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The Effect of Project-Based Learning Assisted by Simple Solar Panels on Students' Creativity in the Topic of Renewable Energy

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Abstrak: Creativity is an essential competence in physics learning, yet lecture-dominated lessons with few teaching aids may provide limited opportunities for its development. This study aimed to examine the effect of Project Based Learning (PjBL) assisted by a simple solar panel on tenth-grade students' creativity in renewable energy. A quasi-experimental non-equivalent control group design was conducted at SMA Negeri 2 Gerung in the 2025/2026 academic year. Purposive sampling selected class X-1 as the experimental group (19 students) and class X-2 as the control group (18 students). Creativity was measured using an eight-item essay test covering fluency, flexibility, originality, and elaboration. The instrument had a Cronbach's Alpha coefficient of 0.731. Mean pretest scores were 41 for the experimental group and 40 for the control group, while mean posttest scores were 84 and 79, respectively. The reported t-test yielded t = 2.269, exceeding the critical value of 2.030 at the 5% significance level. However, the available analysis does not report the exact p-value, confidence interval, or effect size, and does not explicitly adjust for baseline scores. Therefore, the findings should be interpreted cautiously and strengthened through further analysis that accounts for pretest scores.

Keywords: Creativity; Project Based Learning; Renewable energy; Simple solar panel; Quasi-experiment

Introduction

Physics studies natural phenomena through facts, principles, and laws that are examined using scientific methods. Therefore, physics learning should provide opportunities for students to express their ideas, explore various approaches, and develop solutions to physical problems (Amalissholeha et al., 2023; Syahrial et al., 2022). The use of diverse learning media also has the potential to increase students' learning interest, while the difficulties in learning physics that are still encountered in schools indicate the need for learning innovations (Fauziah & Sulisworo, 2022; Sa'diyah & Sunarsih, 2021).

The results of a preliminary study conducted through observations and interviews with the physics teacher of Grade X at SMA Negeri 2 Gerung indicate that physics learning is still predominantly conducted through lectures and discussions, despite the implementation of the Merdeka Curriculum since the 2023/2024 academic year. Some students are less actively engaged, learning motivation is not evenly distributed, and creativity has not yet developed optimally. This condition highlights a gap between the demands for active and creative learning and the actual classroom practices (Durisa et al., 2022). In the topic of renewable energy, contextual learning through practical activities has the potential to help students connect physics concepts with everyday life (Delima & Mayub, 2023). However, the limited availability of teaching aids remains one of the obstacles to implementing such learning activities (Fartina et al., 2022).

The Project-Based Learning (PjBL) model positions students as the main participants in the learning process through collaborative project activities related to real-world problems (Nisa, 2021; Qalbina et al., 2023). Several studies have associated PjBL with improvements in creativity and learning outcomes (Abdi & Airlanda, 2023; Chen & Yang, 2019; Taliak et al., 2024). Other active learning approaches, such as STEM and guided inquiry,

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have also been reported to promote the development of scientific creativity (Doyan et al., 2023; Nisrina et al., 2025). These findings support the potential of PjBL; however, they do not yet fully explain how a simple solar panel project can be used to facilitate creativity indicators in renewable energy learning.

A simple solar panel has the potential to serve as a concrete learning medium in PjBL because it allows students to observe the conversion of solar energy into electrical energy through the photovoltaic effect (Susilo et al., 2025). Changes in electrical output due to differences in light intensity, angle of incidence, temperature, and shading can provide a basis for designing, testing, and improving projects (Aslam et al., 2022). These activities have the potential to facilitate fluency through the development of various ideas, flexibility through the consideration of alternative designs, originality through the development of different solutions, and elaboration through explanations of the project processes and outcomes. Although previous studies have discussed PjBL and the development of creativity (Abdi & Airlanda, 2023; Taliak et al., 2024), research integrating simple solar panel projects with the assessment of four creativity indicators in renewable energy topics still needs to be further developed. Therefore, this study aims to analyze the effect of PjBL assisted by simple solar panels on the creativity of Grade X students in the topic of renewable energy.

Method

This study employed a quasi-experimental method with a Non-equivalent Control Group Design (Sugiyono, 2024). This design was selected because students could not be randomly assigned to classes, and external variables could not be fully controlled (Abraham & Supriyati, 2022). The experimental class received PjBL assisted by simple solar panels, while the control class received conventional instruction. Both classes were administered a creativity pretest and posttest (Table 1).

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Eksperimental	O_1	X	O_2
Control	O_3	-	O_4

X: PjBL assisted by simple solar panels; O1 and O3: pretest; O2 and O4: posttest.

The study was conducted at SMA Negeri 2 Gerung during the 2025/2026 academic year, with all Grade X students as the population. The sample was selected using purposive sampling based on the consideration of relatively comparable numbers of students, the same subject teacher, and closely scheduled physics lessons (Sugiyono, 2024). Class X-1 consisted of 19 students and served as the experimental class, while Class X-2 consisted of 18 students and served as the control class. Both classes received instruction on the same topic but using different learning approaches. The initial conditions of both groups were assessed through a pretest before their final results were compared.

