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Project-Based Learning in Science Learning: A Philosophical Perspective of Realism in Madrasah Ibtidaiyah

Khoiru Mutiya[1], **Maemonah**[2], **Nyangfah Nisa Septiana**[3]
[1,2,3]Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia

e-mail: [1]23204082017@student.uin-suka.ac.id, [2]maimunah@uin-suka.ac.id, [3]23204082018@student.uin-suka.ac.id

Abstract: The philosophy of realism in education emphasizes direct experience and observation of concrete phenomena as the foundation of knowledge. This principle aligns closely with Project-based Learning (PjBL), which engages students in authentic tasks to solve real-world problems. This study analyzes the application of PjBL in grade 5 Natural Science learning at a Madrasah Ibtidaiyah in Yogyakarta and identifies factors influencing its implementation. Using a descriptive qualitative approach, which includes observation, interviews, and documentation, the findings reveal that PjBL reflects the principles of realism, as students construct knowledge through active participation and direct interaction with real phenomena. Teachers implemented PjBL through six stages, culminating in a project to create a simple lung model. This activity enabled students to understand the respiratory system through empirical observation, rather than memorization, by examining their breathing patterns before and after engaging in physical activity. PjBL enhanced conceptual understanding, practical skills, critical thinking, and creativity. High student engagement, teacher creativity, and institutional support facilitated implementation, while time limitations, scarce resources, and limited teacher knowledge presented challenges.
Keywords: Madrasah Ibtidaiyah, natural science learning, philosophy of realism, project-based learning

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A. Introduction

Natural Science learning at the Madrasah Ibtidaiyah or Indonesian Islamic elementary school level plays a strategic role in shaping scientific knowledge, critical thinking skills, and environmental care attitudes from an early age (Melianti et al., 2023). At this level, students require guidance to understand the connection between science and real life, ensuring that their learning is not only theoretical but also relevant to their daily lives. A good science education will equip learners with 21st-century skills, including collaboration, creativity, communication, and problem-solving (Herlinawati et al., 2024).

However, conventional methods, such as lectures, memorization, and practice questions, continue to dominate science learning in many Madrasah Ibtidaiyah's (Rahimi et al., 2024). This approach tends to position students as passive recipients of information, thereby limiting the opportunity to explore directly. As a result, scientific concepts can be challenging to relate to the natural phenomena encountered daily. Barriers such as limited facilities, time, and inadequate teacher training in innovative learning strategies further widen the gap between ideal learning objectives and practical implementation in the field (Wardhani et al., 2023).

This condition necessitates a more active, contextual, and meaningful learning model, enabling students to develop critical thinking skills and solve problems independently (Rahayu et al., 2022). One relevant model is Project-Based Learning (PjBL), which places learners as active subjects in planning, implementing, and evaluating real projects (Haratua et al., 2024). This model integrates problem-based learning, experimentation, and product creation with teamwork and effective communication (Hamidah, 2024).

Various studies have shown that PjBL can improve learning outcomes, communication skills, and critical thinking (Guo et al., 2020; Isnani, 2023; Luthfi et al., 2024; Novitasary, 2023). Through PjBL, students can conduct observations, experiments, and analyses of real data, making learning more meaningful (Niryan et al., 2024). This success shows the potential of PjBL as a learning strategy that is in line with the needs of science education at Madrasah Ibtidaiyah.

Philosophically, PjBL is closely related to the philosophy of realism. Realism emphasizes that knowledge is obtained through direct experience and observation of concrete objects (Worrall, 1982). In education, this view places reality-based learning as a foundation, where learners interact directly with the physical world and natural phenomena (Yahya et al., 2025). This principle aligns with the characteristics of PjBL, which prioritizes observation, experimentation, and contextualization of knowledge (Jeong, 2025; Santos et al., 2023).

Although in theory, PjBL and realism have parallels, empirical studies that combine the two in science learning at Madrasah Ibtidaiyah are still rare. Most previous studies have focused on the effectiveness of PjBL or the application of realism separately, without explaining how the principles of realism can be implemented through PjBL, including the practical challenges that arise in the process (Alemneh and Gebrie, 2024; Isnaintri et al., 2023).

