Jurnal Inovasi Pendidikan IPA dan Etnosains (JIPIE)
Volume 1, Number 1, 2026 pp. 1-8
Open Access: https://ejournal.bbg.ac.id/jipie

IMPROVING STUDENT LEARNING OUTCOMES THROUGH PROJECT-BASED LEARNING ON SOLAR SYSTEM TOPICS AT SDN 19 BANDA ACEH.

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ARTICLE INFO

Article history:
Received: April 1, 2026
Revised: April, 20 2026
Accepted: May, 5 2026
Available online: May, 31 2026

Keywords:
Project-Based Learning, Learning Outcomes, Solar System, Science Education, Elementary School.

ABSTRACT

This study aims to improve the learning outcomes of 6th-grade students at SDN 19 Banda Aceh on solar system topics by implementing the Project-Based Learning (PjBL) model. The research was motivated by the low student learning outcomes caused by teacher-centered instructional practices, limited use of learning media, and low student engagement, which resulted in most students failing to meet the Minimum Mastery Criteria (KKM). This classroom action research involved 28 students and was conducted in two cycles to address initial student performance that fell below the Minimum Mastery Criteria (KKM). Data were gathered through observation, tests, and documentation. In Cycle I, classical mastery reached 73.0% (19 students) with an average score of 78.0%, which did not yet meet the required standard. Following improvements in Cycle II, student outcomes increased significantly, with mastery reaching 88.4% (23 students) and only 11.5% of students remaining below the threshold. The study concludes that the project-based learning model is effective in enhancing student learning outcomes in Science and Social Studies (IPAS) regarding the solar system in elementary education.

INTRODUCTION

Education is a cornerstone that determines a nation's progress and the quality of its human resources. Through education, individuals are expected to generate innovative and creative ideas to navigate the challenges of modern times (Rahayu et al., 2022). Improving the quality of education in Indonesia involves creating a meaningful learning environment where dynamic interactions occur between students, teachers, and learning resources (National Education System Law No. 20, 2003). In this context, the teacher's role has shifted

from being the primary source of information to a facilitator who supports students in their knowledge construction process.

A crucial discipline in the elementary school curriculum is Natural Science (IPA). Science education is essentially the study of natural phenomena within a cause-and-effect context, encompassing planning, implementation, and evaluation phases (Aenun, 2023). It aims to provide students with holistic knowledge, a realistic worldview, and problem-solving skills (Shofatun et al., 2016). Although mastering science is vital in today's technological era (Umami, 2021), it is often perceived as a difficult subject due to its broad scope and the conceptual depth required. Ideally, science education should emphasize direct experience, enabling students to understand the natural environment scientifically and effectively (Primayana et al., 2019).

However, current realities reveal a gap between ideal standards and classroom practice. Initial observations at SDN 19 Banda Aceh showed that 6th-grade learning processes remain dominated by conventional, teacher-centered lectures. Teachers rarely utilize varied media and rely heavily on textbooks. This environment causes students to become bored, passive, and hesitant to express opinions. Consequently, student engagement is low, leading to learning outcomes that fall below the Minimum Mastery Criteria (KKM). Learning outcomes themselves represent changes in behavior, knowledge, and skills achieved by students following the educational process (Sudirman, 2007; Mirdanda, 2018).

To address these issues, an innovative learning model is required to enhance active student engagement. Project-Based Learning (PjBL) serves as a solution that prioritizes contextual learning through complex activities (Andiana, 2019). This model allows students to take an active role and responsibility in solving problems through real-world projects (Fitria, 2021). The advantage of PjBL lies in its ability to develop critical thinking, creativity, decision-making, and self-confidence (Yani & Taufik, 2020). Through PjBL, abstract topics such as the Solar System—which involves the interaction of the Sun, planets, and other celestial bodies—can be studied in a more applicable and engaging manner.

Based on this background, this study was conducted to examine the implementation of the Project-Based Learning (PjBL) model in improving student learning outcomes on solar system topics in Grade VI at SDN 19 Banda Aceh. This research is expected to provide insights for teachers in selecting effective learning models to foster interest and optimize students' scientific competence.

RESEARCH METHODOLOGY

This study employs Classroom Action Research (CAR), designed to address specific classroom issues through self-reflection and continuous improvement of teaching practices. The research was conducted in two cycles, each following a systematic procedure consisting of four main stages: planning, acting, observing, and evaluating combined with reflection. During the planning stage, the researcher developed project-based learning (PjBL) lesson plans and evaluation instruments.

