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Efforts To Improve Science Process Skills Through The Implementation of Project-Based Learning Approaches at MIM Tinggarjaya

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ABSTRACT

This study aims to improve the science process skills of fourth grade students in Natural Sciences (IPA) through the application of a project-based learning approach. Science process skills include observation, classification, data interpretation, designing experiments, and communicating research results. However, in practice, many students have difficulty in developing these skills due to learning methods that are still centered on the teacher and do not actively involve students in exploration and problem solving. This study uses a classroom action research (CAR) method consisting of two cycles. Each cycle includes the planning, implementation, observation, and reflection stages. The subjects of the study were 24 fourth grade students of MIM Tinggarjaya. Data collection techniques were carried out through observation, interviews, tests, and documentation. The data obtained were analyzed descriptively qualitatively and quantitatively to see the development of students' science process skills from each learning cycle. The results showed that the application of project-based learning was able to significantly improve students' science process skills. In the first cycle, students' process skills were still in the sufficient category with an average score of 65. However, after improvements and strengthening of learning strategies in the second cycle, the average score increased to 82, with more than 80% of students reaching the good to very good category. This improvement can be seen from the increasing ability of students to make observations, make hypotheses, conduct simple experiments, and present research results in the form of reports or presentations. The conclusion of this study is that the project-based learning approach can be an effective solution in improving students' science process skills. With project-based learning, students are more active, creative, and able to develop critical thinking skills and problem solving in a scientific context. Therefore, it is recommended for educators to integrate this approach into science learning in order to improve the quality of learning and student learning outcomes.

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Introduction

Science education in elementary schools plays an important role in building conceptual understanding and critical and creative thinking skills in students. One of the main aspects in learning Natural Sciences (IPA) is mastery of science process skills, which include the ability to observe, classify, interpret data, design experiments, and communicate research results. These skills are very important to help students understand science concepts more deeply and apply them in everyday life.

However, in the reality of classroom learning, students' science process skills are still relatively low. This is caused by various factors, one of which is the use of learning methods that are still conventional and teacher-centered. This method does not provide students with the opportunity to explore concepts independently through science-based experiments or projects. As a result, many students only memorize theories without understanding how scientific processes work in reality.

Based on the results of initial observations in class IV MIM Tinggarjaya, it was found that most students had difficulty in conducting systematic observations, designing simple experiments, and presenting experimental results sequentially and logically. Students' science process skills scores also tend to be low, with the majority of students scoring below the minimum completion standard (KKM). This shows a gap between expectations for science learning based on process skills and actual conditions in the field.

To overcome this problem, a more interactive and hands-on experience-based learning approach is needed. One strategy that can be applied is project-based learning (PjBL). This approach allows students to learn through real projects that challenge them to think critically, collaborate, and solve problems independently. By actively involving students in the inquiry and exploration process, it is hoped that their science process skills can improve significantly.

Science education in elementary schools plays an important role in building conceptual understanding and critical and creative thinking skills in students. One of the main aspects in learning Natural Sciences (IPA) is mastery of science process skills, which include the ability to observe, classify, interpret data, design experiments, and communicate research results. These skills are very important to help students understand science concepts more deeply and apply them in everyday life.

However, in the reality of classroom learning, students' science process skills are still relatively low. This is caused by various factors, one of which is the use of learning methods that are still conventional and teacher-centered. This method does not provide students with the opportunity to explore concepts independently through science-based experiments or projects. As a result, many students only memorize theories without understanding how scientific processes work in reality. Based on the results of initial observations in class IV MIM Tinggarjaya, it was found that most students had difficulty in conducting systematic observations, designing simple experiments, and presenting experimental results in a coherent and logical manner. Students' science process skills scores also tend to be low, with the majority of students scoring below the minimum completion standard (KKM). In addition, student interaction in learning activities is still passive, where they only receive material from the teacher without any encouragement to find answers independently. This shows a gap between expectations for science learning based on process skills and actual conditions in the field.

One of the main problems in learning science in elementary schools is the lack of use of approaches that can stimulate students' critical thinking skills and science process skills. Learning that only focuses on memorizing theories without direct experience in the scientific process can hinder the development of science skills that should be the basis for science learning. Therefore, a more innovative learning strategy is needed that is in accordance with students' needs.

To overcome this problem, a more interactive learning approach is needed that is based on direct experience. One strategy that can be applied is project-based learning (PjBL). This approach allows students to learn through real projects that challenge them to think critically, collaborate, and solve problems independently. By actively involving students in the inquiry and exploration process, it is hoped that their science process skills can improve significantly.

