



The Effect of Project-Based Learning (PjBL) Model on the Scientific Creativity at Grade VI Students of State Elementary School 091283 Marihat Huluan

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Abstract

This study aims to improve the scientific creativity of sixth-grade students at Marihat Huluan Elementary School 091283 on the water cycle through the application of the Project-Based Learning (PjBL) model. This study used a pre-experimental method with a sample of 19 students. The research instrument was a scientific creativity test covering aspects of fluency, flexibility, originality, and elaboration. The results showed that the implementation of the PjBL model significantly improved students' scientific creativity. The average student score increased from 63.00, categorized as "Quite Creative" in the pre-test, to 80.31, categorized as "Creative" in the post-test. Furthermore, at the final stage of the study, no more students were found in the "Less Creative" category, and 31.5% of students achieved the "Very Creative" category. This increase in scientific creativity was influenced by project activities that encouraged students to actively explore, collaborate, think creatively, and solve problems independently. Thus, the Project-Based Learning model has proven effective in improving elementary school students' scientific creativity on the water cycle.

Keywords: Project-Based Learning, scientific creativity, water cycle.

INTRODUCTION

Education is a lifelong process, encompassing all conscious and unconscious efforts and activities undertaken to guide, shape, and develop the full potential of human beings. According to Driyarkara (2006), education is the process of humanizing young people, namely the effort to





liberate people so they can think, be responsible, and act ethically in society. According to UNESCO (United Nations Educational, Scientific, and Cultural Organization), education is a human right and a learning process that enables individuals to develop the skills, attitudes, and values necessary for living productively and harmoniously in society. Education aims not only to transfer knowledge but also to shape character, increase cultural awareness, foster creativity, and prepare individuals to face the challenges of the times in a sustainable manner.

Based on the definitions above, education is a systematic process aimed at changing human behavior through directed learning, so that individuals can develop optimally, master life skills, contribute to social development, and achieve personal well-being and national progress. According to Law No. 20 of 2003 concerning the National Education System, "Education is a conscious and planned effort to create a learning atmosphere and process so that students actively develop their potential to possess spiritual and religious strength, self-control, personality, intelligence, noble character, and the skills needed by themselves, society, the nation, and the state." The goal of international education is to prepare individuals to become global citizens capable of living, working, and contributing in a connected and diverse global society. International education also emphasizes cross-cultural understanding, tolerance, and global cooperation. The goals of education, according to the International Baccalaureate (IB), are to develop students who are curious, knowledgeable, caring, and open to differences, to develop individuals who are reflective, possess integrity, and are capable of making ethical decisions, and to encourage students to understand various perspectives and cultures around the world.

The objectives of national education as stated in Law Number 20 of 2003 concerning the National Education System are to develop the potential of students to become people who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. Meanwhile, according to Hamalik (2005), National Education has the aim of creating people who are knowledgeable, have noble character, and have skills that can support the progress of the nation. In the objectives of National Education, it can develop scientific creativity. According to Runco (2004) Creativity is a person's ability to produce something new and useful, whether in the form of ideas, products, or solutions that are unique and different from those that already exist. Scientific creativity has several indicators. According to Torrance (1974), Fluency is the ability to generate many ideas or answers; Flexibility is the ability to think from various perspectives; Originality is the ability to generate unique and unusual ideas; and Elaboration is the ability to develop or elaborate on existing ideas.





The goal of national education, which is to develop student creativity, is still very low in Indonesia. According to Nurhadi (2010), low creativity is also caused by the lack of adequate facilities and support for creative activities, such as laboratories, libraries, and attractive teaching aids. Triatmini, T., & Susanto, M.R. (2024) stated that student creativity in Indonesia is very low. They conducted a study at SDN Nglingdur Girisubo, Gunungkidul. Teachers have so far only relied on drawing/singing methods, resulting in a lack of student creativity in creating works and utilizing natural materials because the learning model does not develop students' scientific creative potential, while according to Raihan (2020) states that children and adolescents rarely see concrete examples of creative thinking and problem solving in the social environment, so they are not accustomed to developing imagination and unique ideas. Therefore, in implementing students' creative thinking, researchers apply a learning model that can develop students' creativity according to Bell (2010) says that "Project Based Learning provides space for students to create original products based on their own understanding, which naturally fosters scientific creativity." Based on the above experts, students' creativity tends to be underdeveloped or under-applied in the learning process. This contrasts with other countries such as Finland, South Korea, Japan, and Singapore.

