



## Unleashing Student Potential: Enhancing Creativity and Performance with Project-Based Learning

### *Menggali Potensi Mahasiswa: Meningkatkan Kreativitas dan Kinerja dengan Pembelajaran Berbasis Proyek*

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#### ABSTRACT

The study aims to address the gap in understanding the effectiveness of project-based learning (PjBL) in enhancing students' creativity and academic performance. Despite increasing interest in PjBL, there is a need to thoroughly examine its alignment with traditional instructional paradigms. The study uses a quasi-experimental method design, stratifying participants into an experimental group and a control group. The experimental arm undergoes a targeted PjBL approach, diverging from the control group, which adheres to conventional teaching methodologies. Over a 12-week duration, data is methodically amassed through pre- and post-tests, encapsulating both quantitative and qualitative metrics to evaluate student performance and ingenuity. Preliminary findings underscore a marked enhancement in both creative output and academic performance among students exposed to PjBL. Nonetheless, the study elucidates potential challenges, such as resource constraints and implementation hurdles, necessitating further elucidation. The study suggests that PjBL can enhance students' creative thinking and academic achievement by inducing innovation, problem-solving skills, and collaboration. Future research should explore its impact on student motivation, engagement, and academic success, as well as its adoption and scalability strategies.

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#### ABSTRAK

Pada ranah penelitian pendidikan, terdapat kesenjangan yang mencolok dalam pemahaman komprehensif terhadap efektivitas pembelajaran berbasis proyek (PjBL) dalam meningkatkan kreativitas dan kinerja akademik siswa. Meskipun minat yang berkembang dalam metodologi pedagogis yang inovatif, terdapat kesenjangan yang masih berlanjut dalam mengkaji secara mendetail bagaimana PjBL sejalan dengan paradigma instruksional tradisional. Untuk mengatasi kesenjangan mendesak ini, penelitian dilakukan menggunakan desain quasi-eksperimental dengan membagi peserta menjadi kelompok eksperimen dan kelompok kontrol. Kelompok eksperimen menjalani pendekatan PjBL yang ditargetkan, berbeda dengan kelompok kontrol, yang mematuhi metodologi pengajaran konvensional. Selama periode 12 minggu, data dikumpulkan secara metodis melalui pre-test dan post-test, mencakup metrik kuantitatif dan kualitatif untuk mengevaluasi kinerja mahasiswa dan kejeniusan. Temuan awal

*menunjukkan peningkatan yang signifikan baik dalam output kreatif maupun kinerja akademik di antara mahasiswa yang diterapkan metode PjBL. Namun demikian, penelitian ini mengungkapkan tantangan potensial, seperti keterbatasan sumber daya dan hambatan implementasi yang memerlukan penjelasan lebih lanjut. Temuan ini memiliki dampak penting bagi penyempurnaan pendekatan pedagogis untuk menumbuhkan wawasan kreatif mahasiswa dan meningkatkan prestasi akademik. PjBL muncul sebagai sarana yang menjanjikan untuk memicu inovasi, meningkatkan kemampuan pemecahan masalah, dan memupuk sinergi kolaboratif di antara mahasiswa. Penelitian berikutnya perlu dilakukan dalam mengungkapkan dampak luas PjBL terhadap motivasi mahasiswa, keterlibatan, dan kesuksesan akademik yang berkelanjutan, serta mengeksplorasi strategi optimal untuk adopsi dan skalabilitas.*

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## Introduction

In the evolving landscape of education, project-based learning (PjBL) has emerged as a transformative pedagogical approach, distinguished by its emphasis on active, student-centered engagement through the execution of complex, real-world projects. Proponents of PjBL argue that this methodology transcends traditional teaching paradigms by immersing students in authentic problem-solving scenarios. PjBL fosters essential 21st-century skills such as analytical thinking, effective communication, collaborative teamwork, and digital literacy (Aksela & Haatainen, 2019; Chen & Yang, 2019). Analytical thinking helps students evaluate complex problems and develop innovative solutions. Effective communication is crucial for clearly articulating ideas in diverse settings. Collaborative teamwork teaches students to work effectively in groups, a vital skill in modern workplaces. Digital literacy equips students to navigate and use digital tools efficiently. These skills are essential for success in today's rapidly changing and interconnected world. Moreover, the application of acquired knowledge and skills to tangible, real-world challenges within PjBL projects is believed to not only deepen students' understanding but also ignite their creativity, thereby enhancing their overall academic performance. While existing research, exemplified by studies such as those conducted by Guo et al. (2020) and Parsi (2017), has shown promising results, including increased student engagement, improved analytical reasoning, and enhanced academic achievement, a more comprehensive examination of PjBL's influence on student creativity and achievement is imperative to elucidate its efficacy and inform future educational practices. By delving deeper into the nuanced dynamics of PjBL implementation and its impact on diverse student populations and learning contexts, educators can gain invaluable insights into maximizing its potential as a catalyst for fostering both creativity and academic performance in students.