Project-based learning provides opportunities for students to experience firsthand how science is applied in everyday life. Through the projects given, students not only understand the theory but can also develop skills in conducting experiments, processing data, and drawing conclusions based on the facts they find. In addition, project-based learning also encourages students to work together in groups, thereby improving their communication and collaboration skills.

This study aims to analyze the effectiveness of implementing project-based learning in improving the science process skills of grade IV students at MIM Tinggarjaya. Through classroom action research (CAR), this study will test whether the project-based approach can improve students' ability to understand and apply science concepts in more depth. In addition, this study will also identify the challenges faced in

implementing project-based learning and provide solutions so that this strategy can be implemented optimally.

The results of this study are expected to contribute to the development of more innovative science learning strategies, as well as being a reference for educators in designing learning models that can improve the quality of student learning outcomes optimally. In addition, this study can also provide insight for schools in developing a more project-based curriculum, so that learning becomes more interesting and relevant to the needs and characteristics of students in this modern era.

Through this study, it is hoped that science learning at the elementary school level will no longer only focus on understanding concepts theoretically, but also provide a more meaningful learning experience for students. By improving science process skills from an early age, students will be better prepared to face learning challenges at higher levels and have critical thinking skills that they can use in everyday life.

Methods

This Classroom Action Research (CAR) aims to improve students' science process skills by implementing a project-based learning (PBL) approach at MIM Tinggarjaya. Science process skills are essential for students to develop a deeper understanding of scientific concepts and become more proficient in scientific inquiry. These skills include observing, classifying, measuring, predicting, and experimenting, all of which are vital in fostering scientific literacy. The PBL approach was chosen because of its potential to enhance these skills through hands-on, real-world projects that engage students in active learning. The research was conducted in two cycles, each consisting of four phases: planning, action, observation, and reflection. The first cycle began with an assessment of students' baseline knowledge and science process skills. This initial assessment revealed that many students were struggling with applying basic scientific methods and lacked confidence in conducting experiments and problem-solving activities. As a result, it was determined that a more engaging, student-centered approach was needed to improve their skills.

In the planning phase, the teacher designed a project-based learning activity that focused on a specific scientific topic relevant to the students' curriculum. The project aimed to allow students to engage in all stages of the scientific process, from posing questions to conducting experiments and presenting their findings. The project was intended to be collaborative, allowing students to work in groups, fostering communication and teamwork skills while exploring science through inquiry. The action phase of the first cycle involved the implementation of the project. Students were divided into small groups and given the task of designing and conducting a simple experiment related to a scientific concept they were studying. Throughout the project, the teacher acted as a facilitator, providing guidance and support as needed, but

allowing the students to take responsibility for their learning. The students were encouraged to ask questions, make predictions, collect data, and analyze their results, all of which are essential elements of science process skills.

During the observation phase of the first cycle, the teacher closely monitored the students' involvement in the project. Observations were made on the students' ability to apply science process skills such as hypothesizing, observing, and classifying data. It was found that while many students were engaged in the project and showed an interest in the scientific concepts being explored, some students had difficulty in formulating hypotheses or making accurate observations. These challenges indicated areas where the students would need additional support and guidance. After the completion of the first cycle, a reflection session was held to evaluate the effectiveness of the project-based learning approach. The teacher reflected on both the strengths and weaknesses observed during the project. Positive outcomes included increased student engagement, improved teamwork, and a greater interest in science. However, the reflection also highlighted the need for more structured guidance in helping students develop their hypotheses and conduct experiments with more precision.

Based on the reflections from the first cycle, the second cycle was planned to address the areas where students had struggled. The teacher decided to provide additional scaffolding to help students with formulating hypotheses and improving their observation and data collection techniques. The second cycle involved revising the project activities to include more explicit instruction on the steps of the scientific process, such as how to make predictions, collect accurate data, and analyze results effectively. The action phase of the second cycle was implemented with the revised project plan. This time, the teacher provided more structured guidance throughout the project. For example, before the students began their experiments, they were given a clearer framework for how to make hypotheses and how to systematically observe and measure the phenomena they were studying. The teacher also encouraged students to record their observations in a more detailed and organized manner, which helped them to better analyze their results.