The acting and observing stages were carried out simultaneously, where the researcher implemented the PjBL model while monitoring student activities and classroom challenges. The evaluation stage was conducted to measure student learning outcomes, followed by a reflection phase to analyze data from observations and tests. The results of the reflection in the first cycle served as a basis for formulating corrective measures in the subsequent cycle to ensure the optimal improvement of student learning outcomes on solar system topics.

RESULT AND DISCUSSION

Data Analysis Techniques

The data analysis in this study follows the interactive model proposed by Miles & Huberman, which consists of three main stages: data reduction, data display, and conclusion drawing or verification. During data reduction, the researcher selects, simplifies, and transforms the raw data collected from classroom observations and student tests. The data is then displayed through narrative descriptions and structured tables to provide a clear overview of the learning progress across cycles. Finally, conclusions are drawn to verify whether the implementation of the project-based learning model effectively addresses the identified classroom issues. To measure student achievement, the research utilizes quantitative formulas to calculate the class average and the classical mastery percentage, categorized into levels ranging from "Very Low" to "Very High."

To measure student learning outcomes, the class average $\bar{X}$ and classical mastery percentage (P) are calculated using the following formulas:

$$\bar{X} = \frac{\sum X}{N}$$

$$P = \frac{\sum student\ who\ passed}{\sum Total\ student} x100\%$$

The calculation of classical mastery percentage refers to the criteria of learning completeness commonly used in classroom action research and educational evaluation (Arikunto, 2013; Sudjana, 2016). Student learning success is categorized based on the

following criteria:

Achievement Level	Category
90% – 100%	Very High
80% – 89%	High
65% – 79%	Moderate
55% – 64%	Low
0% – 54%	Very Low

(Source: (Arikunto, 2013; Sudjana, 2016))

Research Results

The research was conducted in two cycles to improve Science (IPAS) learning outcomes regarding the solar system for 6th-grade students at SDN 19 Banda Aceh. Initial pre-test data revealed a significant gap in student achievement, where only 6 students (23.0%) reached the passing grade with a low class average of 64.2.

Cycle I: Implementation and Initial Progress

The first cycle focused on transitioning from conventional teacher-centered lectures to the Project-Based Learning (PjBL) model. In the planning phase, the researcher developed lesson plans (RPP) that integrated visual media and project-based tasks to simplify the abstract concepts of the solar system. During the action and observation phases, students were introduced to the celestial bodies through educational videos and divided into groups to begin the project of sequencing planet models. The results showed a significant improvement from the pre-test, with student mastery rising from 23.0% to 73.0% and the class average reaching 78.0. Despite this progress, the reflection phase identified several shortcomings: some students remained passive during group discussions, and time management was inefficient, causing the project presentations to be rushed. Because the classical mastery (73.0%) had not yet reached the required 75% threshold, the research proceeded to the second cycle with specific pedagogical adjustments.

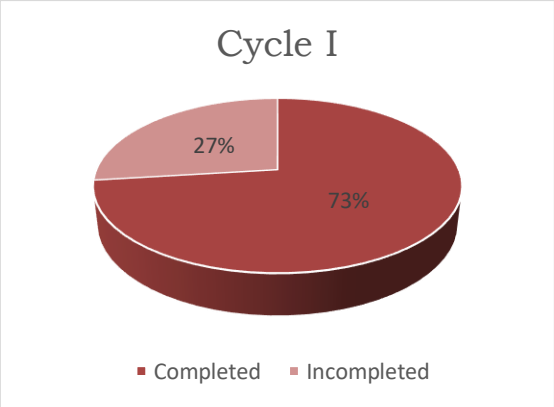

Figure 1. Student learning outcomes and achievement levels in Cycle 1 of Classroom

Action Research

Cycle II: Optimization and Final Achievement

In Cycle II, the research aimed to rectify the weaknesses observed in the previous stage by enhancing instructional media and providing more structured group guidance. The planning phase involved refining the project steps and incorporating more interactive 3D-style images to provide a clearer visualization of planetary orbits. During the implementation, students showed much higher enthusiasm and better collaboration in their groups, demonstrating increased confidence during the performance assessments and presentations. Observations revealed that the students were no longer merely memorizing facts but were actively discussing the characteristics of each planet. This led to a substantial leap in academic performance, with 23 students (88.4%) achieving mastery and the class average climbing to 85.0. The reflection phase concluded that the indicators of success had been fully met, confirming that the refined PjBL model effectively optimized student learning outcomes on solar system topics.

