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Implementation of Problem-Based Learning Using Quartet Card Games to Improve Learning Outcomes in Third-Grade Integrated Science

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Abstract
The low IPAS learning outcomes on the life cycle of living organisms among third-grade students at SD 3 Wergu Wetan are an issue that requires attention. Initial assessment results showed that the class average score was only 58.24, with a class-level mastery rate of 25%. This study aims to improve IPAS learning outcomes through the application of a Problem-Based Learning model assisted by a quartet card game. This study is a Classroom Action Research (PTK) conducted in two cycles, each comprising the stages of planning, implementation, observation, and reflection. The research subjects were 20 third-grade students at SD 3 Wergu Wetan. Data were collected through tests, observations, interviews, and documentation, then analyzed using descriptive quantitative and qualitative methods. The results showed that the implementation of the Problem-Based Learning model supported by a quartet card game could improve students' IPAS learning outcomes. The class average score increased from 58.24 in the pre-cycle to 81.80 in Cycle I and 86.35 in Cycle II. The class mastery rate also increased from 25% in the pre-cycle to 75% in Cycle I and reached 85% in Cycle II. Based on these results, the Problem-Based Learning model supported by quartet card games can be used as an alternative teaching method to improve IPAS learning outcomes in elementary schools.

Keywords: *classroom action research; IPAS learning outcomes; life cycle of living organisms; problem-based learning; quartet card game*

INTRODUCTION

Education plays a vital role in developing a high-quality workforce by fostering the knowledge, skills, attitudes, and abilities needed today and in the future. The implementation of Merdeka Belajar places students at the center of the learning process so that learning must be designed to provide meaningful, context-appropriate experiences focused on the students' own needs (Nugroho, 2023). Therefore, teachers must be able to create learning experiences that encourage students to actively participate in building knowledge and improving critical thinking skills. One subject that helps achieve these goals is Natural and Social Sciences (IPAS). The IPAS subject in the Merdeka Curriculum is designed to help students understand various aspects of their surroundings, whether related to nature or society. Students are taught to observe, ask questions, conduct research, and find solutions to problems in their daily lives. IPAS instruction focuses not only on conceptual understanding but also on developing critical thinking, communication, collaboration, and problem-solving skills. Therefore, IPAS instruction requires teaching models and learning media that can make students more active throughout the learning process.

Progress in IPAS learning can be assessed through students' learning outcomes. Learning outcomes are key indicators of the extent to which learning objectives have been achieved. A student's learning outcomes depend not only on their initial abilities but are also influenced by external factors, such as teaching methods, the tools used, and the learning environment created by the teacher.

Learning that does not actively engage students typically results in poorer conceptual understanding and learning outcomes. Learning that allows students to discover and develop their own knowledge can lead to better learning outcomes. The issue of low learning outcomes persists in the IPAS learning process at the elementary school level. Based on observations and initial assessments conducted on third-grade students at SD 3 Wergu Wetan, it was found that students' learning outcomes on the topic of the life cycles of living organisms were still relatively low. Of the 20 students who participated in the lesson, only 5 met the Learning Objective Achievement Criteria (KKTP) of 78%. The average score for students in that class was 58.24, and the class-wide mastery rate reached 25%. These conditions indicate that most students have not yet met the desired competency standards. The low learning outcomes stem from instruction that remains teacher-dominated, a lack of diverse learning media, students' lack of focus during the learning process, and insufficient student participation in learning activities. One solution that can be implemented to address this issue is the use of the Problem-Based Learning (PBL) model. The PBL model is a learning approach that begins with a problem, thereby encouraging students to seek information, conduct research, engage in discussions, and find solutions to the given problem. The implementation of PBL has been proven to enhance student engagement in learning, critical thinking skills, conceptual understanding, and learning outcomes because it allows students to play an active and direct role in the learning process (Annisa et al., 2021; Astuti et al., 2023; Sholikah et al., n.d.). Furthermore, the use of PBL has also been shown to improve participation and learning progress in science (IPAS) among elementary school students, as demonstrated by a 2025 study by Erawatini and her team.