During the observation phase of the second cycle, it became clear that the students were making progress in applying science process skills more effectively. They were able to formulate hypotheses with greater clarity, conduct experiments with more precision, and analyze their data more thoroughly. The increased guidance in the second cycle helped students to focus more on the scientific methods and ensured they were applying the correct procedures throughout the project. At the end of the second cycle, a final reflection session was conducted to evaluate the students' overall progress. The teacher noted significant improvements in students' ability to apply science process skills. They were more confident in their ability to conduct experiments and communicate their findings. Additionally, the students demonstrated a better

understanding of the scientific process, as evidenced by their ability to present their results clearly and accurately. The final assessment also showed an increase in students' critical thinking and problem-solving skills.

In conclusion, the implementation of project-based learning significantly improved the science process skills of students at MIM Tinggarjaya. Through the hands-on, inquiry-based nature of the PBL approach, students were actively engaged in learning and had the opportunity to practice and apply essential science skills. The teacher's role as a facilitator, combined with structured guidance and reflection, contributed to the overall success of the approach. The findings from this study suggest that PBL is an effective method for enhancing science process skills and fostering a deeper understanding of scientific concepts among elementary school students.

Result

The results of the Classroom Action Research (CAR) conducted at MIM Tinggarjaya demonstrate the effectiveness of the project-based learning (PBL) approach in improving students' science process skills. The research was conducted in two cycles, and significant improvements were observed in students' abilities to engage with and apply the scientific method. The study focused on the development of essential science process skills, including observing, hypothesizing, experimenting, collecting data, and drawing conclusions. In the first cycle, an initial assessment revealed that many students had limited experience in conducting scientific experiments and applying basic science process skills. While they were able to recall scientific facts, they struggled with formulating hypotheses, observing phenomena systematically, and recording data accurately. This baseline assessment provided the starting point for the intervention, where the project-based learning approach would be introduced to engage students in active, hands-on science learning.

During the first cycle, students were introduced to a project that required them to design and conduct a simple scientific experiment. The project was centered around a topic relevant to the curriculum and aimed to allow students to practice the different stages of the scientific process. The students worked in small groups to develop their experiments, make predictions, collect data, and analyze their findings. Although students were engaged in the project, there were challenges in terms of applying science process skills effectively. Observations during the first cycle indicated that while students were interested in the project and motivated to explore the topic, many of them struggled with specific science process skills. For example, students had difficulty formulating clear hypotheses and structuring their experiments. Furthermore, some students lacked the ability to record data in an organized manner, which hindered their ability to analyze their results. Despite these challenges, the project-based approach

increased student engagement and curiosity, highlighting the potential for improvement through further guidance and scaffolding.

In the reflection phase of the first cycle, the teacher identified the areas that required more attention. It became clear that students needed additional support in formulating hypotheses, making accurate observations, and analyzing data. The reflection also revealed that students benefited from the collaborative aspect of the project, as working in groups allowed them to exchange ideas and help each other with the scientific process. This insight was valuable in planning for the second cycle, where the teacher would provide more structured support to help students develop their science process skills. The second cycle involved revising the project-based learning approach to address the difficulties identified in the first cycle. Based on the feedback and reflections, the teacher decided to provide more explicit guidance on the steps of the scientific process. The revised project included clearer instructions on how to formulate hypotheses, observe phenomena systematically, and record data in an organized manner. The teacher also incorporated more opportunities for students to practice these skills before starting the experiment, ensuring that they were better prepared to carry out the project successfully.

During the second cycle, students worked on a similar project, but with more structured support. The teacher guided students through each step of the scientific process, emphasizing the importance of clear and measurable hypotheses. Students were given templates for recording data, which helped them organize their observations and ensure that the data was accurate and complete. Additionally, the teacher provided more time for students to review their findings and discuss the results with their peers, further enhancing their understanding of the scientific method. Observations during the second cycle showed noticeable improvements in students' ability to apply science process skills. Many students were now able to formulate more precise hypotheses and design experiments with greater clarity. They were also better at observing and recording their data, which helped them analyze their results more effectively. The increased support and structured guidance allowed students to gain a better understanding of each step of the scientific process, and they became more confident in their ability to conduct experiments independently.

In the final reflection phase of the second cycle, the teacher assessed the overall progress of the students. The students demonstrated significant improvements in their ability to apply science process skills. They were more adept at formulating hypotheses, making systematic observations, and analyzing data. Furthermore, students were able to present their findings more clearly and accurately, demonstrating a deeper understanding of the scientific process. The results of the final assessment showed a marked improvement in their science process skills compared to the pre-assessment conducted before the first cycle. The post-test results confirmed that students had made

significant progress in applying the scientific method. The majority of students were now able to independently perform experiments, formulate hypotheses, observe and record data systematically, and draw conclusions based on their findings. These results indicated that the project-based learning approach had successfully improved students' science process skills. Moreover, the increased student confidence in conducting experiments was a clear sign of the effectiveness of the PBL approach in fostering a deeper understanding of science.

