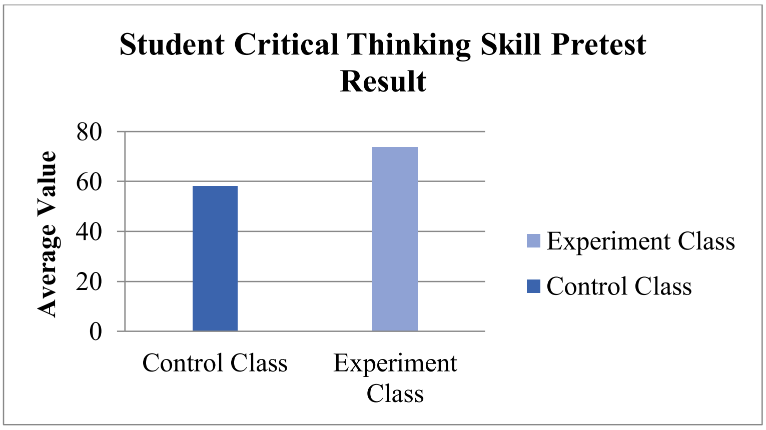

Figure 2. Diagram of Pretest Results of Control and Experimental Classes

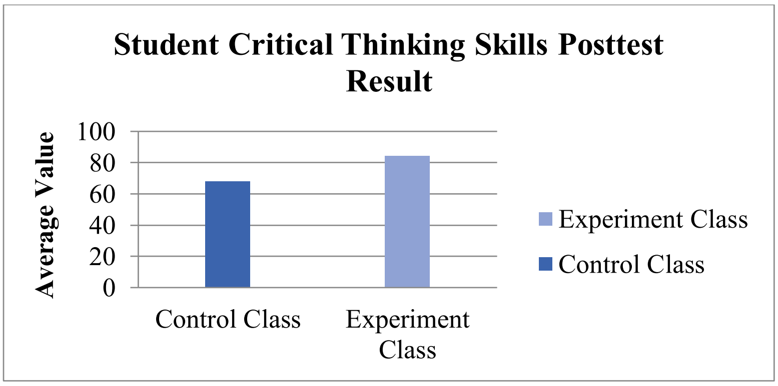

Figure 3. Diagram of Posttest Results of Control and Experimental Classes

According to Figures 1 and 2, the experimental class's average pretest score was 73.70, whereas the control class's was 58.07. Students' critical thinking abilities improved in both courses following the intervention, which involved using project-based learning in the experimental class and the lecture technique in the control class. The experimental class's average posttest score rose to 84.10, whereas the control class's rose to 67.83. When compared to more conventional teaching techniques like lectures, project-based learning had a greater impact on students' critical thinking abilities, as seen by the experimental class's more notable rise.

The t-test is then used to assess the data following the acquisition of the average pretest and posttest computations in the experimental class and control class. Two t-tests the independent sample t-test and the paired sample t-test were employed in this investigation. The normality and homogeneity of the data must be checked before doing the t-test. Table 1 below displays the findings of the data normalcy test:

Table 1. Normality Test Results

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Pretest Class Ta (Control)	,159	30	,051	,961	30	,327
Posttest Class Ta (Control)	,150	30	,082	,945	30	,125
Pretest Class Ba (Experiment)	,126	30	,200	,969	30	,514
Posttest Class Ba (Experiment)	,118	30	,200	,941	30	,096

According to Table 1 above, the Shapiro-Wilk normality test yielded a sig value of 0.327 for the control class pretest, 0.125 for the control class posttest, 0.514 for the experimental class pretest, and 0.096 for the experimental class posttest. This indicates that the sig. > 0.05. Thus, it may be said that every piece of data has a normal distribution. Following the completion of the normalcy test, the homogeneity test was conducted. The outcomes of the homogeneity test are as follows:

Table 2. Homogeneity Test Results

Test of Homogeneity of Variances					
		Levene Statistics	df1	df2	Sig.
Value	Based on Mean	2,346	1	58	,131
	Based on Median	1,719	1	58	,195
	Based on Median and with adjusted df	1,719	1	57,900	,195
	Based on trimmed mean	2,331	1	58	,132

