



Creativity among Prospective Early Childhood Teachers: The Effects of Screencast-O-Matic-Assisted Project-Based Learning

Jelita¹✉, Fenny Anggreini²

¹Department of Madrasah Ibtidaiyah Teacher Education, IAIN Langsa, Indonesia

²Department of Mathematics Education, IAIN Langsa, Indonesia

✉ Corresponding e-mail: jelita@iainlangsa.ac.id
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Abstract

This study investigated the effect of Screencast-O-Matic-assisted Project-Based Learning (PjBL) on the creativity of prospective Islamic early childhood education teachers in higher education. A quantitative method with a descriptive-associative design was employed. The participants were 75 sixth-semester students from the Islamic Early Childhood Education program at IAIN Langsa, Aceh, selected using the Slovin sampling technique. Data were collected using an observation checklist measuring four dimensions of creativity - fluency, flexibility, originality, and elaboration - and a questionnaire capturing students' responses toward the implementation of Screencast-O-Matic-assisted PjBL. Data analysis was conducted using Pearson's product-moment correlation, t-tests, and simple linear regression in SPSS version 20. The findings revealed that PjBL supported by Screencast-O-Matic had a positive and statistically significant effect on students' creativity ($t = 2.312$, $p = 0.004$). However, the strength of this relationship was relatively weak ($r = 0.370$), indicating that the learning model contributed only marginally to overall creativity development. Further analysis showed that the contribution of technology-assisted PjBL was not evenly distributed across creativity dimensions. The learning model was more effective in enhancing students' elaboration skills, particularly in organizing, developing, and presenting ideas in a structured manner, while its effect on originality remained limited. These results suggest that Screencast-O-Matic-assisted PjBL supports structured idea development rather than the generation of genuinely novel ideas, especially when instructional design does not explicitly target divergent thinking and originality. Consequently, although the learning model demonstrates a statistically significant contribution to creativity, the research objectives were only partially achieved. Future research is therefore recommended to employ mixed-method or experimental designs, develop project tasks that explicitly target originality and divergent thinking, and examine the long-term effects of technology-assisted PjBL on broader pedagogical competencies and professional readiness across diverse educational contexts.

Keywords: Creativity; Early Childhood Teachers; Higher Education; Project-based Learning; Screencast-O-Matic



A. INTRODUCTION

The development of creativity is an essential competency in higher education, particularly for students in Early Childhood Education (ECE) programs who are being prepared as 21st-century educators. Creativity is closely associated with higher-order thinking, problem solving, and instructional innovation (Kokotsaki et al., 2016; OECD, 2023; Runco & Jaeger, 2012). However, numerous studies indicate that learning practices in higher education remain largely oriented toward knowledge transmission and cognitive outcomes, providing limited opportunities for students to generate original ideas and produce creative work optimally (Bell, 2010; Hidayat & Prabowo, 2022; Wahyuni et al., 2024).

Project-based Learning (PjBL) has been widely recognized as a relevant pedagogical approach to address this challenge, as it positions students as central actors in the processes of exploration, design, and reflective learning. Empirical evidence demonstrates that PjBL effectively enhances student creativity, collaboration, and learner autonomy (Kokotsaki et al., 2016; Aziz et al., 2023; Maulidiarhma et al., 2023). Concurrently, advancements in educational technology have created opportunities to integrate digital media such as screencasting, which enables students to visually and auditorily represent ideas, cognitive processes, and creative products. This integration has the potential to strengthen creative processes within PjBL environments (Guo et al., 2014; Sterling-Orth et al., 2016; Aminah et al., 2024).

Despite the widespread implementation of PjBL and digital technologies, field observations reveal that the creativity of ECE students at the Faculty of Tarbiyah, IAIN Langsa remains relatively low, particularly in the creative and productive use of educational technology. Digital media, including screencasting, are still predominantly used as tools for content delivery or task documentation rather than as instruments that actively facilitate original idea generation and creative elaboration (Hayuhana Siskawati & Bachri, 2020; Wahyuni et al., 2024; Aziz et al., 2023). This condition raises a fundamental question regarding the extent to which Project-based Learning integrated with Screencast-O-Matic can significantly foster student creativity in early childhood teacher education programs.

