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# Project-Based Learning to Foster Creativity and Collaboration Among High School Students

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**ABSTRACT**

This study aims to explore how the implementation of Project-Based Learning (PjBL) can encourage the development of creativity and collaboration among high school students. Using a qualitative approach with a case study method, data were collected through in-depth interviews, observations, and documentation of project-based learning activities in a high school. The results show that PjBL provides a space for students to express ideas creatively through real-life projects and strengthens collaborative skills such as communication, role-sharing, and shared responsibility. Furthermore, teachers play a crucial role as facilitators who guide students' exploration process. However, challenges remain in terms of time management and unequal participation among students. These findings confirm that PjBL is an effective approach in developing 21st-century skills when implemented in a structured manner and supported by the active role of teachers.
**Keywords:** Project-Based Learning, creativity, collaboration, high school students

## INTRODUCTION

The demands of the 21st century emphasize the importance of mastering soft skills, particularly creativity and collaboration, as essential competencies that students must possess to face the ever-evolving dynamics of the workplace and global life. In the educational context, the development of these two skills is not merely complementary but an integral part of the learning process, aimed at developing individuals who are adaptive, innovative, capable of interdisciplinary collaboration, and ready to face the complex challenges of the future (Utami et al., 2025). Therefore, the education system is required to design a learning approach that not only focuses on academic achievement, but also encourages students to think creatively, solve problems collaboratively, and develop their potential holistically (Fariza & Kusuma, 2024).

The conventional education system is still dominated by a passive learning approach, where the teacher acts as the sole source of knowledge and students tend to be one-way recipients of information (Aqila et al., 2025). This approach focuses on memorization and academic achievement, but provides little space for students to explore ideas, think critically, solve real-world problems, and work in teams (Hannan et al., 2025). As a result, the development of essential 21st-century skills such as creativity,

collaboration, and communication is not optimally facilitated. Limited space for active student participation in the learning process leads to low engagement and motivation, and does not optimally prepare students to face complex and dynamic real-world challenges. Therefore, a transformation in the learning paradigm is needed to make it more student-centered and able to integrate approaches that encourage higher-order thinking skills and effective collaboration (Neliwati et al., 2024, p. 21).

Project-Based Learning (PjBL) is a constructivism-based learning approach that emphasizes the active involvement of students in building knowledge through direct experience. Habibah, 2024). In this approach, students do not merely passively receive information from teachers, but are actively involved in the learning process by working on projects related to real-world problems in their environment.

PjBL encourages students to think critically, find solutions, and innovate through collaborative group work and independent exploration. Thus, learning focuses not only on achieving academic outcomes but also on developing life skills such as communication, leadership, and social responsibility. This approach is believed to create meaningful, relevant, and enjoyable learning for students because they are directly involved in the process of searching for meaning and solving contextual problems. Humam & Muh. Hanif, 2025).

Various research results show that the Project-Based Learning (PjBL) approach has a significant positive impact on improving students' conceptual understanding and their active involvement in the learning process.(Ramadan & Hindun Hindun, 2023)Through PjBL, students not only learn abstract theories but also apply that knowledge in real-world contexts through projects relevant to everyday life. This approach encourages students to engage directly in investigation, collaboration, decision-making, and problem-solving, which in turn strengthens conceptual mastery and increases their sense of responsibility for their own learning.(Ansya, 2023). Furthermore, PjBL provides space for the development of creativity and critical thinking skills, as students are encouraged to design innovative solutions and communicate project results independently or in groups. In other words, PjBL not only strengthens cognitive aspects but also fosters intrinsic motivation and social skills that are essential for success in the real world (Omelianenko & Artyukhova, 2024).

Although the Project-Based Learning (PjBL) approach has been proven to have various benefits in improving the quality of learning, its implementation at the secondary school (SMA) level is still far from optimal and faces a number of complex challenges (Hakim et al., 2025). One of the main obstacles is the limited time within a dense curriculum, making it difficult for teachers to design and implement in-depth and sustainable learning projects. Furthermore, teacher preparedness is also crucial, given that not all educators have an adequate understanding of the principles, planning, and evaluation of PjBL, resulting in implementation often not being as intended.