The homogeneity test indicates a Sig. (P-Value) of 0.131 based on Table 2. This indicates that the significance level is greater than 0.05. Therefore, it can be claimed that the data is homogeneous or that its variations are identical. The t-test is performed following the completion of the normality and homogeneity tests, which determine whether the data is homogeneous and regularly distributed. The outcomes of the paired sample t-test for the experimental and control classes are as follows:

Table 3. Control Class Paired Sample T-Test Results

Paired Differences									
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval		t	df	Sig. (2-tld)
					Lower	Upper			
Pair 1	Pre-Control - Post-Control	-9,767	7,486	1,367	-12,562	-6,971	-7,145	29	,000

Table 3 indicates that the sig. (2-tailed) result is 0.000, or less than 0.05. According to this, the alternative hypothesis (Ha) is accepted and the null hypothesis (H0) is rejected. In conclusion, the control class's critical thinking abilities differed between the pretest and posttest. Additionally, the following table displays the experimental class's paired sample t-test results:

Table 4. Experimental Class Paired Sample T-Test Results

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval		t	df	Sig. (2-tld)
					Lower	Upper			
Pair 1	PreExperiment - PostExperiment	-10,400	8,365	1,527	-13,524	-7,276	-6,810	29	,000

Table 4 shows a sig. (2-tailed) of 0.000, or less than 0.05. According to this, the alternative hypothesis (Ha) is accepted and the null hypothesis (H0) is rejected. All things considered, there is a difference between students' critical thinking abilities before and after project-based learning. The independent sample t-test was carried out as follows following the completion of the paired sample t-test:

Table 5. Independent Sample T-Test Results

		Levene's Test		t-test for Eqlty of Means						
		F	Sig.	t	df	Sig. (2-tld)	Mean Difference	Std. Error Difference	95% Confidence Interval	
									Lower	Upper
Value	Equal variances	6,743	0,12	-10,533	58	,000	-16,267	1,544	-19,358	-13,175
	Not Equal variances			-10,533	47,324	,000	-16,267	1,544	-19,373	-13,160

According to Table 5. It yields the sig value. 0.000 (2-tailed) indicates less than 0.05. According to this, the alternative hypothesis (Ha) is accepted and the null hypothesis (H0) is rejected. In conclusion, students in the experimental class, which used a project-based learning model, had different critical thinking abilities than students in the control class, which used conventional teaching methods (lecture/no special treatment). This is consistent with research findings by (Verawati et al., 2024) which showed that project-based learning improved students' critical thinking abilities by 41.75%. Furthermore, a study by (Dewi et al., 2023) verified that employing a project-based learning paradigm enhanced students' critical thinking abilities.

3.1. Students' Critical Thinking Ability Before and After Learning

Following the implementation of project-based learning, the average posttest score of students in the experimental class increased to 84.10, indicating that students' critical thinking abilities in science classes in grade 5 SDIT Zaid Bin Tsabit had improved. According to Verawati et al. (2024), project-based learning improved students' critical thinking abilities by 41.75%, which lends credence to this. This is consistent with the findings of interviews with deputy principals, science instructors, and 5th grade teachers. Prior to the introduction of project-based learning, the following critical thinking abilities of children were assessed through interviews with a 5th grade science teacher with the initials DW on May 02, 2025:

"For critical children, they are actually quite critical, it's just that if asked to explain themselves they cannot yet, because many are not brave, still shy. But if you ask questions and answers, they will have an opinion. But for other children, there are some who do have low critical thinking skills".

Then, the results of an interview conducted on May 02, 2025 to the 5th grade teacher, with the initials AN said that:

"Before implementing project-based learning, they only knew the theory but did not know how it worked, and so on. So it can be said that their critical thinking skills are less honed or low".

Furthermore, an interview conducted on May 02, 2025 to the vice principal with the initials AS, said that:

"Before implementing project-based learning there were some who were quite critical, but the rest were still lacking in critical thinking".