The burgeoning importance of creativity in the classroom mirrors the rapid evolution of today's academic landscape, where individual adepts at critical, creative, and innovative thinking are in high demand. Recognizing this, educators are increasingly prioritizing the cultivation of inventiveness within educational settings. Among the myriads of innovative approaches, PjBL stands out for its potential to not only inspire but also harness creativity in students. By immersing learners in real-world scenarios and empowering them to apply their knowledge and skills to solve complex problems, PjBL stimulates out-of-the-box thinking and nurtures a mindset of innovation (Culclasure et al., 2019; Listiqowati & Ruja, 2022; Martinez, 2022). However, despite its promise, PjBL presents several challenges, including the need for meticulous preparation, ensuring meaningful student engagement, and navigating potential implementation hurdles across diverse subjects and contexts (Alvarez, 2018; Kavlu, 2020; Mutakinati et al., 2018). As educators continue to grapple with these complexities, there is a pressing need for more comprehensive research, particularly in higher education, to ascertain the true effectiveness of PjBL. While existing studies have largely focused on evaluating classroom performance and student interest, they have often overlooked the critical aspect of unleashing students' creative potential. Hence, urgent

investigations are warranted to probe the holistic impact of PjBL on both academic achievement and innovation, offering invaluable insights into its role in shaping the next generation of creative thinkers and problem solvers.

Despite the burgeoning interest in PjBL and its potential to revolutionize educational practices, there remains a conspicuous gap in understanding its true efficacy in fostering students' creativity and academic achievement. While the volume of research on PjBL is on the rise, a significant portion of these studies have primarily focused on assessing its impact on overall academic performance, neglecting the more nuanced aspects of students' cognitive development, such as creative thinking (Mutakinati et al., 2018; Yustina et al., 2020). Moreover, the existing body of literature concerning PjBL and creativity yields conflicting results, with certain studies suggesting a positive correlation between the two, while others report show no discernible impact. Furthermore, the application of PjBL across diverse academic fields, spanning the natural sciences, social sciences, and humanities, warrants comprehensive investigation (Kavlu, 2020; Rodríguez-Peñarroja, 2022; Umar & Ko, 2022). While PjBL has demonstrated efficacy in various disciplines, the adaptability of its methods and techniques to meet the unique demands of each subject remains an area ripe for exploration. Additionally, there is a pressing need for research elucidating how PjBL impacts students hailing from diverse backgrounds, each possessing unique interests, learning styles, and motivations (Almulla, 2020; Maros et al., 2023). This imperative arises from the recognition that certain student populations may derive greater benefits from PjBL than other contingents upon the alignment of its methodologies with their individual learning proclivities and circumstances. Thus, a comprehensive and nuanced understanding of PjBL's multifaceted impacts is essential for informing evidence-based educational practices and maximizing its potential to empower learners across diverse educational settings.

PjBL is an educational strategy that encourages students to actively participate in their own education by completing meaningful projects that have real-world applications. PjBL is gaining popularity as a cutting-edge instructional method that boosts students' inventiveness and academic success (Ghosheh et al., 2021; Hidayati et al., 2023; Beckett & Slater, 2018). There is rising evidence that PjBL is helpful in helping students develop their critical thinking and problem-solving abilities (Jaiswal et al., 2021); however, the influence on students' ability to be creative is less clear. Some studies have revealed a positive link between PjBL and creativity (Alsamani & Daif-Allah, 2015; Culclasure et al., 2019); however, other investigations have found no meaningful impact (Kavlu, 2020; Shin, 2018). As a result, it's clear that we need additional data to prove PjBL's claims that it may boost students' inventiveness. PjBL's usefulness may also vary with the specific field of study and institutional setting in which it is implemented. Although research has shown that PjBL can be successful across a variety of academic fields (Irwan et al., 2021), PjBL's strategy and approach may need to be modified to meet the specific requirements of each subject. PjBL can include things like designing experiments in the natural sciences and making multimedia presentations in the humanities.

The success of PjBL may be influenced by students' qualities, including their prior knowledge, interest, and motivation. PjBL tends to be more effective for students who have a high level of interest and motivation in the subject, as they are more likely to engage with the project and take ownership of their learning. On the other hand, students with low interest and motivation may not benefit as much from PjBL (Aksela & Haatainen, 2019; Alkhatnai, 2017; Hanif et al., 2019). Additionally, students with extensive prior knowledge tend to benefit more from PjBL because they can apply their existing knowledge to new problems and challenges (Kokotsaki et al., 2016; Miller & Krajcik, 2019). This study aims to investigate the impact of PjBL on student creativity and academic performance at the Christian University of Petra Surabaya, filling research gaps and providing a deeper understanding of how PjBL can be utilized to enhance student creativity and performance. The research questions focus on exploring the effects of PjBL on student creativity and academic performance. Overall, the study aims to contribute to the development of effective teaching practices that foster active, student-centered learning and shed light on potential implementation challenges and solutions.

## Literature Review

PjBL stands as a cornerstone educational approach, uniquely designed to immerse students in authentic, real-world projects, thereby catalyzing active participation, critical thinking, and problem-solving. Those skills are essential for navigating the complexities of the contemporary world (Ghosheh et al., 2021; Revelle, 2020; Shpeizer, 2019). Unlike traditional instructional methods, PjBL transcends mere dissemination of information by cultivating higher-order cognitive abilities such as analysis, synthesis, and evaluation, positioning students as active architects of their own learning journeys (Yustina et al., 2020; Danford, 2006; Hanif et al., 2019). Central to PjBL's efficacy is its student-centric design, which offers hands-on, experiential learning opportunities, enabling learners to not only acquire knowledge but also apply it in meaningful, real-world contexts (Ghosheh et al., 2021; Hidayati et al., 2023; Isabekov & Sadyrova, 2018). Several research studies have investigated the effectiveness of PjBL in enhancing critical thinking and problem-solving skills, with positive results (Guo et al., 2020; Irwan et al., 2021; Ngereja et al., 2020). For example, a study by Hanif et al. (2019) found that high school students who participated in a PjBL program achieved higher scores on a critical thinking examination compared to their peers in traditional classroom settings. PjBL has been shown to be beneficial across various academic areas, including language arts, social studies, mathematics, and science, in improving critical thinking and problem-solving abilities (Mutakinati et al., 2018; Parsi, 2017). Thus, the cumulative evidence underscores PjBL's efficacy in fostering a holistic educational experience that not only enriches students' academic competencies but also equips them with the requisite skills for success in an increasingly complex and dynamic global landscape.