The implementation of the PBL model can be successful if supported by the use of learning media that align with the characteristics and needs of elementary school students. Third-grade students are in the concrete operational stage, so they find it easier to understand concepts when using visual media and activities that involve hands-on experiences. One method that can be used is playing the quartet card game. The quartet card game is an educational tool that presents information through images and text grouped in specific categories. Using the quartet card game makes it easier for students to learn while playing, making the learning process more engaging, interactive, and enjoyable. Various studies have shown that the use of quartet cards can help improve the learning outcomes of elementary school students. The use of quartet cards has been shown to help improve learning outcomes and student engagement because it offers a more engaging learning experience compared to conventional teaching methods (Amalia et al., 2020; Prasetyaningtyas, 2020). Furthermore, quartet cards have also been shown to help improve elementary school students' learning outcomes in the IPAS subject by presenting material that is clearer and easier to understand (Fitriyana et al., 2024). These findings suggest that quartet cards have great potential to enhance the effectiveness of the PBL model in IPAS instruction.

Previous research has also shown that combining instructional models with appropriate media can improve student learning outcomes. The use of the problem-based learning method, supported by illustrated card media, has been shown to successfully improve elementary school students' conceptual understanding, as demonstrated by a study conducted by Annisa and her team in 2021. Furthermore, the use of the problem-based learning method supported by card media has shown an improvement in the learning outcomes of third-grade elementary school students (Astuti et al., 2023). These findings indicate that combining student-centered learning models with engaging instructional media can make the learning process more effective. However, research on the application of the problem-based learning model using quartet card games in the "life cycle of living organisms" curriculum for third-grade elementary school students remains limited. Most previous studies have examined either the use of the problem-based learning model or quartet cards separately. Therefore, this study was conducted to address the imbalance in previous research and to provide an alternative solution for improving elementary school students' IPAS learning outcomes.

Based on the issues outlined above, this study was conducted to describe the initial state of students' learning outcomes on the life cycle of living organisms in the IPAS subject before the implementation of the problem-based learning model supported by the educational quartet card game. In addition, this study aims to analyze the application of the problem-based learning model supported by the educational quartet card game in improving student learning outcomes and to evaluate the improvement in teachers' skills in managing IPAS instruction on the life cycle of living organisms in third grade at SD 3 Wergu Wetan. Through the application of this model and learning media, it is hoped that the learning process will become more active and meaningful and will support improvements in the quality of instruction and student learning outcomes.

METHOD

This study is a classroom action research project aimed at improving students' learning outcomes in the subject of the life cycles of living organisms by implementing a problem-based learning model supported by a quartet card game. Classroom action research is a type of research conducted by teachers themselves in their own classrooms using specific methods, with the aim of continuously improving the quality of the learning process and outcomes (Arikunto et al., 2021).

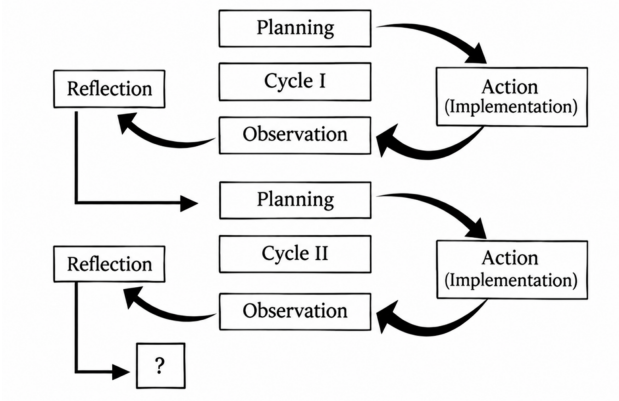

Figure 1. PTK Cycle Flowchart (Arikunto, 2021)

This study was conducted at SD 3 Wergu Wetan, located in the Kota Kudus subdistrict, Kudus Regency, during the odd semester of the 2026/2027 school year. The subjects of this study were 20 third-grade students, consisting of 11 girls and 9 boys. This research topic was selected because the results of the initial assessment indicated that students' understanding of the life cycle of living organisms was still lacking, thus requiring efforts to improve learning by applying a more innovative and student-centered learning model. The study was conducted in two cycles. Each cycle followed the action research model developed by Kemmis and McTaggart, which is divided into four stages: planning, implementation, observation, and reflection (Kemmis et al., 2014). The findings from each cycle were used as a reference to refine the steps in the subsequent cycle. During the planning stage, the researcher developed various instructional materials, such as teaching modules, instructional resources, a quartet card game, student worksheets, observation instruments, and instruments to evaluate student learning outcomes. The action phase involved implementing a problem-based learning model that utilized the quartet card game in the "life cycle of living organisms" unit. The observation stage was conducted to assess the teacher's competence and students' process skills during the learning activities. Next, a reflection phase was conducted to evaluate the results of the intervention and determine improvements to be made in the next cycle.