Another challenge lies in students' learning culture, which tends to be passive and accustomed to conventional learning models focused on memorization and exam scores. This requires time and specific strategies to build motivation, independence, and the ability to collaborate within a project context. A lack of infrastructure, understanding from school stakeholders, and systematic implementation guidelines also complicate the effective implementation of PjBL. Therefore, efforts to strengthen teacher capacity, adapt the curriculum, and create a conducive learning ecosystem are crucial steps to overcome these obstacles (Regmi, 2024).

An in-depth study based on a qualitative approach is needed to understand contextually and comprehensively how the implementation of Project-Based Learning (PjBL) is able to shape and develop students' creativity and collaboration in real

learning practices (Sari et al., 2024). This approach allows researchers to explore more broadly the dynamics of the learning process that occurs in the classroom and outside the classroom, including interactions between students, the role of teachers as facilitators, and supporting and inhibiting factors that influence the effectiveness of PjBL (Marpaung, 2024).

By gathering data directly from the experiences and perspectives of students, teachers, and schools, a qualitative approach can reveal deeper meanings about how students build creative ideas, share responsibilities, solve problems together, and foster a sense of ownership of their learning processes and outcomes (Mulyani, 2023). This study is also important to capture the social and cultural nuances in the school environment that influence the success of PjBL implementation, so that it can produce an understanding that is not only descriptive, but also reflective and applicable in efforts to improve learning models that are oriented towards strengthening soft skills in the 21st century.

The novelty of this research lies in its conceptual contribution, namely by in-depth description of the internal process of developing student creativity and collaboration in the context of project-based learning (PjBL), based on the direct experiences of students and teachers. This research uses a qualitative approach with a contextual case study design, which is still relatively limited in previous studies, especially at the high school level in Indonesia. In addition to providing a richer understanding of the dynamics of PjBL implementation in the field, this research also produces implementation recommendations based on empirical findings that can be used to develop effective contextual learning models in encouraging the strengthening of 21st-century soft skills, such as creativity, collaboration, communication, and problem-solving.

This study presents a novelty by offering a qualitative-descriptive approach that focuses on exploring the real and in-depth experiences of teachers and students in using virtual labs in science learning. Different from previous research that tends to be quantitative and oriented towards learning outcomes, this study highlights the social and pedagogical dimensions of technology utilization in the context of secondary education in Indonesia. Another novelty lies in highlighting the reality on the ground regarding how technology is accepted, interpreted, and integrated by educational actors at the school level. The findings of this study are expected to provide contextual and applicable input for the development of education policies, particularly in designing teacher training and strategies for integrating virtual labs into the science curriculum more effectively and sustainably.

The research gap in Project-Based Learning (PjBL) studies lies in the dominance of quantitative approaches in previous studies, which generally focus only on measuring learning outcomes, without in-depth exploration of the experiences, processes, and social dynamics that occur during PjBL implementation. Research that specifically highlights how creativity and collaboration are formed naturally in the project-based learning process is still very limited, especially at the secondary education level in Indonesia. Furthermore, the minimal exploration of student and teacher perceptions as the main actors in PjBL implementation results in a lack of holistic understanding of the challenges, strategies, and learning values that emerge in real-life classroom practice.

The purpose of this study is to explore in depth how the implementation of Project-Based Learning (PjBL) at the secondary school level can encourage the development of students' creativity and collaborative skills in an authentic learning context. This study also aims to comprehensively understand teachers' and students' perceptions of the effectiveness and various challenges they face during the PjBL implementation process in the classroom, including how they respond, adapt, and

overcome obstacles that arise in project activities. In addition, this study seeks to identify learning strategies that are considered successful in building teamwork, fostering a spirit of mutual cooperation, and stimulating creative thinking among students, so that they can become the basis for developing contextual learning models that are more relevant to the needs of 21st-century learning.