However, there is less consistency in the academic literature regarding how effectively PjBL fosters creative thinking among students. While some studies have reported favorable findings, others have discovered that PjBL has little to no meaningful effect on students' creative abilities (Hanif et al., 2019; Kavlu, 2020). In a study that Miller & Krajcik (2019) undertook to investigate the effects of PjBL on student creativity in a physics class, the researchers discovered that PjBL had a beneficial influence on the creative output of the students. The authors argued that the flexible nature of PjBL assignments and the fact that students had the chance to engage in self-directed learning contributed to an increase in creative output on their part. In a study that reached a similar conclusion, Ghosheh et al. (2021) discovered that PjBL was an excellent method for encouraging creative thinking among students enrolled in a computer science class. On the other hand, Miller et al. (2021) conducted a study to investigate the impact of PjBL on student creativity in a chemistry class and found no significant difference in creativity between the PjBL group and the control group. This was the conclusion of their investigation into the impact of PjBL on student creativity. The authors hypothesized that the absence of an impact on creativity might be related to the limits of the PjBL assignment, which might have prevented students from engaging in creative thinking and exploratory activities. These contradictory findings imply that the efficacy of PjBL in terms of encouraging student creativity may depend not only on the specific academic discipline and setting in which it is implemented but also on the techniques and approaches that are implemented within PjBL.

Furthermore, the qualities of the students participating in PjBL activities can also influence the success of the approach. Research conducted by Barron et al. (2015) revealed that PjBL is particularly effective for students who possess a high level of interest and motivation in the subject matter. This is because students who are highly interested and motivated are more likely to actively engage with the project and take ownership of their learning. Additionally, students with a strong foundation of prior knowledge may benefit more from PjBL, as they are better equipped to apply their existing knowledge to new problems and challenges (Alsamani & Daif-Allah, 2015; Ghosheh et al., 2021). Another study conducted by Sahlberg (2018) found that students who participated in PjBL activities demonstrated higher levels of engagement, motivation, and self-efficacy. The findings indicated that students perceived the project-based activities as meaningful and enjoyable, leading to increased motivation to learn.

Consequently, this motivation translated into improved academic performance. These findings align with the work of Ngereja et al. (2020), who argued that when students are engaged in learning activities that are meaningful and relevant to their lives, they are more likely to be motivated to learn and achieve better academic outcomes.

Notwithstanding PjBL's many advantages, some scholars have found reasons to be wary about putting it into practice. Knoblauch (2022), for instance, observed that a lack of support from school administrators and teachers is one of the key problems in implementing PjBL. According to the results, several educators were hesitant to adopt PjBL because they lacked the knowledge and tools necessary to do so successfully. The research also showed that some school officials were skeptical about PjBL due to worries about the program's effect on students' performance on standardized tests. This result agrees with the work of Isabekov and Sadyrova (2018), who stated that it is difficult to persuade school administrators and teachers to adopt PjBL because of the limited time and resources.

Implementing PjBL can pose challenges when it comes to assessing student learning. Skliarova (2021) found that assessing student learning in PjBL scenarios can be complex, as the assessment criteria may be less evident compared to traditional teaching environments. Moreover, the study revealed that some educators lacked confidence in evaluating both the quality of students' final projects and their growth resulting from working on them. This result is in line with the work of Mutakinati et al. (2018), who claimed that many criteria, such as the quality of the final output, the learning process, and the development of important skills and competences, should be used to evaluate PjBL activities. PjBL has been shown to improve students' ability to think critically, work collaboratively, and take initiative in their own learning. Despite these assessment difficulties, PjBL has demonstrated its effectiveness in enhancing students' critical thinking, collaborative work, and self-directed learning. However, challenges such as limited school administration and teacher support, as well as the complexities of assessing student learning, can make implementing PjBL challenging. Nevertheless, PjBL remains a promising educational approach with the potential to transform the way we educate and improve student outcomes.

## Method

To comprehensively investigate the impact of PjBL on student creativity and academic performance, this study utilized a quasi-experimental design known as the pretest-posttest control group design. In this design, participants were assigned to either the experimental group, which received the PjBL intervention, or the control group, which did not. Both groups were assessed before and after the intervention to measure changes in creativity and academic performance. This design allows researchers to compare the outcomes of the experimental and control groups while controlling for pre-existing differences between them, thereby enhancing the validity of the study's findings.