This research aims to address this need by examining the application of PjBL in science learning for Grade 5 students at Madrasah Ibtidaiyah from the perspective of realism, as well as identifying the supporting factors and obstacles to its implementation. Through this approach, the research aims to make a theoretical contribution to enriching the literature on integrating educational philosophy with innovative learning models, as well as to provide practical contributions for teachers in designing science learning that is more contextual, meaningful, and grounded in a strong educational philosophy.

B. Method

This study employs a descriptive qualitative approach to provide in-depth descriptions of the application of project-based learning in science learning grade 5 students at Madrasah Ibtidaiyah, from the perspective of realist philosophy. This approach was chosen because it is able to explain the meaning of phenomena based on the direct experience of research subjects through narrative, description, and interpretation (Cresswell and Clark, 2018; Sugiyono, 2020). The researchers conducted the study during the even semester of the 2024/2025 academic year, specifically from February to March 2025, at an Madrasah Ibtidaiyah in Yogyakarta City that implemented project-based learning within the Independent Curriculum. They selected the research informants using a purposive sampling technique, targeting participants considered most relevant to the research focus.

Table 1. Research Informant

No	Code	Age	Gender	Information
1.	A1	55 yrs	female	headmaster
2.	A2	52 yrs	female	teacher
3.	A3	11 yrs	male	grade 5 student
4.	A4	11 yrs	male	grade 5 student
5.	A5	11 yrs	female	grade 5 student
6.	A6	11 yrs	female	grade 5 student
7.	A7	11 yrs	female	grade 5 student

The informants consisted of one principal (A1), one teacher in grade 5 (A2), and five students in grade 5 (A3–A7). The researchers determined the number of informants based on the principle of data saturation, selecting participants until the information collected was sufficient to represent the phenomenon under investigation. Meanwhile, the data collection methods applied include observation, interviews, and documentation (Abdussamad et al., 2024). Observations were carried out to record the implementation of project-based science learning by paying attention to the indicators of realism philosophy, including the connection of activities with the real world, the involvement of students in observation and experimentation, the relationship with natural phenomena, the contextualization of concepts in daily life, and evaluation (Worrall, 1982).

Interviews were conducted with school principals, teachers, and students in grade 5 to explore their experiences, perceptions, and obstacles in implementing PjBL. Interview questions included how teachers designed reality-based projects, how students felt the benefits of experiments, and how they overcame challenges in learning practice. Documentation included photos of learning activities, which are the work of students in the form of products that strengthen observation and interview data.

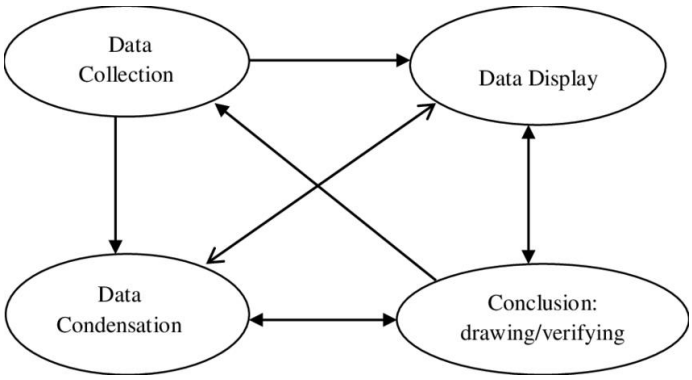

Figure 1. Data Collection Techniques

Based on Figure 1, the data obtained were analyzed through three main stages: data condensation, data presentation, and conclusion drawing (Miles et al., 2014; Qomaruddin and Sa'diyah, 2024). Data condensation involved selecting, focusing, and simplifying field data to make it relevant to the research focus. The condensed data were then presented in a descriptive narrative format to facilitate interpretation.