The research data included information on teacher competence, students' process skills, and student learning outcomes. Data on teacher competence were obtained through a teacher competence observation sheet. Data on students' process skills were obtained by observing students during learning activities using a student process skills observation sheet. Learning outcome data were obtained from evaluation tests administered at the end of each cycle. Additionally, supporting data were gathered through interviews and document analysis. The techniques used to collect data in this study included observation, testing, interviews, and documentation. Observation was used to gather data on teachers' competencies and students' learning process skills. Tests were used to determine the extent of students' understanding at the end of each cycle. Interviews were conducted to gather information about students' obstacles and responses during the learning process, while documentation was used to supplement the research data with photographs of learning activities and other supporting documents.

The research instruments consisted of an observation sheet to measure teacher skills, an observation sheet to measure students' learning process skills, an interview guide, documentation, and test items to evaluate learning outcomes. The teacher skills observation sheet was used to evaluate the implementation of the Problem-Based Learning (PBL) methodology, while the students' learning process skills observation sheet was used to measure the depth of student participation during the learning process. Data on teacher skills and student process skills were analyzed using descriptive quantitative analysis techniques expressed as percentages. Learning outcomes were calculated by

determining the class average, the number of students who met the Minimum Competency Standard (KKM), and the percentage of class-level mastery. An individual's learning mastery was determined based on the Learning Objective Achievement Criteria (KKTP) set at 78 percent. Data from interviews and documents were then analyzed using descriptive qualitative methods to aid in understanding the research findings. The study was considered successful if teachers' competencies reached a minimum of 80% in the "good" category, students' process skills reached a minimum of 80% in the "good" category, and at least 85% of students met the KKTP of 78.

RESULTS AND DISCUSSION

Pre-cycle Results

The pre-cycle phase was conducted to determine the initial level of student learning in the IPAS subject, specifically regarding the life cycles of living organisms, before implementing the problem-based learning model aided by the educational quartet card game. Data were obtained through a pre-test administered to 20 third-grade students at SD 3 Wergu Wetan. Based on Table 1, the average score for student learning outcomes in the pre-cycle phase was 58.24, with a class achievement rate of 25%. Of the 20 students who took the initial assessment, only 5 achieved the minimum passing score of 78, while the other 15 had not yet met the learning proficiency standard. These results indicate that the majority of students still struggle to understand the material on the life cycles of living organisms. The low student learning outcomes are supported by observation results showing that student engagement in learning is still suboptimal.

Some students remained passive during learning activities, participated little in discussions, and had difficulty understanding and connecting the concept of the life cycle of living organisms to their daily lives. Additionally, the lack of variety in instructional media made the learning process less engaging, which in turn led to low student comprehension of the material. Based on these initial conditions, corrective measures are needed to increase student engagement in the learning process while simultaneously improving their learning outcomes. Therefore, this study implemented a problem-based learning model aided by an educational quartet card game as an effort to improve student learning outcomes on the life cycle of living organisms in third grade at SD 3 Wergu Wetan. Cycle I was conducted over three sessions using a Problem-Based Learning model supplemented by an educational quartet card game to teach the life cycle of living organisms. The data collected included teacher skills, student process skills, and student learning outcomes.

Table 1. Student Learning Outcomes in the Pre-cycle Phase

Descripyion	Result
Number Of students	20
Class Average Score	58,24
Student Who Met the Standard	5
Student Who Did Not Meet the Standard	15
Class Achievement Rate	25%

Figure 1. Implementation of Learning Cycle 1

Teacher Skills

Table 2. Results of Teacher Skill Observations in Cycle I

Session	Percentage	Criterion
1	95%	Very Good
2	95%	Very Good
3	95%	Very Good
Average	95,00%	Very Good

The results of the teacher skills observations for Cycle I are presented in Table 2. Based on Table 2, teachers' skills in managing the learning process achieved an average percentage of 95.00%, falling into the "very good" category. These results indicate that teachers were able to effectively implement the Problem-Based Learning (PBL) framework, from problem orientation, student organization, guidance during inquiry, presentation of results, to learning evaluation.

Student Process Skills

Table 3. Results of the Observation of Students' Process Skills in Cycle I

Session	Percentage	Criteria
1	75,83%	Good
2	80,00%	Good
3	84,17%	Very Good
Average	80,00%	Good

The results of the observation of students' process skills in Cycle I are presented in Table 3. Based on Table 3, students' process skills achieved an average percentage of 80.00%, falling into the "good" category. The skills observed included the ability to observe, identify information, categorize concepts, collaborate in groups, and communicate discussion results. These results indicate that most students were actively engaged in the learning process, although there were still some students who required further guidance.