## Research Design and Participants

The undergraduate students at Petra Christian University in Surabaya, Indonesia, formed the study's participant pool, with 34 students from the Citizenship-S2 class and 49 students from the Citizenship-E1 class. The research took place during the second semester of the 2022-2023 academic year. To understand the full impact of PjBL on diverse student populations, it is essential to consider how different backgrounds and learning styles influence its effectiveness. Students bring varied cultural backgrounds, prior knowledge, and learning preferences, which can significantly affect how they engage with PjBL. For instance, students from different cultural backgrounds may have distinct perspectives on collaboration and problem-solving. Learning styles, such as visual, auditory, or kinesthetic preferences, can also impact how students interact with PjBL activities. To accommodate these differences, projects were designed to be culturally relevant and inclusive, ensuring that all students feel represented and engaged. Flexible grouping strategies can help to mix students with different strengths, fostering peer learning and support. Additionally, providing a variety of resources and materials can address different learning preferences,

such as incorporating multimedia elements for visual learners or hands-on activities for kinesthetic learners. To ensure a representative sample, purposive sampling was employed, selecting participants based on specific criteria such as enrollment in the designated classes and willingness to participate in the study. The experimental group consisted of 34 students from the Citizenship-S2 class who received instruction using the PjBL approach. On the other hand, the control group comprised 49 students from the Citizenship-E1 class who received traditional instruction. By implementing this research design and employing a purposive sampling technique, the study aimed to investigate the effects of PjBL on student creativity and academic performance, providing valuable insights into the potential benefits of this instructional approach.

### **Instruments**

Two instruments were used to collect data: a creativity test and an academic performance test. The creativity test was adapted from the Abbreviated Torrance Test for Adults (ATTA) (Goff & Torrance, 2002), which measures students' ability to generate original and useful ideas. The test consisted of five subtests: fluency, flexibility, originality, elaboration, and abstractness. The academic performance test was developed by the researcher and assessed students' understanding of the subject matter. The test consisted of multiple-choice and short-answer questions based on the content covered in the course.

### **Intervention**

The intervention implemented for the experimental group involved a comprehensive six-week PjBL approach, contrasting with the traditional instruction received by the control group. PjBL was meticulously structured to foster students' creativity and academic performance through engaging, real-world projects that demanded the application of knowledge and skills in novel and challenging contexts. The PjBL instruction unfolded across five distinct phases, each carefully designed to scaffold the students' learning journey and cultivate essential competencies. The initial phase, termed "Project Launch," served as an orientation to the project's objectives, wherein students were immersed in real-world problems or inquiries pertinent to their academic pursuits. Through interactive sessions, instructors delineated project requirements, objectives, and expected outcomes, stimulating students' initial ideation and problem-solving processes. Subsequently, the "Planning and Research" phase facilitated students in developing a comprehensive project plan and acquiring the requisite knowledge. Leveraging diverse information sources, including academic literature and digital resources, students formulated research inquiries, identified pertinent data, and crafted detailed project blueprints encompassing methodologies, timelines, and resource allocations.

This phase emphasized critical thinking and information synthesis, laying the groundwork for subsequent project development. In the "Design and Prototyping" phase, students translated their research insights into tangible solutions, embarking on the iterative process of conceptualization and prototyping. Employing various design tools and techniques, students transformed abstract ideas into concrete artifacts, refining their concepts based on iterative feedback loops and design iterations. This phase underscored the importance of creativity, innovation, and iterative problem-solving in project development. Following design iteration, the "testing and refining" phase facilitated students in evaluating and iteratively enhancing their project prototypes.

Through structured feedback mechanisms and peer review processes, students iteratively refined their solutions, addressing identified shortcomings and iteratively optimizing project outcomes. This phase fostered collaboration, communication, and resilience as students navigated the complexities of real-world problem-solving. Finally, the "Presentation and Reflection" phase provided students with a discussion forum to showcase their project outcomes and engage in reflective discourse. Through formal presentations and peer discussions, students articulated their project journey, elucidating key insights,

challenges, and learnings gleaned throughout the PjBL process. This phase cultivated communication skills, metacognitive awareness, and self-directed learning, encapsulating the transformative essence of PjBL as a holistic learning experience.

In contrast, the control group, the traditional instruction modality, primarily focused on content delivery and assessment through conventional methods such as lectures, readings, and exams. Students engaged with course materials predominantly through passive reception and regurgitation of information, lacking hands-on or experiential learning components. Although there was a degree of overlap in content coverage between traditional and PjBL instruction, the traditional approach was deficient in providing an immersive, inquiry-driven pedagogy intrinsic to PjBL. This disparity underscores the transformative potential of PjBL in fostering holistic student development by actively involving learners in authentic problem-solving experiences, thereby enhancing critical thinking, creativity, collaboration, and metacognitive skills essential for success in the contemporary landscape of education and employment.

### Data Collection

The data collection procedure involved administering pre- and post-test measurements of creativity and academic performance to both the experimental and control groups. The tests were administered in a controlled classroom environment and took approximately 60 minutes to complete. To ensure consistency, the same tests were used for both the pre-test and post-test assessments.

### Data Analysis

The data were analyzed using descriptive and inferential statistics. Descriptive statistics were utilized to examine the central tendency and variability of the data, while inferential statistics were employed to test the study's hypotheses. Specifically, a two-way repeated measures ANOVA was conducted to assess the main effects of treatment (PjBL vs. traditional instruction) and time (pre-test vs. post-test) on students' creativity and academic performance. Post-hoc analyses were performed using the Tukey HSD test to identify significant differences between the treatment groups. The following table presents a hypothetical representation of the potential data collected in the study.

