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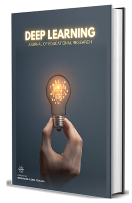

Implementation of Project-Based Learning Model to Improve Student Creativity in Chemistry Subject at SMA Negeri 1 Bakongan Timur

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ABSTRACT

This study examines the application of the Project-Based Learning (PjBL) model to enhance students' creativity in chemistry at SMA Negeri 1 Bakongan Timur. This study was conducted to address the challenges faced by students in demonstrating creative thinking and problem-solving skills during chemistry learning, which often relies heavily on memorization. This study used a classroom action research design implemented in two cycles, each consisting of planning, implementation, observation, and reflection. Participants were 11th-grade students, who were actively involved in project-based activities designed to connect chemistry concepts with real-life applications. Data were collected through observation sheets, documentation of student activities, and a creativity assessment rubric. The study findings indicated that the implementation of the PjBL model significantly enhanced students' creativity as reflected in their ability to generate original ideas, design innovative experiments, and present their projects creatively. Improvement was observed from cycle I to cycle II, where the percentage of students achieving high levels of creativity increased substantially. The results indicate that PjBL not only enriches the learning experience but also fosters independent and critical thinking skills. Therefore, PjBL is recommended as an effective learning model to enhance creativity in chemistry education.

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Introduction

Education in the 21st century emphasizes the importance of developing students' higher-order thinking skills, creativity, and problem-solving abilities as part of their preparation for facing global challenges (Mardhiyah, Aldriani, Chitta, & Zulfikar, 2021). Learning should not only transfer knowledge but also encourage students to construct meaning and apply concepts in real-life situations. This requires the use of innovative learning models. Chemistry as a subject often presents difficulties for students due to the involvement of abstract concepts, formulas, and experiments. Many students tend to memorize without understanding, resulting in low creativity and limited problem-solving abilities (Ricardo & Meilani, 2017). Therefore, it is necessary to implement learning models that can stimulate active engagement and creativity in chemistry learning.

Project-Based Learning (PjBL) is one model recommended to address this issue. Through PjBL, students learn by working on projects that integrate knowledge and practice, encouraging them to produce creative and meaningful products (Putra, Maulana, Rizky, & Fatwa, 2023). Creativity in learning is crucial because it equips students with the ability to generate original ideas, design new solutions, and develop innovative perspectives in science (Fatimah & Maryani, 2018). Without creativity, students may struggle to adapt to the demands of modern society, especially in the era of globalization and the Industrial Revolution 4.0.

Several studies show that learning models that involve active participation, problem-solving, and stimulate creativity, such as Project-Based Learning (PjBL), are effective in improving student learning outcomes (Lubis, 2019). Unlike conventional learning methods, Project-Based Learning (PjBL) requires collaboration, exploration, and presentations, which directly enhance creative thinking. The role of teachers is crucial in implementing Project-Based Learning (PjBL). Teachers act as facilitators who design projects, guide students, and ensure the learning process is effective (Hamka, 2023). With proper guidance, students can develop independence, creativity, and responsibility in completing projects.

Research also highlights that Project-Based Learning (PjBL) provides contextual learning experiences by connecting classroom material with real-life applications (Lubis & Dasopang, 2020). This makes students more motivated and engaged in learning activities because they see the relevance of the knowledge in their daily lives. Furthermore, Project-Based Learning (PjBL) has been shown to reduce student learning anxiety, especially in subjects often considered difficult, such as mathematics and science (Lubis, Dasopang, Ramadhini, & Dalimunthe, 2022). This suggests that this model has great potential to enhance creativity in chemistry learning.

The implementation of a project-based approach also aligns with character education, as students practice teamwork, discipline, and responsibility (Lubis & Wangid, 2019). Thus, Project-Based Learning (PjBL) not only develops cognitive skills but also supports the affective and psychomotor domains. Student creativity is influenced by various factors, including motivation, learning resources, and the teaching methods used. Teachers need to design activities that foster curiosity and innovation to optimize student creativity (Elisyah, Fatwa, Hutabarat, & Humaira, 2024).

Furthermore, the integration of creativity into learning aligns with Indonesian educational goals, which emphasize the development of students' potential in terms of knowledge, skills, and character (Rahman, Munandar, Fitriani, Karlina, & Yumriani, 2022). Therefore, chemistry must be taught in a way that emphasizes not only knowledge but also creativity. Previous research has shown that the implementation of learning models that emphasize exploration, such as Project-Based Learning (PjBL), has a positive impact on improving student achievement in science and language learning (Afriati, Siregar, Fonna, & Muna, 2025). This demonstrates that Project-Based Learning (PjBL) is versatile and applicable across various disciplines.