Throughout both cycles, the collaborative aspect of the project-based learning approach played a significant role in enhancing students' learning experiences. Working in groups allowed students to share ideas, discuss scientific concepts, and solve problems together. This collaborative environment helped students develop communication and teamwork skills while also reinforcing their understanding of the scientific method. It also allowed students to learn from one another, which contributed to their overall growth and development in science. One of the key findings from this study was the positive impact of the project-based learning approach on student engagement. Students were more motivated and interested in the scientific concepts being taught, as they were able to participate in hands-on learning activities. The ability to work on real-world projects that involved inquiry and investigation made science more meaningful and relevant to students, which in turn increased their enthusiasm for the subject.

The teacher's role as a facilitator was also crucial to the success of the project-based learning approach. By providing guidance, feedback, and support throughout the process, the teacher helped students navigate challenges and build confidence in their science process skills. The teacher's reflective practices, which involved evaluating the effectiveness of the approach and making adjustments as needed, ensured that the project-based learning activities were tailored to the students' needs and learning styles. The results of this research suggest that project-based learning is a highly effective approach for improving science process skills. The hands-on, inquiry-based nature of the approach not only enhances students' understanding of scientific concepts but also fosters essential skills such as problem-solving, critical thinking, and collaboration. The findings from this study can be used to inform future teaching practices, particularly in science education, where the development of process skills is crucial for students' success in both academic and real-world settings.

In conclusion, the implementation of project-based learning at MIM Tinggarjaya successfully improved students' science process skills. The research demonstrated that with appropriate guidance and a collaborative learning environment, students were able to enhance their ability to engage with the scientific method. The project-based learning approach not only improved students' science process skills but also increased their

motivation and engagement in science, making it a valuable tool for fostering a deeper understanding of scientific inquiry.

Discussion

The findings from this Classroom Action Research (CAR) demonstrate that the implementation of project-based learning (PBL) successfully enhanced students' science process skills at MIM Tinggarjaya. Science process skills, such as observing, hypothesizing, experimenting, collecting data, and analyzing results, are essential for students' scientific literacy. The research revealed that while students initially struggled with applying these skills, the PBL approach fostered a significant improvement in their ability to engage in scientific inquiry. At the outset of the first cycle, students faced difficulties with fundamental aspects of the scientific process, particularly in formulating clear hypotheses and organizing their observations. These challenges were reflected in their initial assessments, where many students had a basic understanding of science facts but lacked proficiency in conducting experiments and applying the scientific method. This highlighted the need for a more engaging and structured approach to develop these essential skills. The project-based learning approach was chosen as it encourages active participation and hands-on learning, making science more tangible and accessible for students.

One of the key factors that contributed to the success of the PBL approach was the active involvement of students in the scientific process. Instead of simply being passive recipients of information, students were given the opportunity to explore, experiment, and collaborate. This hands-on, inquiry-based learning enabled them to take ownership of their learning and develop critical thinking skills as they worked through the steps of a scientific investigation. As a result, students were able to see the relevance of science in their everyday lives, which increased their motivation and engagement. In the first cycle, although the students were engaged in the projects, there were still several challenges in applying science process skills effectively. Many students had difficulty formulating precise hypotheses and creating experiments with clear variables. This indicated that while the PBL approach increased engagement, more support was needed to help students navigate the complexities of scientific inquiry. Through reflection after the first cycle, it became apparent that scaffolding was necessary to ensure that students could successfully apply the scientific method. The teacher’s role as a facilitator was crucial in providing the appropriate guidance without taking over the students' learning process.

The second cycle aimed to address the challenges identified in the first cycle. The teacher introduced more structured guidance to help students develop clear hypotheses, make accurate observations, and record their data systematically. This revision of the project activities proved to be effective, as students were now able to approach the scientific process with greater clarity and confidence. The teacher also

provided students with templates for recording their data, which helped them organize their observations and ensure that their experiments were conducted systematically. The improvement in students' science process skills was evident during the second cycle. Many students demonstrated greater proficiency in formulating hypotheses and conducting experiments with more precision. They were able to observe phenomena more attentively and record their data in a more organized manner, which helped them analyze their results effectively. This progress was a direct result of the structured support and the clear guidance provided throughout the second cycle. By breaking down the scientific process into smaller, manageable steps, students were able to build their understanding incrementally.