According to the above interview results, students were unable to develop fundamental critical thinking abilities, such as posing questions, recognizing issues, and conducting independent research, or offer straightforward explanations prior to the implementation of project-based learning. In light of this, the experimental class pretest averaged 73.70 while the control class pretest averaged 58.67. The three informants concurred that there was a notable shift in how students think, comprehend, react, and solve problems following the adoption of project-based science learning. According to an interview with a 5th grade science teacher with the initials DW on May 02, 2025, students' critical thinking abilities following the adoption of project-based science learning are as follows:

"After project-based learning, their critical thinking skills have improved, they tend to ask questions and have opinions".

Then, the results of an interview conducted on May 02, 2025 to a 5th grade teacher with the initials AN, said that:

"When project-based learning, they are more enthusiastic, more excited, automatically their critical thinking skills increase, because from their enthusiasm comes curiosity".

Furthermore, an interview conducted on May 02, 2025 to the vice principal with the initials AS, said that:

"After project-based learning, it is certain that the ability to think critically has increased, there is a difference when the learning is only lecture with project-based learning".

It is clear from the above interview results that students' critical thinking abilities have improved when project-based learning was introduced. This is demonstrated by the fact that the experimental class, which employed project-based learning, received an average score of 84.10 on the posttest, compared to 67.83 for the control class, which used the conventional method (lecture). These findings suggest that students are encouraged to think more critically in order to comprehend and solve problems when learning is conducted in a more dynamic, student-centered manner. These results support Selasmawati's assertion that project-based learning methods can enhance students' critical thinking abilities in (Kusuma et al., 2024). Students must work together, have discussions, and present their completed projects to solve difficulties in real-world scenarios that they encounter throughout project-based learning. Students are encouraged to independently examine, assess, and make judgments through this process all of which are essential elements of critical thinking.

3.2 Implementation of Project-Based Science Learning

The implementation of project-based science learning in grade 5 SDIT Zaid Bin Tsabit shows a fairly good implementation, both in terms of the methods used by teachers, student responses, and support from the school. Based on the results of an interview conducted on May 02, 2025 with a science teacher with the initials DW, revealed that:

"For the method, it uses discovery learning, so children are told the problem, then they find the answer themselves. For example, children are given projects/tasks, so they are given clues, then they solve the problem themselves".

Then, the results of interviews related to the views of the 5th grade teacher with the initials AN conducted on May 02, 2025, said that:

"When applying project-based learning, children usually understand more easily, because when making something they tend to be able to observe all the steps from start to finish, so that from there their understanding is more mature than when using lectures, especially for science learning".

Furthermore, the results of interviews related to school policies towards project-based learning conducted on May 02, 2025 to the vice principal with the initials AS, said that:

"From the school side, it is very supportive of project-based learning, if the tools and materials are adequate, as well as getting support from all parties, then we are very very supportive if you want to implement project-based learning".

According to the findings of the interviews concerning the application of project-based learning, project-based learning is generally regarded as a viable and pertinent way to enhance students' comprehension and critical thinking abilities, both in terms of implementation, teacher opinions, and school regulations. This demonstrates the institution's dedication to promoting a method that is seen to be able to raise the standard of education, particularly in the development of 21st century abilities including communication, creativity, critical thinking, and teamwork. These results are consistent with the features of project-based learning as outlined by Amaliya & Kubro, (2025), who stress that projects ought to be the main focus of learning rather than merely an add-on or last task. In this paradigm, learning becomes more meaningful and focused on solving real-world problems since students actively participate in the planning, decision-making, and implementation processes in addition to working on projects as final deliverables. Compared to students who learn through traditional techniques, those who learn through projects show a stronger knowledge of concepts and the ability to articulate arguments rationally. This happens because students who actively participate in projects must integrate knowledge from several sources, work together with others, and reflect on the steps they took and the results they achieved. Therefore, the efficacy of project-based learning in this study's context is supported not only by the opinions of teachers and institutional support, but also by theory and empirical data demonstrating that this model can develop students' critical thinking abilities in a comprehensive and long-lasting way.