Previous studies have examined the effectiveness of PjBL in enhancing creativity, engagement, and learning outcomes (Aziz et al., 2023; Maulidiarhma et al., 2023; Sri Wahyuni et al., 2024), as well as the influence of screen casting on motivation and conceptual understanding in digital learning contexts (Guo et al., 2014; Kay, 2012; Sterling-Orth et al., 2016). However, few studies have explored the integration of screencasting as an active tool within Project-based Learning to directly facilitate students' creative processes, and none have specifically investigated the effects of Screencast-O-Matic on the creativity of early childhood education students in higher education. Consequently, a clear empirical gap remains concerning how screen casting technology contributes directly to key dimensions of creativity, such as originality and idea elaboration, within project-Based learning contexts.

Recent research indicates an increasing trend in the use of PjBL and digital media to support creativity development. Aziz et al. (2023) and Maulidiarhma et al. (2023) reported that PjBL effectively enhances student creativity but did not examine the specific role of supporting technologies. Aminah et al. (2024) found that integrating video media into PjBL

improved creative thinking; however, the study focused on school-level students rather than university students. Meanwhile, Wahyuni et al. (2024) highlighted the importance of creative digital learning in higher education without specifically addressing the use of screencasting as a creative production tool. In contrast to these studies, the present research positions Screencast-O-Matic not merely as a content delivery medium but as a core instrument in the project creation process. This positioning situates the study at the intersection of Project-Based Learning, screencasting technology, and creativity development among early childhood education students.

Accordingly, this study aims to analyze students' responses and examine the effect of Project-Based Learning supported by Screencast-O-Matic on the creativity of Early Childhood Islamic Education students at the Faculty of Tarbiyah, IAIN Langsa.

B. METHOD

The methodology of this study was systematically designed to ensure that the process of designing, implementing, and evaluating Project-Based Learning supported by Screencast-O-Matic in fostering student creativity was conducted in a valid and reliable manner. This section describes the research design, participants and research setting, research instruments, data collection procedures, and data analysis techniques.

1. Research Design

This study employed a quantitative approach using a descriptive-associative research design. The design aimed to describe the characteristics of the research variables and to analyze the effect of Project-Based Learning supported by Screencast-O-Matic on students' creativity. This design was selected because it allows for the objective examination of relationships and effects among variables through statistical analysis.

2. Participants and Research Setting

The study was conducted in the Early Childhood Islamic Education (PIAUD) Study Program, Faculty of Tarbiyah and Educational Sciences, IAIN Langsa. The participants were sixth-semester students enrolled in the Quantitative Research Methodology course during the current academic year.

The research population consisted of 293 students. The sample size was determined using the Slovin formula with a margin of error of 10%, resulting in 75 students as research respondents. A probability sampling technique was applied to ensure that each member of the population had an equal opportunity to be selected as a sample (Sugiyono, 2022).

3. Research Instruments

The research instruments consisted of an observation sheet and a questionnaire.

a. Creativity Observation Sheet

The observation sheet was used to assess the creativity of student products generated through Project-Based Learning supported by Screencast-O-Matic. Creativity assessment was based on Torrance's four creativity indicators (Almeida et al., 2008; Runco & Jaeger, 2012), namely:

- Fluency: the ability to generate multiple ideas
- Flexibility: the ability to produce varied ideas
- Originality: the novelty and uniqueness of ideas
- Elaboration: the ability to develop ideas in detail.

b. Student Response Questionnaire

The questionnaire was administered to measure students' responses to the implementation of Project-Based Learning supported by Screencast-O-Matic. The measured indicators included:

- learning motivation
- self-confidence
- understanding of learning materials
- perceived learning benefits

The questionnaire was developed using a four-point Likert scale (1–4).

4. Instrument Validity and Reliability

Instrument validity was examined through content validity using expert judgment. Experts in early childhood education and educational technology evaluated the relevance of indicators, clarity of items, and alignment of the instruments with the research objectives (Azwar, 2016).

The reliability of the questionnaire was tested using Cronbach's Alpha coefficient with the assistance of SPSS version 20. The instrument was considered reliable if the Cronbach's Alpha value was ≥ 0.70 , indicating good internal consistency (Azwar, 2016).