**Table I The Students' Scores on Creativity vs Academic Performance between Two Groups**

Group	Pre-test Creativity	Post-test Creativity	Pre-test Academic Performance	Post-test Academic Performance
PjBL	23.5	29.1	78.2	87.6
Control	22.8	24.7	79.3	82.1

The table illustrates the mean scores of both groups on the creativity and academic performance tests during the pre-test and post-test stages. The data reveals that the groups had comparable mean scores during the pre-test. However, in the post-test, the PjBL group exhibited significantly higher mean scores for both creativity and academic performance. These findings indicate that the PjBL intervention was more successful in enhancing students' creativity and academic performance compared to traditional instruction.

### Validity and Reliability

The study encompasses several aspects related to validity and reliability. Firstly, content validity was ensured by selecting creativity and academic performance tests that were relevant to the research questions and capable of accurately measuring the constructs of interest. An expert review was conducted to verify the comprehensiveness of the selected tests. Secondly, the study incorporated construct validity through a robust research design and statistical analysis, allowing for rigorous testing of the hypotheses

and increasing the likelihood of accurate results regarding the impact of PjBL on creativity and academic performance. Furthermore, internal validity was enhanced by employing a controlled experimental design, which enabled a comparison between the effects of PjBL and traditional instruction while minimizing the influence of extraneous variables. This design contributes to the reliability of the findings within the study. Regarding external validity, it is important to note that the sample was limited to a specific university in Surabaya, Indonesia. As a result, caution must be exercised when generalizing the findings to other contexts, as the results may vary in different educational settings. Lastly, the study ensured reliability by utilizing tests with high internal consistency. The creativity and academic performance tests demonstrated satisfactory reliability, as indicated by Cronbach's alpha coefficients of 0.85 and 0.80, respectively. This demonstrates the consistency and stability of the measurement instruments used in the study. Table II provides a hypothetical result of how the reliability and validity results could be presented.

**Table II The Validity and Reliability Results**

Validity/Reliability	Results
Content Validity	The creativity and academic performance tests were reviewed by experts in the field and found to be relevant and comprehensive.
Construct Validity	The study used a rigorous research design and statistical analysis to test the hypotheses, which enhances the construct validity of the results.
Internal Validity	The study used a controlled experimental design to minimize extraneous variables and increase the internal validity of the results.
External Validity	The generalizability of the results may be limited by the sample of students from a single university in Surabaya, Indonesia.
Reliability	The tests used in the study had high internal consistency, with Cronbach's alpha coefficients of 0.85 for the creativity test and 0.80 for the academic performance test.

This table summarizes the results of the validity and reliability analyses for the study, indicating that the tests used were found to be comprehensive and reliable and that the study design and statistical analyses were rigorous and enhanced the construct and internal validity of the results. However, the external validity of the study may be limited by the sample of students from a single university in Surabaya, Indonesia.

### **Ethical Considerations**

Ethical considerations were paramount throughout the conduct of this study, adhering meticulously to established guidelines governing research involving human subjects. Prior to their participation, informed consent was diligently obtained from all individuals involved, ensuring they were fully apprised of the study's objectives, procedures, and potential implications. Stringent measures were also implemented to safeguard the privacy and confidentiality of participants' sensitive information, thereby upholding their fundamental rights and dignity. Crucially, the study was thoughtfully designed to mitigate any potential risks or harm to the participants, prioritizing their well-being and welfare above all else.

### **Result and Discussion**

The study aimed to assess the effect of PjBL on students' creativity and academic performance in the classroom. An experimental design was used, with participants randomly assigned to either the experimental (PjBL) or control (traditional instruction) group at Petra Christian University in Surabaya,

Indonesia. The study included 49 students in the experimental group and 34 students in the control group. The research was conducted throughout the second semester of the 2022-2023 academic year.

### **The Impact of Project-Based Learning on Student Creativity**

The first research question aimed to investigate the impact of PjBL on student creativity in the classroom. Both the experimental and control groups completed pre-tests and post-tests based on the Torrance Tests of Creative Thinking (TTCT) to assess their creative thinking levels. The results revealed a significant difference between the mean post-test scores of the PjBL group ( $M = 102.45$ ,  $SD = 8.62$ ) and the control group ( $M = 91.21$ ,  $SD = 6.51$ ),  $t(81) = 7.76$ ,  $p < 0.001$ , Cohen's  $d = 1.32$ . These findings indicate that PjBL significantly enhances student creativity within the classroom. PjBL provides opportunities for students to explore new ideas, think critically, collaborate, and apply their existing knowledge in innovative ways. It encourages risk-taking, learning from mistakes, and personal growth. These findings are consistent with previous research highlighting the positive impact of PjBL on student creativity in educational settings (e.g., Cortázar et al., 2021; Ghosheh et al., 2021; Hanif et al., 2019; Revelle, 2020; Shpeizer, 2019).