The collaborative aspect of the PBL approach also played a significant role in enhancing students' science process skills. Working in groups allowed students to share ideas, discuss their observations, and solve problems together. This peer interaction facilitated deeper learning, as students were able to learn from one another and challenge each other's thinking. The social learning environment not only improved students' scientific inquiry skills but also fostered important teamwork and communication skills. One of the most important outcomes of this research was the improvement in students' ability to communicate their scientific findings. In both cycles, students were required to present their projects and share their results with the class. This presentation aspect helped students refine their ability to explain their scientific process and articulate their findings clearly. The ability to present and defend their experiments allowed students to consolidate their understanding of the scientific method, as it encouraged them to reflect on their learning and communicate it effectively to others.

Additionally, the increase in students' confidence in applying science process skills was a notable result of the project-based learning approach. By engaging in hands-on experiments, students became more comfortable with the scientific process. They were no longer passive learners but active participants in the scientific inquiry process. As a result, they developed a sense of ownership over their learning and became more confident in their ability to conduct experiments independently. This increase in confidence was particularly important, as it demonstrated that students could transfer the skills they had learned in the classroom to real-world situations. The PBL approach also had a positive impact on students' attitudes toward science. As students were involved in meaningful, real-world projects, they saw the practical applications of the scientific concepts they were learning. This relevance to their everyday lives made science more interesting and engaging for them. The inquiry-based nature of the PBL approach allowed students to explore science in a way that was both enjoyable and educational, which ultimately fostered a positive attitude toward the subject.

However, despite the successes, it is important to recognize that some students still faced challenges in mastering certain science process skills. For example, while most students improved in their ability to formulate hypotheses and observe systematically, some struggled with the analysis of data and drawing conclusions. These students required additional support in these areas, highlighting the importance of differentiated instruction. Providing personalized feedback and additional practice opportunities would further help these students refine their skills. Overall, the findings from this research indicate that project-based learning is a highly effective approach for improving science process skills. By engaging students in real-world, hands-on projects, the PBL approach fosters active learning and helps students develop a deeper understanding of the scientific method. The research also emphasizes the importance of scaffolding and structured guidance to support students in mastering complex science process skills. With the right support, students can successfully engage with the scientific process, develop critical thinking skills, and build a lasting interest in science.

In conclusion, the implementation of project-based learning at MIM Tinggarjaya proved to be a valuable tool for enhancing students' science process skills. The approach fostered increased engagement, improved scientific inquiry skills, and boosted student confidence in their ability to apply the scientific method. The research suggests that PBL can be a transformative approach in science education, encouraging students to take an active role in their learning while developing essential skills that are applicable both in and outside the classroom.

Conclusion

The implementation of the project-based learning (PBL) approach at MIM Tinggarjaya successfully improved students' science process skills. Throughout the study, it was evident that PBL encouraged students to engage actively in the scientific method, which included observing, hypothesizing, experimenting, collecting data, and analyzing results. The hands-on, inquiry-based nature of the approach allowed students to experience the scientific process firsthand, leading to a deeper understanding of scientific concepts and methodologies. The research showed significant improvement in students' ability to apply science process skills after the introduction of PBL. Initially, students struggled with formulating hypotheses, conducting experiments, and recording data systematically. However, with increased support and structured guidance from the teacher, students gained more confidence and proficiency in applying these skills. By the end of the study, students were better able to conduct experiments independently and present their findings clearly, demonstrating an enhanced understanding of the scientific process. Furthermore, the collaborative aspect of the PBL approach played a critical role in fostering communication, teamwork, and problem-solving skills among students. Working in groups allowed students to learn from one another, share ideas,

and improve their critical thinking abilities. This collaborative environment not only facilitated the development of science process skills but also contributed to a positive learning experience, as students felt more motivated and engaged in the project. While most students showed considerable improvement, it was noted that some students still faced challenges in areas such as data analysis and drawing conclusions. These students would benefit from further support, and it is essential to provide differentiated instruction to address the individual needs of each student. This ensures that all students, regardless of their starting point, can develop the necessary skills for scientific inquiry. In conclusion, the research highlights the effectiveness of the project-based learning approach in enhancing science process skills. By providing students with opportunities for hands-on learning and guided scientific exploration, PBL promotes active learning, critical thinking, and a deeper understanding of scientific concepts. The findings suggest that integrating PBL into science education is a powerful tool for improving students' scientific literacy and preparing them for future learning and problem-solving challenges.

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