Student Learning Outcomes

Table 4. Student Learning Outcomes for Cycle I

Description	Results
Number of Students	20
Hight Score	90
Lowes Score	66
Class Average	81,80
Students Who Met the Standard	15
Students Who Did Not Meet the Standard	5
Class Achievement Rate	75%

Student learning outcomes at the end of Cycle I are presented in Table 4. Based on Table 4, the average student learning outcome score in Cycle I was 81.80, with a class achievement rate of 75%. A total of 15 students achieved the minimum competency standard (KKTP) of 78, while the other 5 students did not meet the standard. These results indicate an improvement in learning outcomes compared to the initial conditions; however, the research success indicator has not been met because the class-wide mastery rate has not reached the minimum target of 85%.

Reflection on Cycle I

The results of the intervention in Cycle I showed improvements in teacher skills, student process skills, and student learning outcomes. However, the class-wide mastery rate remained at 75%, thus failing to meet the research success indicators. Therefore, the intervention continued into Cycle II with improvements aimed at enhancing guidance for students experiencing learning difficulties, optimizing group work, and reinforcing the material and active student participation during instruction.

Results of Cycle II

Figure 2. Implementation of Learning Cycle 2

Cycle II was conducted as a follow-up to the reflections from Cycle I. The improvements made included enhancing guidance for students experiencing learning difficulties, optimizing group work, and providing more targeted reinforcement of the material. The data collected in Cycle II included teacher skills, student process skills, and student learning outcomes.

Teacher Skills

Table 5. Results of Teacher Skills Observations in Cycle II

Session	Percentage	Criterion
4	96%	Very Good
5	97%	Very Good
6	98%	Very Good
Average	97,00%	Very Good

The results of the teacher skills observations in Cycle II are presented in Table 5. Based on Table 5, teachers' skills in managing instruction during Cycle II achieved an average percentage of 97.00%, falling into the "very good" category. These results indicate an improvement compared to Cycle I. Teachers have become more skilled at applying the Problem-Based Learning framework, managing instructional activities, and guiding students during problem-solving activities and group discussions.

Students' Process Skills

Table 6. Results of Observations of Students' Process Skills in Cycle II

Session	Percenteage	Criterion
4	88,33%	Very Good
5	92,29%	Very Good
6	96,04%	Very Good
Average	92,22%	Very Good

The results of the observations of students' process skills in Cycle II are presented in Table 6. Based on Table 6, students' process skills achieved an average percentage of 92.22%, falling into the "very good" category. Improvements were evident in students' abilities to observe, identify information, categorize concepts, collaborate in groups, and communicate the results of discussions. These results indicate that the majority of students were actively engaged in the learning process and were able to carry out learning activities in accordance with the designed stages.

Student Learning Outcomes

Table 7. Student Learning Outcomes for Cycle II

Description	Result
Number of Students	20
Highest Score	96
Lowest Score	72
Class Average	86,35
Students Who Met the Standard	17
Students Who Did Not Meet the Standard	3
Class-Level Achievement Rate	85%

Student learning outcomes at the end of Cycle II are presented in Table 7. Based on Table 7, the average student learning score in Cycle II reached 86.35 with a class-wide mastery rate of 85%. A total of 17 students achieved the minimum passing score (KKTP) of 78, while the other 3 students had not yet achieved learning mastery. These results indicate an improvement compared to Cycle I and have met the established research success indicator, namely a minimum class-wide mastery rate of 85%.

Reflection on Cycle II

The implementation of the intervention in Cycle II showed improvements in teacher skills, student process skills, and student learning outcomes. The class-wide achievement rate reached 85%, thereby meeting the study's success indicator. Additionally, both teacher skills and student process skills were rated as "very good." Therefore, the research intervention was terminated in Cycle II because the study's objectives had been achieved.

DISCUSSION

To examine improvements in teachers' skills, students' process skills, and learning outcomes during the implementation of the interventions, a summary of the research results is presented in figure 3.