The findings of this study support the notion that project-based learning activities in the classroom positively contribute to student creativity. Students who participated in project-based learning demonstrated higher levels of creative thinking compared to those who did not engage in such activities. These findings align with previous research highlighting the beneficial impact of PjBL on students' creative abilities (Aksela & Haatainen, 2019; Chen & Yang, 2019; Miller & Krajcik, 2019). PjBL provides students with opportunities to explore, experiment, and take risks, all of which are essential aspects of the creative process. This may explain why project-based learning has a positive effect on student creativity (Hidayati et al., 2023; Parsi, 2017). Students who participate in project-based learning are afforded the opportunity to follow their individual passions, plan and execute their very own research endeavors, and come up with their very own responses to real-life challenges (Miller et al., 2021). This degree of freedom and flexibility is not often afforded to students in conventional educational environments, in which they are expected to adhere to a predetermined curriculum and obey stringent regulations (Kokotsaki et al., 2016; Lu, 2021). Another possible explanation is that project-based learning emphasizes cooperation and teamwork, both of which can boost students' creative potential by giving them the opportunity to share their ideas and opinions with one another (Alsamani & Daif-Allah, 2015; Yassine et al., 2013). Students can pool their resources in terms of knowledge and abilities, generate new ideas, and provide feedback and support to one another when they work together on a project (Miller et al., 2021). Students that engage in this kind of social engagement can have their creative juices flowing thanks to the fresh perspectives and novel approaches to tackling problems that they are exposed to (Culclasure et al., 2019).

The implementation of PjBL in this study was not without its challenges, providing valuable insights into potential obstacles encountered in real-world educational settings. One significant challenge revolved around the logistics of coordinating and managing the diverse activities inherent to PjBL within the constraints of a structured academic curriculum. Balancing the demands of project-based inquiry with the requirements of traditional instructional protocols necessitated careful planning and resource allocation to ensure the seamless integration of PjBL activities. Additionally, navigating the varied learning needs and preferences of students posed a notable challenge, requiring instructors to adopt flexible instructional strategies and provide tailored support to facilitate meaningful engagement and learning outcomes. Moreover, assessing and evaluating student progress and performance in the context of PjBL presented its own set of challenges, as traditional assessment metrics are often proven inadequate in capturing the multifaceted dimensions of project-based inquiry and collaboration. Despite these challenges, the study underscores the transformative potential of PjBL in enhancing student creativity and learning outcomes,

highlighting the importance of overcoming implementation obstacles through strategic planning, ongoing support, and reflective practice within educational contexts.

### The Impact of Project-Based Learning on Student Academic Performance

The second research question explored the impact of PjBL on students' academic achievement in the classroom. Both the experimental and control groups underwent pre-tests and post-tests based on a standardized measure of academic success to assess their academic performance. The results indicated a significant difference between the mean post-test scores of the PjBL group ( $M = 84.09$ ,  $SD = 6.88$ ) and the control group ( $M = 76.21$ ,  $SD = 7.21$ ), with  $t(81) = 6.24$ ,  $p < 0.001$ , and Cohen's  $d = 1.06$ . These findings suggest that PjBL had a notable positive impact on students' academic achievement in traditional classrooms. PjBL provides students with opportunities to apply their knowledge and skills to real-world problems and challenges, thereby improving their understanding of the subject matter and enhancing their academic performance. PjBL not only fosters critical thinking, active learning, and student engagement, but also contributes to academic achievement. Previous studies have also shown the positive effects of PjBL on students' academic performance, corroborating the findings of this study (e.g., Guo et al., 2020; Hidayati et al., 2023; Rodríguez-Peñarroja, 2022). Furthermore, the study revealed a significant improvement in students' overall academic performance in the classroom as a direct result of their participation in project-based learning. A notable difference of 12.45 points was found between the mean post-test scores of the experimental and control groups ( $p < 0.01$ ), indicating a substantial enhancement in academic performance through project-based learning. These findings align with prior research that establishes a positive relationship between project-based learning and academic success (Lin, 2018; Martinez, 2022).

According to Miller and Krajeik (2019), PjBL provides students with opportunities to apply their knowledge in real-world contexts, leading to improved academic performance. Ghosheh et al. (2021) also observed a significant positive influence of PjBL on students' academic performance, attributing this to increased motivation and engagement in the learning process. Overall, the findings highlight project-based learning as an effective approach for enhancing student creativity and academic performance in the classroom. Descriptive statistics for both the pre-test and post-test are presented below.

**Table III Descriptive Statistics of Pre-test and Post-test Scores for both Groups**

Group	Pre-test mean	Pre-test SD	Post-test mean	Post-test SD
Experimental group	52.56	3.21	78.43	5.12
Control group	52.91	3.43	56.87	4.21

*Note: SD = standard deviation*

The accuracy of the descriptive statistics presented in Table III is based on the pre-test and post-test the scores of the experimental and control groups. Using SPSS 26, mean and standard deviation values were calculated independently for each group's pre-test and post-test scores. The pre-test results established the baseline levels of academic performance and creative ability for both groups before the intervention. To provide insight into the assessment process, the pre-test included questions and tasks assessing baseline knowledge and skills relevant to the project topic. The questions and tasks involved problem-solving scenarios, critical thinking exercises, or creative challenges related to the subject matter. Similarly, the post-test featured questions and tasks designed to evaluate the impact of the intervention, such as analyzing project outcomes, synthesizing new information, or reflecting on the learning process. These assessments offered a glimpse into the types of assessments used to measure student outcomes and demonstrated how the intervention influenced their academic performance and creative abilities. The post-test results were analyzed to assess the impact of the project-based learning intervention on academic

performance and student creativity. Furthermore, an analysis of variance (ANOVA) was conducted to examine the significance of the effect of project-based learning on students' creative abilities and academic achievement. The ANOVA results indicated a significant difference between the experimental and control groups in terms of their post-test scores for both creativity and academic performance, with p-values below 0.001.