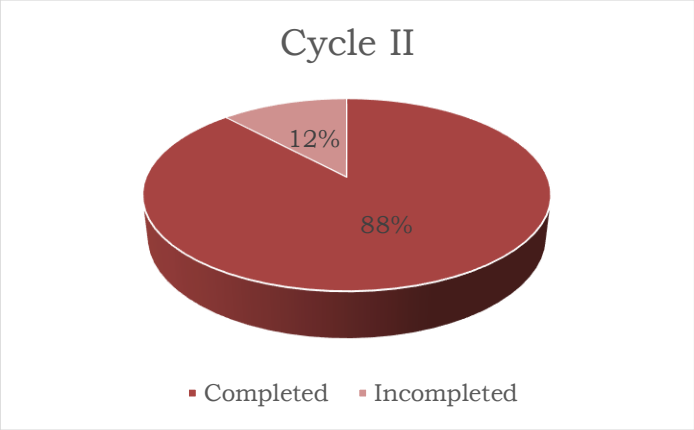

Figure 2. Student learning outcomes and achievement levels in Cycle 1 of Classroom Action Research

Discussion

The application of the PjBL model successfully transformed the learning dynamics from a teacher-centered approach to an active, student-centered environment. In the initial state, conventional methods left students passive and disengaged, resulting in poor academic performance. By engaging students in real-world projects—such as constructing and sequencing solar system models—the abstract concepts of celestial bodies became more concrete and accessible. This finding is consistent with previous studies which indicate that Project-Based Learning enhances student engagement and conceptual understanding

through authentic learning experiences (Thomas, 2000; Bell, 2010).

The progression from a 23.0% mastery rate in the pre-test to 88.4% by the end of Cycle II confirms that project-based activities stimulate critical thinking and scientific curiosity. This result aligns with research conducted by Krajcik and Blumenfeld (2006), who emphasize that PjBL supports deeper learning by encouraging inquiry, collaboration, and problem-solving. Furthermore, the use of supplementary videos and group collaboration further reinforced student understanding, supporting the findings of (Hmelo-Silver, 2004) that structured collaborative learning environments significantly improve students' cognitive outcomes.

Overall, these results demonstrate that PjBL is a highly effective model for teaching complex science topics in elementary education, particularly in improving both learning outcomes and student participation (Holm, 2011).

CONCLUSIONS AND SUGGESTIONS

The implementation of the Project-Based Learning (PjBL) model at SDN 19 Banda Aceh has proven to be a highly effective strategy for improving the Science (IPAS) learning outcomes of 6th-grade students on solar system topics. The research findings indicate a significant and consistent upward trend in academic achievement across two cycles, where the initial classical mastery of only 23.0% in the pre-test rose to 73.0% in Cycle I and ultimately reached 88.4% in Cycle II, with the final class average climbing to 85.0. This study demonstrates that shifting from a teacher-centered approach to a student-centered, project-based environment allows students to transform abstract astronomical concepts into concrete understanding through hands-on activities and collaborative problem-solving. Beyond improving test scores, the PjBL model successfully enhanced student engagement, critical thinking, and confidence, proving to be a vital instructional tool for optimizing scientific competence and addressing the challenges of modern elementary education.

BIBLIOGRAPHY

Ardianti, D. L. (2021). Pengaruh model pembelajaran Problem Based Learning berbasis Socio-Scientific Issues terhadap keterampilan berpikir kritis siswa pada materi pembakaran hidrokarbon (Bachelor's thesis). Jakarta: FITK UIN Syarif Hidayatullah Jakarta. http://repository.uinjkt.ac.id/dspace/handle/123456789/56450

Arifianti, U. (2020). Project Based Learning dalam pembelajaran IPA. Social, Humanities, and Educational Studies (SHES): Conference Series, 3(3), 2079-2082. https://doi.org/10.20961/shes.v3i3.57071

Arikunto, S. (2013). Dasar-dasar evaluasi pendidikan (Edisi revisi). Jakarta: Bumi Aksara.