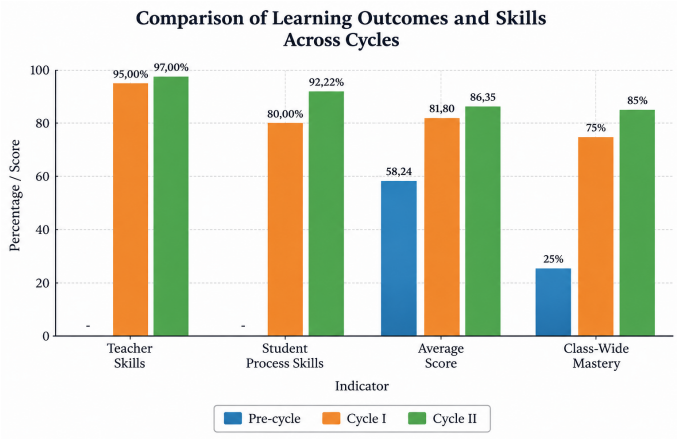

Figure 3. Summary of Research Results

Based on Figure 3, all research indicators showed improvement in each cycle. The improvement in teacher skills from 95.00% in Cycle I to 97.00% in Cycle II was followed by an improvement in student process skills from 80.00% to 92.22%. In line with these improvements, the average student learning score increased from 58.24 in the pre-cycle to 81.80 in Cycle I and 86.35 in Cycle II, while the classical mastery rate rose from 25% to 75% and reached 85%. These findings indicate that learning success is influenced not only by the implementation of the Problem-Based Learning model aided by educational quartet card games but also by the improved quality of teachers' instructional management and students' active engagement throughout the learning process.

Initial Conditions of Student Learning Outcomes on the Life Cycle of Living Organisms

Pre-cycle results showed that the learning outcomes of third-grade students at SD 3 Wergu Wetan on the topic of the life cycles of living organisms were still low. The class average score was 58.24, with a classical mastery rate of 25%. These results indicate that the majority of students had not yet achieved the established minimum competency standards (KKTP). The low learning outcomes were likely due to a teaching approach that remained teacher-centered, resulting in suboptimal student engagement in the learning process. Furthermore, the lack of variety in instructional media has resulted in low student interest and motivation. These conditions highlight the need to implement a learning model that actively engages students in the learning process, thereby enhancing their conceptual understanding.

Improving Teacher Skills through the Implementation of a Problem-Based Learning Model Supported by Quartet Card Educational Game

The research results show that teachers' skills improved from 95.00% in Cycle I to 97.00% in Cycle II, falling into the "very good" category. This improvement indicates that teachers are

increasingly capable of optimally implementing the Problem-Based Learning syntax, ranging from problem orientation, student organization, guidance during inquiry, presentation of results, to learning evaluation. The improvement in teachers' skills occurred through a process of reflection and action refinement in each cycle. Teachers became more effective at managing the classroom, guiding group discussions, and utilizing the educational Quartet Card game as a learning medium. These conditions supported the creation of more active and student-centered learning, thereby making the learning process more effective.

Improving Student Learning Outcomes through the Implementation of a Problem-Based Learning Model Supported by Quartet Card Educational Games

The research results indicate that the implementation of a Problem-Based Learning model supported by quartet card educational games is capable of improving student learning outcomes on the topic of the life cycles of living organisms. The class average score increased from 58.24 in the pre-cycle to 81.80 in Cycle I and rose further to 86.35 in Cycle II. The class mastery rate also increased from 25% in the pre-cycle to 75% in Cycle I and reached 85% in Cycle II. This improvement in learning outcomes occurred because the Problem-Based Learning model provided students with the opportunity to actively engage in identifying problems, searching for information, discussing, and drawing conclusions from their learning. Additionally, the use of the educational quartet card game helped students understand the concept of the life cycles of living organisms through engaging images and information, making the learning process more meaningful and enjoyable. The improvement in learning outcomes was also supported by an increase in students' process skills, as evidenced by a rise in the percentage from 80.00% in Cycle I to 92.22% in Cycle II. Students' enhanced abilities to observe, identify information, collaborate, and communicate learning outcomes helped them understand the material more deeply. Thus, the improvement in learning outcomes achieved is the result of the integration of teachers' improved skills in managing the learning process, students' improved process skills, and the application of the Problem-Based Learning model aided by educational quartet card games, which foster active and meaningful learning.

CONCLUSION

Based on the results of the classroom action research conducted over two cycles, it can be concluded that the implementation of the problem-based learning model, supported by educational quartet card games, is effective in improving learning outcomes in Integrated Science (IPAS) on the life cycle of living organisms among third-grade students at SD 3 Wergu Wetan. This improvement is evidenced by an increase in the class average score from 58.24 in the pre-cycle to 81.80 in Cycle I and 86.35 in Cycle II, as well as an increase in the class mastery rate from 25% to 85%. This success was supported by improvements in the teacher's skills in managing the learning process and in the students' process skills during the learning activities. Thus, the implementation of the problem-based learning model aided by the educational quartet card game can serve as an effective alternative learning method to improve learning outcomes in IPAS on the topic of the life cycles of living organisms.

DECLARATION OF GENERATIVE AI

The authors declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

CONFLICTING INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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