## METHOD

This study uses a qualitative approach with a case study method, which aims to gain an in-depth understanding of the implementation of Project-Based Learning (PjBL) in secondary schools (Zein, 2024). The main focus is to explore the experiences of students and teachers in implementing Project-Based Learning (PjBL) and its impact on the development of creativity and collaboration. The research location was determined purposively in certain high schools/vocational schools, with participants consisting of students actively involved in project-based learning, teachers who have implemented PjBL for at least one semester, and the principal or curriculum representative if relevant. The sampling technique used purposive sampling with the criteria of students who are active in projects and represent diverse academic backgrounds, as well as teachers who are experienced in implementing PjBL.

Data collection was conducted through in-depth interviews to explore experiences and perceptions, participant observation of student interactions and collaboration during the project, and documentation of project artifacts and learning logs. Research instruments included semi-structured interview guidelines, observation sheets, and documentation formats. Data analysis was conducted using thematic analysis through the stages of transcription, coding, categorization, theme extraction, and interpretation. Data validity was maintained through triangulation of sources and methods, member checking with informants, and peer debriefing with colleagues. From an ethical perspective, this study guaranteed the confidentiality of data and respondents' identities, was conducted with written permission from the school, and involved informed consent from all participants. The researcher maintained neutrality and objectivity throughout the research process.

## RESULTS AND DISCUSSION

The results of the study showed that the implementation of Project-Based Learning (PjBL) significantly encouraged increased student creativity, as reflected in their ability to generate new ideas through projects such as digital products, posters, and solutions to local problems. PjBL provided space for students to think outside the box and develop their imagination in completing assignments, while teachers observed tangible improvements in how students expressed their ideas independently. Furthermore, students' collaborative abilities also strengthened, as evidenced by their skills in assigning roles, resolving conflicts, synthesizing ideas in teamwork, and improved interpersonal communication and sense of shared responsibility in completing projects. In this context, the teacher's role shifted from instructor to facilitator, guiding the exploration of ideas and the problem-solving process, although challenges such as time management and role adaptation remained obstacles. Student responses to PjBL were generally positive; the majority felt more motivated and engaged compared to conventional learning methods such as lectures, as they enjoyed the freedom to create and learn through hands-on experience, although some students still faced difficulties in time management and equal assignment of tasks.

### Creativity in PjBL is in line with constructivist theory

Creativity in the application of Project-Based Learning (PjBL) is very much in line with the constructivist approach in learning theory, which emphasizes the active role of students in constructing knowledge through direct experience and social interaction (Saad & Zainudin, 2024). In this context, project-based learning provides ample space for students to explore ideas, experiment, and generate original solutions to real-life problems (Mubarok et al., 2025). This is in line with Jean Piaget's view that emphasizes the importance of active learning and knowledge construction through concrete experiences, as well as Lev Vygotsky's theory that emphasizes the role of the social environment and the zone of proximal development (ZPD) in encouraging cognitive growth.

PjBL creates challenging yet supportive learning situations, where students can develop their creativity through teacher guidance and collaboration with peers, so that their thinking processes continue to develop along with engagement in meaningful and authentic tasks. Thus, PjBL not only encourages academic achievement, but also facilitates reflective, independent, and creative learning in accordance with constructivist principles (Chasanah et al., 2025).

**Collaboration as a 21st century competency**

Collaboration is one of the key competencies of the 21st century that is highly needed in the modern workplace, where the ability to work in teams, communicate effectively, and make decisions collectively is an integral part of professional success (Dewi et al., 2024). Research findings show that the effective implementation of Project-Based Learning (PjBL) can shape and develop a cooperative attitude among students. Through project activities that require role allocation, task coordination, and the integration of various ideas, students learn to listen to each other, respect differences of opinion, and resolve conflicts constructively (Wibowo & Salfadilah, 2025).

This process indirectly forms strong interpersonal skills, increases empathy, and fosters a sense of shared responsibility for the team's work results (Sundari et al., 2024). In a PjBL learning environment, students not only learn to work collaboratively to achieve project goals, but also learn to adapt to group dynamics and make decisions democratically. These skills are highly relevant to the needs of today's workplace, which demands cross-disciplinary collaboration, flexibility, and social skills in facing complex and ever-changing global challenges.