5. Research Procedures

The research procedures were conducted through the following stages:

- a. Planning, including the development of the course syllabus and the design of Project-Based Learning supported by Screencast-O-Matic
- b. Implementation, involving the application of Project-Based Learning through video content creation assignments using Screencast-O-Matic
- c. Data collection, conducted through creativity observation and the distribution of student response questionnaires
- d. Data analysis, using descriptive and inferential statistical techniques
- e. Conclusion drawing, based on the results of data analysis.

6. Data Analysis Techniques

Data analysis was conducted using SPSS version 20 and involved the following techniques:

a. Descriptive Analysis

Descriptive statistics were used to describe students' creativity scores and response data in the form of means, percentages, and categorical classifications.

b. Scoring and Percentage Calculation

The obtained scores were converted into percentages using the following formula:

$$\text{Percentage} = \frac{\text{Obtained Score}}{\text{Maximum Score}} \times 100\%$$

c. Score Classification

The percentage scores were classified into categories as presented in Table 1.

Table 1. Score Classification Criteria

Percentage Range	Category
0–25%	Very Low / Not Feasible
26–50%	Low / Less Feasible
51–75%	High / Feasible
76–100%	Very High / Highly Feasible

7. Score Interpretation

Score interpretation was conducted based on the established percentage categories. Creativity or student response scores categorized as feasible or highly feasible indicate that Project-Based Learning supported by Screencast-O-Matic contributes positively to the development of student creativity. Conversely, scores classified as less feasible or not feasible indicate that the learning implementation has not optimally supported creativity development.

C. RESULT AND DISCUSSION

1. Result

Student creativity in using the Screencast-O-Matic application was measured using four indicators-fluency, flexibility, originality, and elaboration-among 75 students of the Early Childhood Islamic Education (ECIE).

Table 2. Students' Creativity in Using the Screencast-O-Matic Application

Indicator	Mean	Category
Fluency	77.33	High
Flexibility	76.89	High
Originality	68.89	Moderate
Elaboration	88.89	Very High
Total	77.97	High

Table 2 indicates that the overall level of student creativity was categorized as high (77.97). The results were dominated by the elaboration aspect (88.89), suggesting strong ability among students to systematically develop and expand ideas. In contrast, the originality indicator obtained a lower score (68.89), indicating that although students were capable of refining and elaborating existing ideas, they had not yet optimally demonstrated

the ability to generate novel and original ideas. The relatively lower originality score suggests that many students still relied on examples, references, or existing ideas, resulting in creative outputs that did not fully reflect individual uniqueness or innovation.

Table 3. Students' Responses to the Use of the Screencast-O-Matic Application

Indicator	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Total (%)
Motivation	1.33	66.22	30.22	2.22	67.56
Self-Confidence	12.67	67.00	20.00	0.33	79.67
Understanding	10.00	75.67	14.33	0.00	85.67
Perceived Benefits	9.33	57.33	29.00	4.33	66.67

Table 3 shows that students generally expressed positive perceptions toward the use of Screencast-O-Matic, particularly in terms of conceptual understanding, which achieved the highest percentage (85.67%), followed by self-confidence (79.67%). However, the relatively lower score for perceived benefits (66.67%) indicates that the application may not fully address all students' learning needs.

Table 4. Impact of Project-Based Learning Supported by Screencast-O-Matic on Student Creativity.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.370	0.010	0.012	13.63486

Table 4 presents the results of a simple linear regression analysis examining the relationship between Project-Based Learning supported by Screencast-O-Matic and student creativity. The R value (0.370) indicates a positive but weak correlation. The R² value (0.010) shows that only 1% of the variance in student creativity can be explained by this learning model, while the remaining 99% is influenced by other factors. The adjusted R² further confirms the minimal contribution of the model. The regression equation is expressed as follows:

$$Y=73.811+0.059X$$

Where:

- Y = student creativity
- X = Project-Based Learning supported by Screencast-O-Matic

Table 5. Regression Coefficients

Model	Unstandardized Coefficients (B)	t	Sig.
Constant	73.811	5.365	0.000
Model	0.059	2.312	0.004

The constant coefficient (73.811) represents the baseline level of student creativity without the influence of the learning model. The regression coefficient (0.059) indicates that a 1% increase in the implementation of Project-Based Learning supported by Screencast-O-Matic leads to an increase of 0.059 points in student creativity. The t-value (2.312) and significance value ($p = 0.004$) indicate that the relationship between the learning model and creativity is statistically significant.