According to PISA and TIMSS (OECD, 2018 & 2019), results from 64 countries tested student creativity. The study used a maximum score of 60 points, and a score of ≥ 33 points was considered to be a criterion for achieving high student creativity in a country. The results of the research conducted showed that 12 countries ranked highest in student creativity achievement in Indonesia: Singapore with a score of 41 points, South Korea 38 points, Canada 38 points, Australia 37 points, Estonia 36 points, Finland 36 points, New Zealand 36 points, Japan 35 points, OECD Average 33 points, Malaysia 26 points, Thailand 24 points, Philippines 22 points. Meanwhile, Indonesia itself received 19 points, which is categorized as low and does not meet the requirements for a high level of student creativity in Indonesia.

Based on the above studies, the low level of student creativity in Indonesia is caused by a lack of supporting facilities, a lack of varied learning methods, and a lack of innovative learning models that encourage exploration and creation. This is very necessary learning models are needed to improve students' scientific creativity in elementary schools. Based on the results of pre-observations conducted by class VI of SD Negeri 091283 Marihat Huluan, their creativity in learning science about the Water Cycle is still low, and boredom is found among students. The causes are: Teachers lack variety in applying the models used so that students tend to get bored in facing learning. Teachers often use teacher-centered learning so that students are less active in learning. Students have a lack of confidence in conveying answers and ideas to teachers.





Students still think that thematic learning is very difficult.

Based on observations and practical teaching experiences, researchers found that student learning outcomes were still low. Seven students (37%) received a score of 70 or higher, categorized as passing (70-100), and 12 students (63%) received a score of 70 or lower, categorized as failing. This indicates that many students' learning outcomes in science are still considered uncreative. Therefore, teachers need to be more creative in selecting and using learning models that can help students understand the material. Project-Based Learning (PjBL) can be used as a learning model, which aims to provide students with opportunities to express answers or ideas and provide hands-on experience. According to Thomas (2000), PjBL is a student-centered learning approach in which students learn by conducting in-depth investigations into complex and meaningful real-life problems and producing a product or work as the final result.

Based on the opinions of experts and relevant research, it can be concluded that the PjBL learning model is a learning model that prioritizes student creativity in groups or individuals, so that each member must work together to complete the assigned task, then when given a question by the teacher, the original group students are called to answer and provide the group conclusions given by the teacher.

METHODOLOGY

1. Type of Research

This research is a quantitative study using a pre-experimental approach. According to Sugiyono (2018), pre-experimental research is research that provides treatment to research subjects without a control group. The design used is a One Group Pretest-Posttest Design. In this study, a pretest was first administered to determine the students' initial abilities before receiving the treatment. After the pretest, the sample was then given treatment using the Project-Based Learning (PjBL) model, followed by a posttest. This study allows for more accurate results because it allows for comparisons between the pre-treatment and post-treatment conditions. This study does not use a control or comparison group, but instead focuses solely on comparing the results between the pretest and posttest in one group receiving the treatment. Data collected after the treatment is considered data from the experimental group. In other words, this approach uses a one group pretest-posttest design. This research design can be explained in Table 1:



Table 1. Design of the research

Pretest (O_1)	Treatment (X)	Posttest (O_2)
O_1	X	O_2

Source developed from: Sugiyono (2018: 74)

Note:

O_1 = Pretest given before treatment.

X = Treatment using the Project Based Learning (PjBL) model.

O_2 = Posttest given after treatment.