Although many teachers still rely on traditional teaching methods, recent findings underscore the need for pedagogical innovation. The use of Project-Based Learning (PjBL) is not only an alternative but also a necessity in developing 21st-century skills (Dasopang, Lubis, & Dasopang, 2022). Based on this context, the implementation of Project-Based Learning (PjBL) in chemistry learning is expected to encourage students at SMA Negeri 1 Bakongan Timur to be more active, innovative, and creative in processing information and applying it to real-life projects. Therefore, this study focuses on examining how the Project Based Learning model can be applied to improve student creativity in chemistry subjects. It is expected that the results will provide valuable contributions to chemistry education and broader pedagogical practices.

Methods

Penelitian ini menggunakan desain penelitian tindakan kelas (PTK) yang berfokus pada peningkatan kreativitas siswa melalui penerapan model Pembelajaran Berbasis Proyek (PjBL) dalam mata pelajaran kimia. Penelitian tindakan kelas dipilih karena memungkinkan guru dan peneliti untuk berkolaborasi dalam mengidentifikasi masalah, menerapkan solusi, dan mengevaluasi hasil secara langsung dalam proses pembelajaran (Arikunto, 2002). Penelitian ini dilaksanakan di SMA Negeri 1 Bakongan Timur pada tahun ajaran 2025/2026. Partisipan penelitian adalah siswa kelas XI, yang dipilih berdasarkan tantangan belajar kimia mereka, terutama dalam hal kreativitas dan pemecahan masalah. Kelas ini dipilih secara purposif, dengan mempertimbangkan kebutuhan siswa dan persetujuan guru kimia.

Prosedur PTK dilaksanakan dalam dua siklus, dengan setiap siklus terdiri dari empat tahap: perencanaan, pelaksanaan, observasi, dan refleksi (Sugiyono, 2018). Pada tahap perencanaan, peneliti dan guru secara kolaboratif merancang rencana pembelajaran, media pembelajaran, dan instrumen penilaian kreativitas yang disesuaikan dengan topik kimia. Pada tahap implementasi, guru menerapkan model PjBL dengan membagi siswa ke dalam kelompok-kelompok kecil dan memberikan tugas berbasis proyek. Tugas-tugas ini dirancang untuk menghubungkan konsep kimia dengan aplikasi kehidupan nyata, seperti kimia lingkungan dan produk kimia sehari-hari, untuk mendorong kreativitas (Lubis, 2019).

Observasi dilakukan bersamaan dengan implementasi untuk mencatat aktivitas siswa, kolaborasi kelompok, dan kemajuan proyek. Lembar observasi, rubrik kreativitas, dan dokumentasi digunakan untuk mengumpulkan data, memastikan aspek kualitatif dan kuantitatif kreativitas tercakup (Hamka, 2023).

Refleksi dilakukan setelah setiap siklus untuk menganalisis kekuatan dan kelemahan implementasi. Peneliti dan guru mengevaluasi apakah tujuan pembelajaran tercapai, khususnya peningkatan kreativitas siswa, dan membuat penyesuaian yang diperlukan untuk siklus berikutnya (Dasopang, Lubis, & Dasopang, 2022).

Analisis data dilakukan menggunakan statistik deskriptif dan interpretasi kualitatif. Data kuantitatif dari rubrik kreativitas disajikan dalam persentase, sementara data kualitatif dari observasi dan refleksi dianalisis secara naratif untuk memberikan pemahaman yang komprehensif tentang perkembangan siswa (Rahmah & Lubis, 2024). Melalui pendekatan metodologis ini, penelitian ini memastikan validitas dan reliabilitas dengan menggunakan triangulasi sumber data, termasuk observasi, asesmen, dan refleksi. Integrasi instrumen-instrumen ini memungkinkan penggambaran yang lebih akurat tentang efektivitas model PjBL dalam meningkatkan kreativitas siswa dalam pembelajaran kimia.

Result

The implementation of the Project Based Learning (PjBL) model in chemistry learning at State Senior High School 1 Bakongan Timur was conducted in two cycles. The results of the study showed a significant improvement in student creativity, both in terms of idea generation, project design, and presentation skills. At the beginning of cycle I, only a small percentage of students demonstrated high creativity, but improvements were evident by the end of the cycle. During cycle I, students were still adjusting to project-based tasks. Some groups experienced difficulties in dividing roles and finding innovative ideas for their projects. This is in line with the findings of Dasopang, Lubis, and Dasopang (2022), who noted that students often need adaptation time when transitioning from teacher-centered to student-centered learning approaches.

Despite the initial challenges, the creativity rubric results indicated that 55% of students reached a moderate level of creativity, while only 20% demonstrated high creativity. The remaining students were categorized at a low level, reflecting their struggle with independent project development. Similar findings were reported by Ricardo and Meilani (2017), who emphasized that motivation and adaptation strongly influence student creativity. In the reflection stage, adjustments were made to better guide students in brainstorming and structuring projects. Teachers provided more scaffolding, including examples of project outlines and strategies for creative problem-solving. According to Hamka (2023), the role of teachers as facilitators is crucial in motivating students to maximize their potential.