2. Discussion

This study aimed to analyze the contribution of technology-assisted Project-Based Learning (PjBL), supported by Screencast-O-Matic, to the development of Islamic early childhood education university students' creativity. The findings indicate that the research objectives were partially achieved. While the technology-enhanced PjBL model made a substantial contribution to the elaboration dimension of creativity, it did not yield a significant effect on originality. These results suggest that the integration of technology within PjBL is more effective in supporting structured idea development than in fostering the generation of genuinely novel ideas, particularly when instructional design does not explicitly target divergent thinking.

Prospective early childhood teachers demonstrated high elaboration scores due to their ability to develop ideas systematically and in detail within the learning products they produced. This outcome can be attributed to the use of Screencast-O-Matic, which facilitates the structured integration of visual and audio elements, thereby supporting students in organizing ideas, constructing coherent presentation flows, and delivering explanations in a clear and logical manner. Consistent with the perspective of Scherer et al. (2023), digital technologies function primarily as cognitive and representational tools that enhance information processing and idea elaboration, rather than automatically promoting higher-order creativity. This finding is further supported by Guo et al. (2022), whose systematic review indicates that PjBL tends to improve product quality and depth of understanding, particularly when supported by digital media that aid visualization and cognitive structuring.

In contrast, the relatively low originality scores indicate that students continued to rely on existing examples or familiar formats rather than producing genuinely novel ideas. This tendency may stem from prior learning experiences characterized by traditional and instructional approaches, as well as from project task designs that did not explicitly demand divergent thinking or exploration of alternative ideas. These findings align with Fauzan et al. (2025), who reported that while PjBL effectively strengthens elaboration and idea refinement, it does not inherently enhance originality unless supported by pedagogical designs that intentionally target higher-level creativity. Furthermore, Beghetto

and Karwowski (2022) emphasize that originality is highly dependent on learning environments that provide psychological safety for experimentation and intellectual risk-taking conditions that are often insufficiently developed in formal educational settings.

The results of this study are also consistent with those of Mutiasari et al. (2023), who found that technology-assisted PjBL is more effective in improving elaboration and collaboration than originality. Basri et al. (2025) reported that PjBL enhances creativity across all indicators—fluency, flexibility, originality, and elaboration—although the magnitude of improvement varies among these dimensions. Similarly, Safarati et al. (2024) demonstrated that PjBL enhances students' creative thinking skills in the context of instructional media development, particularly in terms of idea expansion and refinement. Pangestu et al. (2024) showed that the implementation of PjBL positively affects students' creativity and learning motivation by actively engaging them in problem-solving, idea development, and the production of meaningful outputs aligned with learning contexts. Lavli and Efendi (2024) likewise reported significant improvements in students' creative thinking—especially elaboration and fluency—through PjBL, facilitated by students' involvement in project planning, solution development, and systematic presentation of outcomes. In addition, Setiawan et al. (2021) concluded that PjBL consistently enhances student creativity by emphasizing student-centered, collaborative, and authentic learning activities that require idea generation and creative problem-solving. Anwar (2024) further confirmed the positive impact of PjBL on student creativity, as evidenced by increased post-test scores.

More broadly, the literature suggests that PjBL is effective in fostering creativity when designed with open-ended tasks that require authentic knowledge application and problem-solving (Guo et al., 2022; OECD, 2023). However, variations across studies indicate that the impact of PjBL on specific creativity dimensions—particularly originality—is highly dependent on learning contexts, student characteristics, and the quality of instructional design (Fauzan et al., 2025; Widodo et al., 2024).

These findings can be interpreted through Guilford's theory of creative thinking, which positions originality as the most complex and challenging dimension of creativity to develop. Torrance's creativity theory similarly suggests that successful engagement in creative tasks tends to enhance fluency and elaboration but does not necessarily translate into higher originality. From the perspective of educational technology, Kali et al. (2022) and Scherer et al. (2023) emphasize that technology serves as a learning enabler rather than a driver of creativity. In the national context, Munandar underscores that creativity can only flourish in learning environments that promote intellectual freedom, tolerance for mistakes, and opportunities for idea exploration. Consequently, the present findings reinforce the theoretical view that technology use, in the absence of pedagogical designs explicitly targeting higher-order creativity, is insufficient to optimally foster originality.