2. Research Location and Time

This research will be conducted at SD N 091283 Marihat Huluan, Jorlang Huluan Village, Pamatang Sidamanik District, Simalungun Regency, North Sumatra Province. The research will be conducted after the research permit is issued. The time the researcher will conduct this research is in February, the even semester of the 2025/2026 academic year.

3. Research Population and Sample

A population is all subjects or objects with specific characteristics that are the focus of a study to draw conclusions (Sugiyono, 2019:126). Based on this, the population in this study was all sixth-grade students at SD N 091283 Marihat Huluan, Pamatang Sidamanik, in the 2025/2026 academic year, totaling 19 students.

The sample in this study was all sixth-grade students at SD N 091283 Marihat Huluan. According to Sugiyono (2019:127), a sample is a portion of the population's size and characteristics. The sampling technique used in this study was total sampling. Total sampling is a sampling technique where the sample size is equal to the population. Therefore, the sample size in this study was 19 students.

4. Data Collection Techniques

Data collection techniques are the most strategic step in research, because the goal of research is to obtain data. Without understanding data collection techniques, researchers will not obtain data that meets established data standards. Data collection techniques significantly influence research results, because with appropriate data collection techniques, accurate and reliable data can be obtained. Sugiyono (2016:224)

The data collection techniques used in this research are:

1) Observation



Observation involves observing the research subjects to observe the activities undertaken by them. This observation allows researchers to determine the learning conditions in the classroom before and after using the Project-Based Learning model.

2) Documentation

Documentation aims to obtain data directly from the research site, including relevant books, regulations, activity reports, photographs, films, documentaries, and other data relevant to the research. Documentation obtained from related parties in order to find out the history of the school, the condition of teachers and students, facilities and infrastructure, photos of the student learning process, as well as data on student learning outcomes obtained from grade V elementary school teachers.

RESULTS

This research was conducted in sixth-grade students at Marihat Huluan State Elementary School 091283 in the 2025/2026 academic year. The population was all sixth-grade students at Marihat Huluan State Elementary School 091283, with a sample size of 19 students. In this study, the researcher employed a pre-experimental study using the Project-Based Learning (PjBL) model.

Based on the data analysis described previously, it was found that the average score for students' scientific creativity before the Project-Based Learning (PjBL) model was 63.00 and increased to 80.31 after the treatment. The results of the hypothesis test using the Paired Sample T-test showed a significance value of 0.000, which is lower than the established significance level of 0.05. Furthermore, the calculated t-value of 12.450 is greater than the t-table value of 2.101. This proves that the alternative hypothesis H_a is accepted and the null hypothesis H_0 is rejected, meaning that the implementation of the Project-Based Learning (PjBL) learning model has a significant and positive effect on the scientific creativity of sixth-grade students at SD N 091283 Marihat Huluan on the water cycle.

The improvement in students' scientific creativity through the Project-Based Learning (PjBL) model in this study aligns with developments in science education theory over the past five years. These research findings are supported by the findings of Hidayat et al. (2022), who confirmed that PjBL is significantly effective in stimulating students' curiosity and originality of ideas. In the context of solving scientific problems, PjBL provides space for students to explore various solutions without fear of error, which is a key foundation of scientific creativity.

Furthermore, Miller & Krajcik (2021) explain that in project-based science learning,





students are positioned as 'young scientists'. They do not simply memorize the water cycle theoretically but construct knowledge through sustained inquiry. The process of designing projects, conducting observations, and producing tangible products (such as water cycle demonstration devices) requires students to integrate conceptual understanding with creative thinking skills. This directly contributes to a significant increase in students' scientific creativity scores, enabling them to generate new and unique ideas to explain natural phenomena.

Based on the explanation above, it can be concluded that the Project-Based Learning model is highly appropriate for sixth-grade elementary school students to apply to the water cycle. This model not only helps students better understand scientific concepts but also fosters creative and scientific thinking skills, which are essential for facing future challenges.