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. The Clearing House, 83(2), 39–43. https://doi.org/10.1080/00098650903505415

Buck Institute for Education. (2019). What is Project Based Learning? PBLWorks. https://www.pblworks.org/what-is-pbl

Dinda, Y. M. (2021). Pengaruh model pembelajaran Advance Organizer terhadap pemahaman konsep dan keterampilan berpikir kritis (Doctoral dissertation). Lampung: UIN Raden Intan Lampung. http://repository.radenintan.ac.id/16325/

Fajriyyah, R. L., Ngabekti, S., & Partini, P. (2024, May). Meningkatkan motivasi belajar siswa dengan model pembelajaran PjBL di kelas VII pada materi sistem tata surya. Prosiding Seminar Nasional Pendidikan dan Penelitian Tindakan Kelas, 1409-1416.

Fitria, R. (2021). Penerapan model Project Based Learning (PjBL) untuk meningkatkan hasil belajar IPA siswa sekolah dasar. Jurnal Pendidikan Tambusai, 5(2), 3450-3456. https://doi.org/10.31004/jptam.v5i2.1419

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? Educational Psychology Review, 16(3), 235–266. https://doi.org/10.1023/B:EDPR.0000034022.16470.f3

Holm, M. (2011). Project-based instruction: A review of the literature on effectiveness in prekindergarten through 12th grade classrooms. Rivier Academic Journal, 7(2), 1–13.

Isnanto, I., Ahmad, W., & Kudus, K. (2024). Peningkatan hasil belajar siswa melalui model pembelajaran berbasis proyek berbantuan aplikasi Wordwall pada materi tata surya di sekolah dasar. SITTAH: Journal of Primary Education, 5(2), 155-166. https://doi.org/10.58917/sittah.v5i2.138

Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-based learning. In R. K. Sawyer (Ed.), The Cambridge handbook of the learning sciences (pp. 317–334). Cambridge University Press.

Lucas, G. (2005). Instructional research and methods: Project-based learning. George Lucas Educational Foundation.

Nova, S. (2024). Pengaruh model Project Based Learning berbantuan aplikasi Canva terhadap hasil belajar siswa kelas V pada mata pembelajaran IPAS di sekolah dasar (Doctoral dissertation). Bandung: FKIP Universitas Pasundan.

Pendit, S. S. D., & Handayani, N. P. D. (2024). Pengaruh penggunaan model pembelajaran PjBL terhadap keterampilan kolaborasi siswa pada pembelajaran IPA di kelas VI SD Inpres 1 Tanamodindi. COLLASE (Creative of Learning Students Elementary Education), 7(1), 120-131. https://doi.org/10.33369/collase.v7i1.32557

Primayana, K. H. (2022). Implementasi pendidikan karakter dalam pembelajaran Bahasa Indonesia di sekolah dasar. Cetta: Jurnal Ilmu Pendidikan, 5(1), 50-54. https://doi.org/10.37329/cetta.v5i1.1555

Rahayu, F., Risnawati, R., & Hamdani, M. F. (2024). Pengaruh keterampilan mengajar dan kinerja guru pendidikan agama Islam terhadap mutu pendidikan di SMP Negeri 8

Pekanbaru. Jurnal Review Pendidikan dan Pengajaran (JRPP), 7(4), 18221-18232. https://doi.org/10.31004/jrpp.v7i4.33155

Rosefi, T. S. (2024). Pengaruh metode outdoor study terhadap hasil belajar siswa kelas V pada pembelajaran IPA di SDN 156 Seluma (Doctoral dissertation). Bengkulu: UIN Fatmawati Sukarno.

Sari, V., & Eliyasni, R. (2023). Peningkatan hasil belajar peserta didik menggunakan model Problem Based Learning di kelas V SD Negeri 14 Luhak Nan Duo Kabupaten Pasaman Barat. Innovative: Journal Of Social Science Research, 3(3), 4691-4699. https://doi.org/10.31004/innovative.v3i3.1813

Sudjana, N. (2016). Penilaian hasil proses belajar mengajar. Bandung: Remaja Rosdakarya.

Thomas, J. W. (2000). A review of research on project-based learning. Autodesk Foundation.

Willifitri, S. (2023). Upaya menerapkan model pembelajaran Problem Based Learning (PBL) dalam meningkatkan prestasi belajar siswa pada pelajaran matematika di SDN 138/VIII Sungai Bengkal. Jurnal Ilmu Pendidikan dan Psikologi (JIPP), 1(2), 97-102. https://doi.org/10.59059/jipp.v1i2.133