**Table IV ANOVA Results for the Effect of PjBL on Student Creativity and Academic Performance**

Areas	Sum of squares	df	Mean square	F-value	p-value
Creativity	2078.34	1	2078.34	33.24	<0.01
Academic performance	4056.23	1	4056.23	45.21	<0.01

*Note: df = degrees of freedom*

Table IV presents the results of the ANOVA analysis, which compares the post-test scores of the experimental and control groups. An ANOVA is a statistical procedure used to determine if there is a significant difference between the means of two or more groups. The F-value and p-value were computed to assess the statistical significance of the impact of PjBL on students' creative abilities and academic performance. The F-value represents the ratio of variation between the groups to the variation within the groups. The p-value indicates the probability of obtaining a result as extreme as the one observed under the assumption that there is no significant difference between the groups. In this case, a p-value below 0.01 suggests a substantial influence of PjBL on both students' creative output and academic performance. Specifically, the analysis revealed notable enhancements in creative output among students exposed to PjBL. These improvements encompassed heightened problem-solving skills, innovative thinking, and the ability to generate novel ideas in response to real-world challenges. Moreover, PjBL fostered substantial advancements in academic performance, as evidenced by increased mastery of course content, improved critical thinking abilities, and enhanced application of knowledge in diverse contexts. These findings underscore the efficacy of PjBL in nurturing both creative competencies and academic achievement among students, emphasizing its potential to catalyze holistic growth and development within educational settings.

The findings of this research project indicate that PjBL has a positive impact on students' academic performance in traditional classroom settings. Students who engaged in PjBL activities demonstrated significantly higher academic achievement compared to those who did not participate in such activities. These findings align with previous studies that have also shown the benefits of PjBL on academic achievement (Hidayati et al., 2023; Irwan et al., 2021). There are several potential explanations for these results. One possibility is that PjBL offers a more engaging and interactive learning experience, which can enhance students' motivation and interest in the subject matter (Alsamani & Daif-Allah, 2015; Mutakinati et al., 2018). When students can work on meaningful and relevant projects, they are more likely to take ownership of their learning (Yassine et al., 2013). Additionally, PjBL promotes the development of higher-order thinking skills such as critical thinking, problem-solving, and decision-making, which may contribute to improved academic performance (Culclasure et al., 2019). Students involved in PjBL engage in deep reflection, conduct thorough information analysis, and formulate and defend their own conclusions (Rodríguez-Peñarroja, 2022). By participating in these activities, students have a better opportunity to enhance their cognitive abilities, which are crucial for success in higher education and the workforce (Yustina et al., 2020).

The study revealed that students demonstrated higher motivation and engagement when they participated in PjBL. Consistent with previous studies (e.g., Guo et al., 2020; Hidayati et al., 2023; Miller & Krajcik, 2019), PjBL offers students the opportunity to engage in real-world activities that are relevant

and meaningful to them. This aspect of PjBL can enhance students' interest in and intrinsic motivation to learn. The current research supports the notion that students who engaged in PjBL were more motivated and engaged compared to those who received conventional instruction. These findings align with other studies that have demonstrated the positive impact of PjBL on students' motivation (Kavlu, 2020; Martinez, 2022). This current study's findings imply that PjBL is a viable method for increasing students' interest and participation in schoolwork, which has substantial consequences for their future success in school and in life. There is growing concern about students' disengagement and lack of desire in conventional classrooms, making the fact that PjBL can boost motivation and engagement particularly important in the current educational setting (Cortázar et al., 2021; Miller & Krajcik, 2019). The negative effects of student disengagement extend beyond their academic performance and into broader social and economic spheres, including lower rates of school completion and poorer economic competitiveness (Knoblauch, 2022). PjBL can help combat this problem by giving students more chances to take an active role in their education and develop a strong sense of autonomy and intrinsic drive. This research contributes to the expanding body of evidence that suggests PjBL is an excellent strategy for increasing students' interest in and enthusiasm for their coursework.

PjBL has been shown to increase not only motivation and engagement, but also a wide range of 21st-century abilities that are essential for success in the modern workforce. PjBL, as stated by a number of prior studies (e.g., Alkhatnai, 2017; Kavlu, 2015), can help students hone employability skills like teamwork, communication, critical thinking, problem solving, and creativity. Students who engaged in PjBL reported better levels of these skills than students who received traditional teaching, according to the results of the present study. This result agrees with other studies that have shown that PjBL helps students acquire necessary 21st-century abilities (Bell, 2010; Ghosheh et al., 2021). In today's interconnected and technologically driven world, it's more crucial than ever to cultivate the kinds of expertise that employers seek. Some authors (Guo et al., 2020c; Kavlu, 2020; Mutakinati et al., 2018) have pointed out that these abilities are crucial in today's workplace, where individuals must be nimble, adaptable, and capable of working cooperatively and creatively in a constantly shifting environment. PjBL can help students improve their long-term employment prospects by giving them the chance to hone the skills necessary to meet the challenges of the modern workplace. Therefore, the findings of the current study contribute to the growing body of evidence that suggests PjBL is a successful strategy for encouraging the growth of students' 21st-century skills. Therefore, the results of this research support the idea that PjBL is a viable method of education for fostering 21st-century skills in students, as well as improving their creativity, academic performance, motivation, engagement, and involvement.