DISCUSSION

The results of this study indicate that the implementation of the Project-Based Learning (PjBL) model significantly improved the scientific creativity of sixth-grade students at SD Negeri 091283 Marihat Hulan. This can be seen from the increase in the average score of students' scientific creativity from 63.00 before treatment to 80.31 after the implementation of PjBL. The statistical analysis through the Paired Sample T-test also confirmed that the increase was significant, as indicated by the significance value of 0.000, which was lower than 0.05, and the calculated t-value of 12.450, which exceeded the t-table value of 2.101. These findings demonstrate that PjBL has a positive effect on students' scientific creativity in learning the water cycle material. The increase in students' scientific creativity occurred because the PjBL model provides opportunities for students to actively participate in the learning process. During project activities, students were encouraged to investigate problems, discuss ideas with peers, and develop solutions independently. Such learning conditions stimulated students to think creatively and explore various possibilities in solving scientific problems. Unlike conventional learning, which often focuses on teacher explanations, PjBL places students at the center of the learning process, allowing them to develop their ideas more freely.

The findings of this study are consistent with the theory that creativity develops effectively through active and meaningful learning experiences. Through project-based activities, students were involved in observation, experimentation, and the creation of project products related to the water cycle. These activities encouraged students to connect prior knowledge with real-life experiences, which strengthened their conceptual understanding while simultaneously improving their creativity. Students were not only asked to understand concepts theoretically but also to apply them in practical and innovative ways. In addition, the



implementation of PjBL encouraged collaboration among students. Group discussions and cooperative project work helped students exchange ideas, provide feedback, and refine their thinking processes. This collaborative atmosphere contributed to the development of flexibility and originality, which are important aspects of scientific creativity. Students became more confident in expressing their opinions and proposing new ideas during the learning process. Such conditions support the development of higher-order thinking skills that are essential in science education.

The improvement in scientific creativity found in this study is also supported by previous studies. Hidayat et al. (2022) stated that PjBL effectively stimulates students' curiosity and originality of ideas because students are directly involved in authentic learning activities. Similarly, Miller and Krajcik (2021) explained that project-based science learning positions students as "young scientists" who actively construct knowledge through investigation and inquiry. In this study, students designed and created water cycle projects that required them to observe, analyze, and explain natural phenomena creatively. These experiences contributed to the improvement of students' creativity scores.

Furthermore, the use of the water cycle topic in this study was highly suitable for the implementation of PjBL because the material is closely related to students' daily lives. Students could easily observe evaporation, condensation, and rainfall processes in their surroundings, making the learning experience more contextual and meaningful. Contextual learning through projects increased students' engagement and motivation, which ultimately supported the development of scientific creativity. When students are motivated and actively involved, they tend to produce more creative and innovative ideas. Another important finding is that after the implementation of PjBL, there were no students categorized as "Less Creative," while several students achieved the "Very Creative" category. This indicates that PjBL not only improved average achievement but also positively affected students with lower initial creativity levels. The learning activities provided equal opportunities for all students to participate, contribute ideas, and develop their potential. Therefore, PjBL can be considered an inclusive learning model that supports creativity development among diverse student abilities.

Overall, this study confirms that the Project-Based Learning model is highly effective for elementary school science learning, particularly in improving students' scientific creativity on the water cycle material. The model helps students develop conceptual understanding, problem-solving abilities, collaboration skills, and creative thinking simultaneously. Therefore, teachers are encouraged to apply PjBL more frequently in science learning activities to create an active, meaningful, and creativity-oriented learning environment for elementary school students.