**The changing role of teachers demands training and pedagogical readiness.**

The change in the role of teachers in the implementation of Project-Based Learning (PjBL) from conventional instructors to active facilitators requires adequate pedagogical readiness, including mastery of learning facilitation strategies and formative assessment (Evertson & Weinstein, 2013). In the context of Project-Based Learning (PjBL), teachers no longer merely deliver material, but must also be able to guide students' exploration, facilitate discussions, encourage critical reflection, and create a learning environment that supports independence and collaboration. This requires a deep understanding of project-based learning design, the ability to design driving questions, and skills in providing constructive and ongoing feedback. Therefore, structured and ongoing training is crucial for teachers to develop pedagogical competencies appropriate to the demands of this approach.

Furthermore, teachers need to be equipped with insight into contextual formative assessment, which not only measures the final project outcomes but also monitors the process, skill development, and teamwork dynamics of students. Without this readiness, the teacher's role in Project-Based Learning (PjBL) risks being

suboptimal, thus preventing the learning objectives that emphasize strengthening 21st-century soft skills from being fully achieved (Wulandari et al., 2025).

**Challenges in implementation**

The implementation of Project-Based Learning (PjBL) in secondary schools cannot be separated from various complex and interrelated challenges (Sintia et al., 2025). One of the main challenges is the need for adequate infrastructure support, such as access to technology, collaborative workspaces, and project-supporting materials and resources, which are often limited, especially in schools with limited budgets. Furthermore, time constraints within a dense curriculum are a significant obstacle, as PjBL demands a longer, more in-depth, and more flexible learning process than conventional approaches.

Another challenge lies in the lack of a fully formed collaborative learning culture, both among students and teachers. Students are still accustomed to individualistic and passive learning models, while some teachers are not yet prepared to encourage teamwork, open communication, and shared decision-making. A lack of experience in managing group dynamics and process-based assessment can also hinder the effectiveness of PjBL implementation. Therefore, the success of PjBL implementation depends not only on the method itself but also requires a supportive educational ecosystem, ranging from teacher readiness, curriculum flexibility, to the creation of a learning environment that encourages active participation, collaboration, and creativity.

**Contributions to literature and practice**

This research makes an important contribution to the literature and practice of education, particularly in enriching our understanding of the dynamics of project-based learning at the secondary school level. Through a qualitative approach that explores the lived experiences of students and teachers, this study not only offers an in-depth empirical perspective on how creativity and collaboration are formed in real-world contexts but also fills a gap in previous studies that tend to be quantitative and focus on final learning outcomes. Practically, the findings of this study can serve as a basis for developing a curriculum that is more contextual, relevant, and adaptive to the needs of students in the 21st century (Arifin & Mu'id, 2024).

The resulting recommendations can serve as a reference for educators, policy makers, and curriculum developers in developing effective PjBL implementation strategies, including designing learning activities oriented towards strengthening soft skills. Thus, this research not only provides academic contributions but also offers practical value for improving the quality of learning in schools, particularly in preparing students to become creative, collaborative individuals who are ready to face global challenges.

**CONCLUSION**

Project-Based Learning (PjBL) has proven to be an effective learning approach in fostering student creativity, as it provides space for them to think freely, create innovative solutions, and express ideas independently through projects relevant to real life. Furthermore, PjBL has also successfully developed collaborative skills among students, such as teamwork, interpersonal communication, joint decision-making, and sharing responsibilities in completing assignments. The success of PjBL implementation depends heavily on the role of teachers as facilitators who are able to create an open learning climate, motivate students, and guide the learning process flexibly. In general, student responses to project-based learning tend to be positive, as they find this method more enjoyable, challenging, and meaningful than conventional approaches. However,

the implementation of PjBL in secondary schools still faces several challenges, such as time constraints, students' readiness to collaborate, and the need for teacher training in active learning methods. Therefore, PjBL can be a strategic learning strategy in developing 21st-century soft skills, especially creativity and collaboration—if implemented with careful planning, adequate training, and strong institutional support.

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