Cycle II showed significant improvement. Students become more confident in exploring ideas and applying chemistry concepts to real-life contexts, such as environmental sustainability and household chemical products. Approximately 75% of students achieved high creativity scores, while only 10% remained at the low level. These results suggest that sustained use of PjBL fosters student independence and creative thinking (Lubis, 2019).

Observation notes revealed that collaboration among students was more effective in the second cycle. Group members were able to distribute tasks fairly, communicate ideas, and provide feedback to one another. This aligns with the findings of Lubis and Dasopang (2020), who reported that project-based learning enhances student collaboration and engagement.

The improvement was also evident in project presentations. Students demonstrated originality in designing experiments and creativity in delivering their findings. Visual aids, models, and demonstrations were widely used, making the presentations more interactive. Fatimah and Maryani (2018) highlighted that visual literacy plays an important role in supporting student creativity, particularly in science-related learning. Student reflections further confirmed their positive experiences with PjBL. They expressed that learning became more enjoyable and meaningful because it was closely related to daily life. Similar insights were found in the study of Lubis, Dasopang, Ramadhini, and Dalimunthe (2022), which showed that contextual learning through projects reduces student anxiety and improves motivation.

In terms of overall progress, the percentage of students who reached the high creativity category increased from 20% in cycle I to 75% in cycle II. This reflects a substantial improvement and validates the effectiveness of PjBL in enhancing creativity in chemistry learning. The descriptive statistical analysis confirmed a consistent upward trend across both cycles. The results of this research indicate that PjBL is not only effective in improving academic achievement but also in developing essential 21st-century skills, particularly creativity. This is in line with the argument of Mardhiyah, Aldriani, Chitta, and Zulfikar (2021), who emphasized that creativity is a critical competency for students to face global challenges in the modern era.

Discussion

The findings of this study demonstrate that the implementation of the Project Based Learning (PjBL) model can significantly improve student creativity in chemistry learning. The increase from 20% of students in the high creativity category during cycle I to 75% in cycle II highlights the effectiveness of PjBL in stimulating idea generation, innovation, and problem-solving. These results reinforce the argument that learning models which encourage exploration and project-based outcomes are more effective in building student creativity than traditional approaches. The improvement in cycle II can be attributed to the contextual nature of PjBL. By linking chemistry concepts to real-life problems, students were able to recognize the relevance of their learning. This aligns with the research of Lubis and Dasopang (2020), who found that contextualized learning materials foster motivation and deeper engagement among students. Chemistry, which is often considered abstract, becomes more meaningful when it is directly related to students' daily lives.

Another important finding is the role of collaboration in enhancing creativity. Students in cycle II were more capable of dividing tasks, exchanging ideas, and producing unique solutions through teamwork. This result is consistent with Hamka (2023), who emphasized that collaborative learning environments encourage not only academic progress but also social and creative skills. PjBL naturally integrates teamwork, making it suitable for developing both cognitive and affective aspects.

The use of creativity assessment rubrics revealed that students improved in three main aspects: originality, elaboration, and presentation. Visual products and experiments become more varied and innovative. This finding resonates with Fatimah and Maryani (2018), who argued that visual literacy in education contributes significantly to student creativity. In chemistry learning, visual aids and models help students transform abstract concepts into concrete ideas. Furthermore, the reduction in student anxiety throughout the project cycles highlights the motivational benefits of PjBL. As reported by Lubis, Dasopang, Ramadhini, and Dalimunthe (2022), project-based learning reduces anxiety in challenging subjects by allowing students to learn through practice rather than rote memorization. The results of this study confirm that students become more confident when actively engaged in meaningful projects.

The increase in student creativity also supports the broader framework of 21st-century learning skills. According to Mardhiyah, Aldriani, Chitta, and Zulfikar (2021), creativity is one of the core competencies students must master to adapt to the demands of globalization and technological change. The implementation of PjBL ensures that chemistry learning is not only about content mastery but also about skill development for future challenges. The teacher's role as facilitator was shown to be vital in the success of PjBL. During cycle I, the lack of sufficient scaffolding hindered creativity development, but adjustments made in cycle II helped students achieve higher results.

This confirms the findings of Dasopang, Lubis, and Dasopang (2022), who stressed that student-centered learning models require active teacher facilitation to guide and motivate students effectively. Overall, this research provides evidence that PjBL is a powerful tool for improving creativity in chemistry learning. Beyond academic achievement, it develops collaborative, innovative, and critical thinking skills that are essential for student success. Thus, adopting PjBL in various subjects can contribute to the holistic development of students in line with national education goals.

Conclusion

The implementation of the Project Based Learning (PjBL) model in chemistry subjects at State Senior High School 1 Bakongan Timur successfully enhanced student creativity, as evidenced by the significant increase from 20% to 75% of students achieving high creativity levels across two cycles. This improvement reflects the effectiveness of PjBL in fostering originality, collaboration, and contextual problem-solving skills while reducing student anxiety and increasing motivation. The findings affirm that PjBL not only supports mastery of chemistry concepts but also develops essential 21st-century competencies, making it a recommended approach for promoting creativity and meaningful learning in science education.

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