CONCLUSION

Based on the research results and discussion regarding the influence of the Project-Based Learning (PjBL) model on the scientific creativity of sixth-grade students at SD N 091283 Marihat Huluan on the water cycle, the following conclusions can be drawn: Initial Student Creativity Ability (Pre-test): Before the PjBL model was implemented, students' scientific creativity ability was still in the "Quite Creative" category with an average score of 63.00. At this stage, students tended to have difficulty generating unique ideas (originality) and were unable to explain scientific processes in depth (elaboration). Scientific Creativity Ability Before Treatment (Pre-test): Students' scientific creativity before the PjBL model was implemented was in the "Quite Creative" category with an average score of 63.00. At this stage, students tended to be dominant in the aspect of fluency (smoothness of answers), but were still low in the aspects of originality (originality of ideas) and elaboration (detailing ideas), where many students gave similar answers and only memorized theory.

REFERENCES

- Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement*, 45(1), 131-142.
- Ansari, B. I., Junaidi, J., Maulina, S., Herman, H., Kamaruddin, I., Rahman, A., & Saputra, N. (2023). Blended-Learning Training and Evaluation: A Qualitative Study. *Journal of Intercultural Communication*, 23(4), 155–164. <https://doi.org/10.36923/jicc.v23i4.201>
- Amabile, T. M. (1996). *Creativity in Context*. Westview Press.
- Arends, R. I. (2008). *Learning to Teach* (7th ed.). McGraw-Hill.
- Arikunto, S. (2010). *Prosedur Penelitian Suatu Pendekatan Praktik*. Rineka Cipta.
- Asdak, C. (2010). *Hidrologi dan Pengelolaan Daerah Aliran Sungai*. Gadjah Mada University Press.
- Barrows, H. S., & Tamblyn, R. M. (1980). *Problem-Based Learning: An Approach to Medical Education*. Springer Publishing Company.
- Connie, C., Risdianto, E., Haryanto, H., Maryani, H., Putra, W., Saputra, N., & Herman, H. (2024). Implementation of a Collaborative Online Learning Model for Standardizing Adaptive PBM Class in Postgraduate MAP UNIB. *EVOLUTIONARY STUDIES IN IMAGINATIVE CULTURE*, 1996–2003. <https://doi.org/10.70082/esiculture.vi.2172>
- Eggen, P., & Kauchak, D. (2012). *Strategies and Models for Teachers: Teaching Content and Thinking Skills* (6th ed.). Pearson Education.
- Hidayat, D. (2022). *Konsep Dasar Ilmu Pengetahuan Alam dan Sosial (IPAS)*. Penerbit Adab.

- Hosnan, M. (2014). *Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad 21*. Ghalia Indonesia.
- Hu, W., & Adey, P. (2002). A scientific creativity test for secondary school students. *International Journal of Science Education*, 24(4), 389–403.
- Johnson, D. W., & Johnson, R. T. (1994). *Learning Together and Alone: Cooperative, Competitive, and Individualistic Learning (4th ed.)*. Allyn and Bacon.
- Joyce, B., & Weil, M. (2000). *Models of Teaching (6th ed.)*. Allyn and Bacon.
- Kemendikbud. (2013). Dokumen Kurikulum 2013. Kementerian Pendidikan dan Kebudayaan.
- Kemendikbud. (2014). *Panduan Implementasi Kurikulum 2013*. Kementerian Pendidikan dan Kebudayaan.
- Kemendikbudristek. (2021). *Modul Pembelajaran Ilmu Pengetahuan Alam dan Sosial (IPAS)*. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.
- Larmer, J., & Mergendoller, J. (2010). *Seven essentials for project-based learning. Educational Leadership*, 68(1), 34-37.
- Markham, T. (2011). *Project Based Learning: A Guide to Standards-Focused Project Based Learning for Middle and High School Teachers*. Corwin.
- Munandar, A. (2023). *Pembelajaran IPAS di Sekolah Dasar*. Deepublish.
- Nyoman, Dkk. (2023). *Implementasi Project Based Learning dalam Meningkatkan Kreativitas dan Hasil Belajar Siswa*. Jurnal Pendidikan Tambusai, 7(1), 23-30.
- Papalia, D. E., Olds, S. W., & Feldman, R. D. (2009). *Human Development*. McGraw-Hill.
- Piaget, J. (1972). *The psychology of the child*. New York: Basic Books.
- Purba, N., Sipayung, R. W., Rahmawati, R., Siagian, B. A., Herman, H., Saragi, C. N., and Fatmawati, E. (2024). An Implementation of Project-Based Learning (PBL) Teaching Model in Improving Early Child's Critical Thinking Skill. *Library Progress International*, 44(3), 90-96. <https://bpsjournals.com/library-science/index.php/journal/article/view/313>
- Purba, N., Wondal, R., Yuliantina, I., Sagala, A. C. D., Budiarti, E., Susanti, D., and Herman, H. (2026) Bringing Numbers to Life through Numeracy Literacy: Practical Use of E-Comic Media in Early Education. *Studies in Media and Communication*, 14(1), 15-25. <https://doi.org/10.11114/smc.v14i1.7933>
- Rahmawati, A., & Pratama, S. (2021). *Implementasi Project Based Learning untuk Mengembangkan Kreativitas Ilmiah*. Jurnal Inovasi Pendidikan Kimia, 1(1), 1-10.
- Retnawati, H. (2017). *Analisis Kuantitatif Instrumen Penelitian*. Yogyakarta: Parama Publishing.
- Santrock, J. W. (2018). *Educational Psychology*. McGraw-Hill Education.