Furthermore, the researchers concluded by synthesizing the findings in relation to empirical data, the philosophical foundations of realism, and the principles of PjBL. They ensured data validity through source triangulation techniques (Creswell, 2018; Susanto et al., 2023). To achieve this, they compared information obtained from school principals, teachers, and students, and applied technical triangulation by integrating data from observations, interviews, and documentation. Through these procedures, the researchers strengthened the credibility and reliability of the research findings.

C. Results and Discussion

Results

Implementation of Project-Based Learning (PjBL)

The implementation of PjBL in the science class at an Madrasah Ibtidaiyah in Yogyakarta demonstrates that students can analyze problems, find alternative solutions, and present arguments logically. Students are also more active in discussions and independent in completing projects designed by teachers. The principal (A1) emphasized that the school began to implement PjBL gradually through the Independent Curriculum, especially in science lessons. He mentioned that teachers design different projects each semester, such as simple experiments. This statement suggests that there is a deliberate effort to connect science learning with students' real-world experiences.

The teacher of grade 5 (A2) said that the project began by making a simple lung model from a balloon and a water bottle (see Figure 3). This activity shows how teachers relate abstract concepts about the respiratory system with concrete practices that are easy for students to understand. A2 further explained that the Natural Sciences learning project aimed to actively involve students in planning, implementing, and evaluating the outcomes. According to the teacher, the three primary stages were the framework for

implementation in the classroom. However, based on the results of in-depth observations and interviews, the classroom activities can be mapped into six steps as follows.

First, the teacher asked a triggering question, "How does the human respiratory system work?". This question raised the curiosity of students (the step of determining the fundamental question). After that, the teacher and students prepared a plan to create a simple lung model using balloons and plastic bottles, as well as divided the roles within each group (including the steps of compiling a project plan, making schedules, and dividing tasks).

The next stage is the implementation of the project, where learners created a lung model and also made breathing observations before and after running to connect theory with real experience. During the activity, teachers circulated the group, providing directions and asking open-ended questions that stimulated critical thinking (monitoring steps). The activity was concluded with an evaluation, which consisted of a presentation of each group's work accompanied by a reflection on the experiment's findings (including evaluation steps and presentation of results).

Thus, although the teacher mentioned the activity in three primary stages, the results of the study showed that the learning practice in grade 5 at the Madrasah Ibtidaiyah had fully reflected the six stages of PjBL.

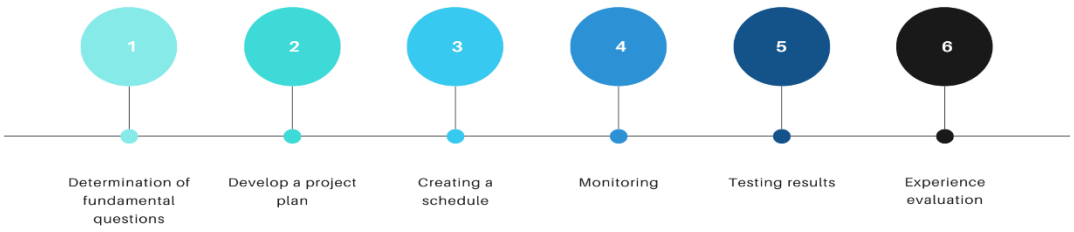

Figure 2. Steps to Implement Project-Based Learning
Source: Adapted from Lestari & Yuwono (2022)

Figure 2 illustrates the stages of implementing project-based learning as described by Lestari and Yuwono (2022). However, teachers also emphasized that there were obstacles, such as limited time and facilities. With conditions like this, it requires teachers' creativity in utilizing simple materials and the enthusiasm of students to remain high. It shows that enthusiasm for learning can be a valuable asset in overcoming technical obstacles.

The fifth-grade students (A3-A7) expressed their experiences. "We are happy because we can directly practice the learning materials, so it is easier to understand." This statement reinforces that direct involvement in experiments has a positive impact on students' conceptual understanding and learning motivation.

Figure 3. The Results of Making Lung Model Works by Students

Integration of the Philosophy of Realism into Project-Based Learning

The application of PjBL aligns with the philosophy of realism, which emphasizes learning based on reality. The teacher directed students to make direct observations, such as comparing breathing patterns before and after running. Based on the researchers' findings, this activity reflects a learning process that emphasizes empirical evidence as a source of knowledge. This activity enables students not only to memorize the concept of science, but also to experience and apply it in real life.