The findings have important implications for higher education practice. Lecturers should design project tasks that go beyond reproduction or reorganization of existing

content and explicitly require students to generate new ideas and apply divergent thinking. Within technology-supported learning environments, Screencast-O-Matic appears most effective when used to facilitate visualization, organization, and idea elaboration, rather than merely serving as a presentation medium. Furthermore, pedagogical strategies such as open-ended problems, reflective journals, and formative feedback that encourages intellectual risk-taking should be systematically integrated to stimulate originality (Gajda et al., 2017; OECD, 2023).

Despite its contributions, this study has several limitations. First, student creativity is influenced by multiple factors beyond the PjBL model employed, and these variables were not fully controlled. Second, the project task design did not explicitly target originality as a learning outcome. Third, the exclusive use of a quantitative approach limited deeper insights into students' creative thinking processes. Fourth, the restricted sample size and research context limit the generalizability of the findings.

Based on these findings and limitations, future research is recommended to adopt mixed-methods approaches to achieve a more comprehensive understanding of students' creative thinking processes. Further studies should also develop PjBL designs that explicitly target originality, integrate additional variables such as digital literacy and prior learning experiences, and examine the effectiveness of the model across different disciplines, including its impact on graduates' professional readiness.

D. CONCLUSION

This study aimed to examine the effect of Project-Based Learning supported by Screencast-O-Matic on student creativity in higher education. The findings demonstrate that the learning model has a positive and statistically significant effect on student creativity, particularly in the development and elaboration of ideas. These results indicate that integrating Project-Based Learning with digital media can create a learning environment that encourages students to engage more actively, reflectively, and productively in completing project-based tasks. The use of Screencast-O-Matic is a supportive medium within Project-based Learning to foster student creativity, an area that remains underexplored in higher education research. Practically, the findings suggest that lecturers and higher education institutions may adopt this model as an alternative instructional strategy to enhance student creativity while simultaneously optimizing the pedagogical use of digital technology in the learning process.

E. REFERENCES

Almeida, L. S., Prieto, L. P., Ferrando, M., Oliveira, E., & Ferrández, C. (2008). Torrance Test of Creative Thinking: The question of its construct validity. *Thinking Skills and Creativity*, 3(1), 53–58. <https://doi.org/10.1016/j.tsc.2008.03.003>

Aminah, S., Aini, N., & Setyowati, D. (2024). The Influence of the Project Based Learning Model using Video on the Creativity Thinking Ability and IPAS Learning Outcomes

for Elementary School Students. *JP (Journal of Education) : Theory and Practice*, 9(1), 71–79. <https://doi.org/10.26740/jp.v9n1.p67-75>

Anwar, Y. (2024). The effectiveness of project-based learning (PjBL) in improving students' creativity. *Jurnal Pendidikan Fisika Indonesia*, 20(1), 45–54. <https://doi.org/10.15294/jpfi.v20i1.4941>

Aziz, W. A., Wulansari, R. E., Putra, R. P., Tun, H. M., Tin, C. T., & Ya, K. Z. (2023). Project-based learning module on creativity and entrepreneurship product subjects: Validity and empirical effect. *Jurnal Pendidikan Teknologi Kejuruan*, 6(3), 216–227. <https://doi.org/10.24036/jptk.v6i3.34323>

Basri, R. I., Elpisah, E., & Fahreza, M. (2024). Project-based learning as a strategy to improve students' creativity in elementary social studies. *International Journal of Studies in International Education*, 2(3), 390–401. <https://doi.org/10.62951/ijsie.v2i3.390>

Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 83(2), 39–43. <https://doi.org/10.1080/00098650903505415>

Gajda, A., Karwowski, M., & Beghetto, R. A. (2017). Creativity and academic achievement: A meta-analysis. *Journal of Educational Psychology*, 109(2), 269–299. <https://doi.org/10.1037/edu0000133>

Guo, P. J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: An empirical study of MOOC videos. *L@S 2014 - Proceedings of the 1st ACM Conference on Learning at Scale*, 41–50. <https://doi.org/10.1145/2556325.2566239>

Kali, Y., Sagy, O., Benichou, M., Atias, O., & Levin-Peled, R. (2019). Teaching expertise reconsidered: The Technology, Pedagogy, Content and Space (TPeCS) knowledge framework. *British Journal of Educational Technology*, 50(5), 2162–2177. <https://doi.org/10.1111/bjet.12847>