- Saragih, N., Sherly, S., & Herman, H. (2024). Konsep Analisis SWOT dalam Meningkatkan Kualitas Pelayanan dan Kepuasan Orangtua Lembaga TK Swasta RK Bintang Timur Pamatang Raya. *Attractive: Innovative Education Journal*, 6(2), 29–35. <https://doi.org/10.51278/aj.v6i2.1094>
- Sari, R. P., & Prasetyo, Z. K. (2022). *Pembelajaran IPAS yang Efektif*. Universitas Negeri Yogyakarta.
- Setiawan, B. (2018). Hubungan Penerapan PjBL dengan Kreativitas dan Keterampilan Proses Sains. *Jurnal Pendidikan IPA Indonesia*, 7(2), 180-187.
- Sinaga, M., Sherly, S., & Herman, H. (2024). Pengaruh Gaya Kepemimpinan Altruistik dan Supervisi Kelas untuk Meningkatkan Kepuasan Kerja Guru di SD Wilayah Siantar Naungan YPK ST. Yoseph Pematangsiantar. *Bulletin of Community Engagement*, 4(2), 1–7. <https://doi.org/10.51278/bce.v4i2.1089>
- Slavin, R. E. (2015). *Cooperative Learning: Theory, Research, and Practice (2nd ed.)*. Allyn and Bacon.
- Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Alfabeta.
- Suryosubroto. (2009). *Proses Belajar Mengajar di Sekolah*. Rineka Cipta.
- Trewartha, G. T. (2015). *An Introduction to Climate*. McGraw-Hill.
- Trianto. (2009). *Mendesain Model Pembelajaran Inovatif-Progresif*. Kencana Prenada Media Group.
- Vebrianto, R., dkk. (2021). *Project Based Learning (PjBL): Konsep, Karakteristik dan Implementasi dalam Pembelajaran*. Jurnal Pendidikan, 2(1), 1-13.
- Ward, R. C., & Robinson, M. (2014). *Principles of Hydrology*. McGraw-Hill.
- Wijayanto, P. W., Priyatiningsih, N., Herman, H., Sudadi, S., and Saputra, N. (2023). Implementation of Problem Based Learning Model to Improve Early Childhood Abilities in Creative Thinking. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 7(1), 1017-1023. DOI: [10.31004/obsesi.v7i1.3909](https://doi.org/10.31004/obsesi.v7i1.3909)
- Wena, M. (2013). *Strategi Pembelajaran Inovatif Kontemporer*. Bumi Aksara.
- Yuliani, N., & Wahyudi, I. (2022). Pengaruh Project Based Learning terhadap Kreativitas Siswa dalam Pembelajaran IPA. *Jurnal Pendidikan Sains*, 10(1), 55-62.