3.3. Barriers and Supporting Factors of Project-Based Science Learning

There are obstacles to project-based learning implementation. Project-based learning implementation is hampered primarily by infrastructure, student preparedness, and time constraints. According to an interview with a 5th grade science teacher with the initials DW on May 02, 2025, the following are the barriers to project-based science learning:

"The obstacle is the facilities, but as a teacher as much as possible it is not burdensome for students, so what is in the school and easy to find, then use it, if it is not there, then don't use it. In addition, there are also time constraints in working, because project-based learning usually takes quite a long time. If the children have a good way of thinking / reasoning, it is easy to teach them, but if the children are difficult to analyze, they know but find it difficult to analyze, so they ask again, have to be explained again, it becomes homework for us as teachers ".

Then, the results of an interview conducted on May 02, 2025 to a 5th grade teacher with the initials AN, said that:

"So far, the inhibiting factor is if they forget to bring the tools and materials, so they are a little late in doing the project, because they have to take turns borrowing from their friends. In addition, although some students are enthusiastic, there are also students who feel unaccustomed to working on projects or uncomfortable when working in groups".

Furthermore, the results of an interview conducted on May 02, 2025 to the vice principal with the initials AS, said that:

"The inhibiting factor is the source of the book, in this school library there is still a lack of book sources, so children have to look for other sources on the internet. In addition, other tools and materials, when children forget to bring them, it will be an obstacle in project-based learning. As well as the lack of teachers in stimulating children's critical thinking skills".

According to the aforementioned interview results, time constraints, a lack of available book resources, and equipment and facilities are the main things that prevent project-based learning. These results support Widiasworo's view in Ginting et al., (2024) which states that the inhibiting factors of project-based learning are time constraints, limited resources, such as teaching materials, equipment and facilities, limited teacher knowledge and skills, and student resistance.

There are supporting variables that aid in the successful implementation of project-based science learning in addition to limiting issues. According to interviews with a 5th grade science teacher with the initials DW on May 02, 2025, the following are supporting variables for project-based science learning:

"The supporting factor is teaching aids, SDIT Zaid bin Tsabit already has several tools that support project-based learning. Parents are also supportive, for example children are asked to bring equipment, parents immediately provide it ".

Then, the results of an interview conducted on May 02, 2025 to the 5th grade teacher with the initials AN, said that:

"All elements are supporting factors, especially from infrastructure, if the infrastructure is there, it can be a support in project-based learning".

Furthermore, the results of an interview conducted on May 02, 2025 to the deputy principal with the initials AS, said that:

"The supporting factors are library resources, good cooperation with parents, also cooperation with the surrounding environment both at school and at home. Teachers are also a supporting factor, if the teachers are actively involved and willing to work together with students, then project-based learning will run smoothly".

According to the findings of the interviews, sufficient infrastructure and facilities, instructor participation, and collaboration between educators, parents, and students are the elements that promote project-based learning. This is due to the fact that project-based learning necessitates teamwork and the utilization of a variety of resources. Sufficient facilities allow students to explore and experiment as much as possible, and instructor participation is essential to keeping the learning process on course. A more favorable learning environment is also produced by parental support, both at home and at school. The aforementioned results are consistent with Widiasworo's viewpoint in Ginting et al., (2024), which claims that the availability of resources, including facilities, equipment, and instructional materials, teacher participation, and student-teacher collaboration are the supporting factors for project-based learning.

4. CONCLUSION

Students' critical thinking abilities improved as a result of grade 5 SDIT Zaid Bin Tsabit is adoption of project-based scientific curriculum. After employing the lecture approach, the experimental class's average pretest score climbed from 73.70 to 84.10, whereas the control class's score only went from 58.07 to 67.83. With the teacher acting as a facilitator, this learning approach enables students to actively participate in the analysis, investigation, and problem-solving processes. Project-based learning implementation is hampered by a number of variables, including infrastructure and facilities, teacher and student preparedness, and time constraints. In the meantime, the availability of sufficient resources, instructors' active participation, and effective teacher-student collaboration are all crucial supporting aspects. The findings of this study have a beneficial effect on how elementary school learning models are developed, particularly in terms of encouraging critical thinking abilities. The results can also be used as a guide by educators and policymakers to incorporate project-based learning into the curriculum and give students a more engaging, dynamic, and purposeful learning environment.

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