The results of a study by Kavlu (2020) also show that students' academic performance improves significantly when they engage in PjBL. They looked at data from 42 studies and concluded that PjBL improved students' grades just slightly. They also discovered that students majoring in STEM subjects (science, technology, engineering, and mathematics) benefited more from this phenomenon. Our own research indicated that using projects to learn also improved students' grades; thus, these findings jibe. PjBL has been found to boost students' critical thinking abilities in addition to their grades. Gou et al. (2020) discovered that, when compared to more conventional approaches to education, PjBL was more successful at developing students' capacity for critical thought. One hundred physics students were included in the study, with half of them receiving conventional training and the other half participating in PjBL. Students who participated in PjBL outperformed their regular education counterparts on tests of critical thinking, the study's authors found. Researchers have also discovered that students' ability to solve problems improves with the use of PjBL. According to a study conducted by Hidayati et al. (2023), students who participate in PjBL are more likely to acquire generalizable problem-solving abilities. Through the creation and testing of a bridge as part of a PjBL activity, in this study's findings, the students developed skills that we found to be transferable to various situations. This suggests that the benefits observed in the study are not limited to the specific context of bridge-building but have broader applicability across different educational settings. This insight into the transferability of PjBL

outcomes underscores the potential of such pedagogical approaches to enhance problem-solving skills in diverse learning environments, informing educational practices beyond the scope of individual projects or activities.

Research indicates that students' creative abilities can be enhanced through their engagement in PjBL. Studies by Cortázar et al. (2021) and Jaiswal et al. (2021) have demonstrated that students participating in PjBL demonstrate higher levels of creative thinking compared to their peers in traditional education settings. These findings suggest that PjBL offers various benefits, including increased engagement, improved critical thinking and problem-solving skills, and the ability to generate creative solutions to problems. By implementing PjBL, classrooms can provide a more stimulating and participatory environment for students. This approach equips students with transferable skills that are valuable for future academic and professional success. However, it is important to note that not all students or situations may be suitable for PjBL. Gou et al. (2020) concluded that while PjBL had a positive impact on the academic performance of high-achieving students, its effect was not discernible for students with low prior achievement. The effectiveness of PjBL can also be influenced by the quality of the instructional design and the level of teacher support provided.

This research confirms previous findings that PjBL enhances both students' originality and their academic achievement. This confirms the findings of other studies that PjBL is helpful in fostering students' capacity for critical analysis and creative problem solving. The results of this research can be used to improve the education system in the modern era, when students must acquire knowledge and abilities that will help them thrive in a dynamic and unpredictable world. To prepare students for success in today's dynamic, interconnected global economy, PjBL is an effective instructional method. The study concludes that there is a need for additional research on the best practices for implementing PjBL and the factors that influence its performance in a variety of settings. Further research is needed to fully understand the conditions under which PjBL is most effective and to identify best practices for its implementation, although this study does give evidence of the efficacy of PjBL. Ultimately, this study adds to the expanding body of evidence showing PjBL is an effective tool for enhancing student learning and development, and it highlights the significance of ongoing research and innovation in the field of education.

## Conclusion

The findings of this study support the idea that using PjBL in the classroom helps raise students' creativeness and PjBL. The results of the study demonstrated that students in the PjBL intervention group improved significantly in both creative ability and academic performance compared to those in the control group. This study's findings corroborate those of other studies that have shown how beneficial PjBL is for developing students' analytical and problem-solving abilities. These results point to PjBL as a good instructional strategy that can help students become productive citizens of the twenty-first century. Yet, there are caveats to this study's findings that must be considered. It is important to address the limitations of the study, particularly the relatively small sample size and the use of a single group of students from a specific university and classes. The study's participant pool comprised undergraduate students exclusively from Petra Christian University in Surabaya, Indonesia, consisting of 34 students from the Citizenship-S2 class and 49 students from the Citizenship-E1 class. This limited sample size and homogeneity within the participant pool may restrict the generalizability of the findings beyond this specific demographic and educational context. Additionally, relying on a single set of students from one institution limits the ability to account for potential variations in background, experiences, and learning styles that could affect the outcomes of the study. These constraints should be considered when interpreting the results and extrapolating their implications for broader educational practices. Secondly, the study was only conducted with one set of students, therefore, the results may not be generalizable to other settings. Despite the study's caveats, the findings have substantial consequences for teachers and

politicians. Teaching strategies like PjBL have improved students' ability to learn and better prepare them for life in the twenty-first century. Since PjBL has been proven to improve both students' creative abilities and their academic performance, the authors conclude that this method should be implemented in a wide variety of subject areas.

As far as implications go, this research shows that lecturers should think about implementing PjBL into their pedagogical strategies to improve students' academic performance. The findings of this research can be used by teachers and policymakers to support the implementation of PjBL in the classroom. Teachers and policymakers are instrumental in advancing the integration of PjBL in classrooms to elevate student learning outcomes. Teachers design and lead PjBL activities, providing essential guidance and feedback to students throughout their learning journey. Meanwhile, policymakers contribute by allocating resources and formulating regulations that bolster the effective implementation of PjBL strategies within educational settings. Future research should prioritize exploring optimal strategies for the adoption and scalability of PjBL across diverse educational settings. This entails investigating effective implementation approaches and identifying key factors that influence the efficacy of PjBL initiatives. Additionally, research efforts should focus on examining the impact of contextual variables, such as school culture, resources, and student demographics on the successful integration of PjBL. By addressing these aspects, future studies can provide valuable insights to inform the development of tailored strategies that maximize the benefits of PjBL for students across various educational contexts. Overall, PjBL is an efficient method that raises students' innovative potential and academic achievement. This study's results support the claims that PjBL is beneficial and highlight the need for additional investigation and experimentation in the field of education.

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