A2 also emphasized that the project activities encouraged students to be more independent in collecting information and finding solutions. A real example was when the experiment's results differed from the estimate. Students learned to evaluate mistakes, analyze their causes, and then find new answers. This situation demonstrates that project-based learning effectively cultivates critical thinking, problem-solving, and evidence-based evaluations grounded in real-world applications. Students stated that the concept of science was easier to understand because it could be observed directly in daily life, making the integration of realism philosophy more meaningful and relevant.

Science lessons are more meaningful and engaging

The application of PjBL in science learning has been proven to make learning activities more interesting and meaningful. The grade 5 teacher explained that the learning process trains students to think critically by engaging them with open-ended questions, such as "Why is breathing faster after running?". As a result, this kind of question can encourage learners to relate everyday phenomena to the scientific concepts being studied. Thus, the learning process does not only stop at theory, but also at understanding based on real experience.

When the experiment's results did not meet expectations, learners practiced evaluating mistakes and seeking solutions. Students realized that the body requires more

oxygen after engaging in physical activity. From these findings, the researcher assessed that PjBL can not only help in understanding concepts, but also foster confidence and perseverance in facing learning challenges. This kind of reflective process is an important capital for students to develop a scientific mindset.

In addition, the fifth-grade students stated that science lessons or science in general felt more enjoyable when learned through projects. A3-A7 revealed that the material was easier to remember after practicing with friends. It demonstrates that PjBL is capable of fostering motivation, cooperation, and critical thinking skills from an early age. This reinforces the belief that a project-based approach makes science learning more contextual, relevant, and appropriate to the needs of learners at the elementary level.

Supporting and Inhibiting Factors for the Implementation of Project-Based Learning

The results also revealed the presence of both supporting and inhibiting factors in the implementation of PjBL in grade 5 of Madrasah Ibtidaiyah. The supporting factor is evident in the enthusiasm of students participating in experimental activities. Students in grade 5 (A3–A7) said, "We like to learn with hands-on practice because it is easier to understand." It demonstrates that genuine involvement motivates students to learn more effectively.

The supporting factor is the creativity of teachers in utilizing simple materials. The teacher of grade 5 said, "Even though the facilities are limited, the teacher tries to use the materials that are around, such as balloons and bottles, so that students can still experiment." This statement emphasizes that teachers' initiatives can overcome the constraints of facilities. School support through the implementation of the Merdeka Curriculum is also an important factor, as conveyed by the principal, "Schools encourage teachers to use more environmentally friendly project-based learning so that children are more active."

On the other hand, there are also inhibiting factors faced. The teacher of grade 5 revealed, "Natural Sciences learning time is limited, so not all projects can be done in depth." It shows that time allocation is one of the obstacles. Additionally, limited facilities are often an obstacle to the implementation of projects. The teacher also added that the understanding of the PjBL strategy and the philosophical foundation of realism still needs improvement so that learning can be more optimal. These obstacles confirm that the success of PjBL is influenced by real conditions in the field, so it requires support for facilities, adequate time allocation, and teacher competence improvement.

Discussion

The implementation of PjBL in grade 5 Natural Science learning at Madrasah Ibtidaiyah aligns with the fundamental principle of realism, which emphasizes real experience as the primary source of knowledge. Realism views the physical world as something real, objective, and understandable through observation and direct experience. The findings of this study show that students more easily understand the concept of Natural Sciences when engaged in a project to make a simple lung model. Such activity

affirms that knowledge is obtained through real interaction with concrete phenomena, in accordance with the realist view that truth is empirical and accessible through direct experience (Hafidhi et al., 2024; Putri et al., 2023).