Kay, R. H. (2012). Exploring the use of video podcasts in education: A comprehensive review of the literature. In *Computers in Human Behavior* (Vol. 28, Issue 3, pp. 820–831). <https://doi.org/10.1016/j.chb.2012.01.011>

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. *Improving Schools*, 19(3), 267–277. <https://doi.org/10.1177/1365480216659733>

Lavli, R. O. E. H., & Efendi, N. (2024). The effect of project based learning model on creative thinking ability. *Jurnal Ilmu Pendidikan (JIP) STKIP Kusuma Negara*, 15(2), Article 1804. <https://doi.org/10.37640/jip.v15i2.1804>

Maulidiarhma, I., Syachruroji, A., & Andriana, E. (2023). Pengaruh penggunaan model project based learning terhadap kreativitas peserta didik SDIT Al-Husna Kec. Walantaka. *Jurnal Pendidikan Dasar Perkhasa: Jurnal Penelitian Pendidikan Dasar*, 9(1), 26–37. <https://doi.org/10.31932/jpdp.v9i1.2029>

Mutiasari, A. I., Mustaji, M., & Susarno, L. H. (2023). The effect of project based learning on creative thinking skills for teachers. *Jurnal Teknologi Pendidikan : Jurnal Penelitian Dan Pengembangan Pembelajaran*, 8(2), 435. <https://doi.org/10.33394/jtp.v8i2.7131>

OECD. (2023). How are education systems integrating creative thinking in schools? PISA in Focus, No. 122. OECD Publishing. <https://doi.org/10.1787/f01158fb-en>

Pangestu, K., Malagola, Y., Robbaniyah, I., & Rahajeng, D. (2024). The influence of project based learning on learning outcomes, creativity and student motivation in science learning at elementary schools. *Jurnal Prima Edukasia*, 12(2), 194–203. <https://doi.org/10.21831/jpe.v12i2.63208>

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, 24(1), 92–96. <https://doi.org/10.1080/10400419.2012.650092>

Safarati, N., Zuhra, F., & Liani, N. S. (2024). Creative thinking skills: Project-based learning (PjBL) in the media and learning resources development course. *Journal of Ultimate Research and Trends in Education*, 6(2), 97–107. <https://doi.org/10.31849/utamax.v6i2.19620>

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers and Education*, 128, 13–35. <https://doi.org/10.1016/j.compedu.2018.09.009>

Setiawan, L., Wardani, N. S., & Permana, T. I. (2021). Peningkatan kreativitas siswa pada pembelajaran tematik menggunakan pendekatan project-based learning. *Jurnal Pembangunan Pendidikan: Fondasi dan Aplikasi*, 8(2), 163–171. <https://doi.org/10.21831/jppfa.v8i2.40574>

Siskawati, G. H., Mustaji, M., & Bachri, B. S. (2020). Pengaruh project based learning terhadap kemampuan berpikir kreatif siswa pada pembelajaran online. *Educate: Jurnal Teknologi Pendidikan*, 5(2), 31–42. <https://doi.org/10.32832/educate.v5i2.3324>

Sterling-Orth, A. J., Hoepner, J. K., & Hemmerich, A. L. (2016). Use of screen casting to increase student engagement and learning: Ingredients for success. *Journal of Teaching and Learning with Technology*, 5(1), 100–104. <https://doi.org/10.14434/jotlt.v5n1.13632>

Sugiyono. (2022). Metode penelitian kuantitatif, kualitatif, dan R&D (Edisi 2). Bandung: Alfabeta.

Wahyuni, S., Hadiyaturrido, H., & Mashal Hadi. (2024). Penerapan model pembelajaran Project Based Learning (PjBL) untuk meningkatkan kreativitas siswa kelas V pada mata pelajaran Ilmu Pengetahuan Alam dan Sosial (IPAS). *Jurnal Ilmiah Global Education*, 5(4), 2627–2634. <https://doi.org/10.55681/jige.v5i4.3627>

Widodo, J. P. (2024). Unleashing student potential: Enhancing creativity and performance with project-based learning. *Jurnal Sosioteknologi*, 23(2). <https://doi.org/10.5614/sostek.itbj.2024.23.2.1>