In addition, this study builds upon previous studies that have demonstrated the effectiveness of PjBL in enhancing student engagement and promoting meaningful learning (Aranzabal et al., 2022; Gomez-del Rio and Rodriguez, 2022). The uniqueness of this research lies in its placement of PjBL within the philosophical framework of realism, a perspective that has not been extensively explored in previous research. The creation of a lung model with a balloon is indeed a form of representation. However, the value of realism becomes more apparent when the students actually experience a change in breathing frequency after running. That is, representation helps visualize concepts, but it is the real experiences that learners have that form the basis of knowledge in the view of realism.

Previous research has shown that the philosophy of realism has been applied in the learning of mathematics, as Aristotle suggests that it enables rational understanding of concepts (Isnaintri et al., 2023). This study complements these findings with evidence that the principle of realism can also be applied in Natural Science learning at the elementary school level. Thus, PjBL is not only relevant within a social constructivist framework but also aligned with realism that emphasizes empirical experience as a source of knowledge (Dilekli, 2020; Franco-Dall'Agnol et al., 2021). The theoretical implication of these findings is that realism can serve as a complementary framework to constructivism in the development of science learning theories, thereby strengthening the philosophical foundation (Nursikin, 2016; Suryana et al., 2022).

Additionally, PjBL supports 21st-century skills, including critical thinking, collaboration, and problem-solving, which are highly relevant to the demands of contemporary education (Santos et al., 2023). However, the researchers identified several practical limitations, including the limitations of teachers' time, resources, and skills in designing contextual projects. These findings are in line with research that confirms that the success of PjBL requires systemic readiness and teacher training support (Ciftci, 2015; Faizah, 2025). From a philosophical perspective, the limitations of teachers also indicate that the understanding of the fundamentals of educational philosophy still needs improvement. It is not enough for teachers to know the technical steps of PjBL, but they also need to understand why real experience is more important than just memorizing concepts (Irma Sari Harahap and Zunidar, 2025; Marini T. et al., 2025).

Moreover, this finding is relevant to the context of Madrasah Ibtidaiyah students who are in the concrete operational stage according to Piaget. Children of this age are more likely to understand something that can be seen and experienced directly (Anditiasari and Dewi, 2021; Faizah, 2017). The realism perspective that emphasizes real-life experience-based learning is very much in line with the cognitive characteristics of learners. Thus, this study confirms that effective learning occurs when students experience reality firsthand, conduct exploratory activities, and draw conclusions based on concrete evidence. The application of realism-based PjBL is not only relevant to the

needs of elementary-level students but also provides a strong philosophical foundation for the development of contextual and meaningful science learning.

D. Conclusion

This study aims to examine the implementation of Project-Based Learning (PjBL) in grade 5 Natural Science learning at Madrasah Ibtidaiyah from the perspective of realism philosophy and to identify the supporting and inhibiting factors influencing its implementation. The findings reveal that teachers implement PjBL in the fifth grade through six main stages: formulating essential questions, designing project plans, creating schedules and assigning roles, carrying out the projects, monitoring the process, and evaluating and presenting the results. This process is in harmony with the principles of realism because it places real experience as the basis for learning. Learners not only memorize concepts but also learn through direct interaction with surrounding phenomena, such as observing breathing patterns and creating simple lung models. Through this approach, students are able to develop critical thinking, collaboration, and independent learning skills from an early age. The supporting factors for implementation can be seen in the enthusiasm of students, the creativity of teachers in utilizing simple materials, and school support through the Merdeka Curriculum. On the other hand, the obstacles that arise include limited time, facilities, and teachers' limited understanding of the PjBL philosophy, which still needs improvement. This study has limitations in scope, as it is still limited to one school and a relatively short period of time, so the findings cannot be generalized widely.

Based on these findings, the researcher recommends the need for teacher training in designing projects based on real phenomena as well as the development of assessment instruments that emphasize critical thinking skills and the association of theory with empirical experience. School policy support through the provision of contextual yet straightforward facilities is also needed, accompanied by follow-up research with a broader scope and longer time to obtain a more comprehensive picture. Thus, the integration of PjBL and the philosophy of realism can provide a strong foundation for contextual, relevant, and meaningful Natural Science learning, supporting the development of students at the elementary level.

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