The learning process consisted of five meetings in each class: the first meeting was allocated for the pretest, the second to fourth meetings were devoted to the treatment, and the fifth meeting was used for the posttest. The experimental class followed the six stages of the PjBL syntax (Muhibbullah et al., 2024), namely formulating fundamental questions, planning and designing the project, developing a schedule, monitoring project implementation, assessing the results, and evaluating the project. The project involved assembling and testing a simple solar panel to convert sunlight into electrical energy, with a focus on the effect of light intensity on electrical output. The control class studied the same topic through direct instruction, using lectures, question-and-answer sessions, discussions, and individual assignments. Details of the activities during the three treatment meetings are presented in Table 2.

Table 2. PjBL Activities in the Experimental Class

Meeting	PjBL Stage	Student Activities
1	Formulating fundamental questions; planning and designing the project; developing a schedule	Responding to guiding questions about the utilization of solar energy, formulating the project problem, developing a project plan, determining the tools and materials, assigning group tasks, and agreeing on a project schedule.
2	Monitoring project implementation; evaluating the process	Assembling a simple solar panel according to the project plan, conducting experiments and recording observations, and discussing challenges and possible solutions.
3	Assessing the results; evaluation	Presenting the product and explaining how it works, receiving feedback based on the assessment rubric, and reflecting on the project process and outcomes.

Creativity was measured using an eight-item open-ended test developed based on four indicators: fluency, flexibility, originality, and elaboration, with each indicator represented by two items (Table 3; Nisrina et al., 2025). The scoring rubric should clearly describe the criteria for scores ranging from 0 to 3 for each creativity indicator to ensure consistent scoring. The alignment of

each test item with its corresponding indicator should also be explained. If expert validation and inter-rater consistency checks have been conducted, the procedures and results should be reported. The instrument was piloted with 24 Grade XI students at the same school. Validity was analyzed using the product-moment correlation (Equation 1), and an item was considered valid if its r_{xy} value was greater than or equal to the r_{tabel} value at the 5% significance level (Arikunto, 2024).

Table 3. Creativity Indicators and Test Item Requirements

Indicator	Test Item Requirements (Two Items per Indicator)
Fluency	Identifying and explaining various types of renewable energy sources and generating multiple ideas for energy-saving behaviors.
Flexibility	Considering the advantages and disadvantages of wind and solar power plants in a coastal area case study, and responding to the dilemma of biofuel utilization from different perspectives.
Originality	Designing ideas for solar cell placement in urban facilities and modifying power generation technology to make it more environmentally friendly and compatible with ecosystems.
Elaboration	Explaining step by step the energy transformation in a waterwheel and detailing the cost of electrical energy based on the specifications of electronic devices.

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}} \quad (1)$$

Reliability was calculated using the Cronbach's Alpha formula (Equation 2), while the levels of item difficulty and discriminating power were analyzed based on the scores of the upper and lower groups (Arikunto, 2024).

$$r_{11} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right) \quad (2)$$

Note: N = number of students; X = item score; Y = total score; k = number of items; σ_b^2 = = sum of item variances; σ_t^2 = total variance.

The research data were analyzed using inferential statistics. Normality was tested using the chi-square test (χ^2), while homogeneity was examined using the F-test (Usmadi, 2020; Sianturi, 2022). The hypothesis was tested using the pooled-variance t-test (Equations 3 and 4) at a significance level of 5%. The null hypothesis (H_0) states that PjBL assisted by simple solar panels has no effect on students' creativity, whereas the alternative hypothesis (H_1) states that it has an effect. H_0 is rejected if the calculated t-value is greater than the critical t-value (t-table).

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s_{gab}^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad (3)$$

$$s_{gab}^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2} \quad (4)$$

Note: $\bar{x}_1$ and $\bar{x}_2$ = mean scores of the experimental and control classes, respectively; s_1^2 and s_2^2 = variances; n_1 and n_2 = number of students.

Result and Discussion

Instrument Quality

The results of the instrument trial involving 24 students are presented in Table 4. All items had item-total correlation coefficients ranging from 0.465 to 0.737, which were higher than the critical r-value of 0.404, indicating that they met the validity criteria based on this test. The instrument obtained a Cronbach's Alpha coefficient of 0.731. This reliability coefficient should be interpreted according to the appropriate criteria rather than merely compared with the critical r-value. Based on the difficulty analysis, seven items were classified as easy and one item as moderate. The discriminating power of all eight items was classified as good to very good. These results provide information about the characteristics of the test items but do not, by themselves, demonstrate that all aspects of the instrument's content validity have been fulfilled.

Table 4. Results of the Creativity Instrument Trial

r_{xy}	Description	DI	Description	DP	Description
0,465	Valid	0,75	Easy	0,67	Good
0,595	Valid	0,74	Easy	0,92	Very good
0,576	Valid	0,76	Easy	0,42	Good
0,559	Valid	0,81	Easy	0,50	Good
0,615	Valid	0,78	Easy	0,83	Very good
0,566	Valid	0,72	Easy	0,50	Good
0,708	Valid	0,74	Easy	0,92	Very good
0,737	Valid	0,68	Moderate	0,75	Very good

r-table = 0,404 (n = 24; α = 5%); DI = Difficulty Index; DP = Discrimination Index.

Description of Students' Creativity

The experimental class obtained an average pretest score of 41, while the control class obtained an average of 40, indicating a one-point difference between the two groups (Table 5 and Figure 1). Following the treatment, the average posttest scores increased to 84 in the experimental class and 79 in the control class. The mean score improvements were 43 and 39 points, respectively, resulting in a four-point difference in the improvement between the two classes. Meanwhile, the difference in the average posttest scores was five points. These differences provide a descriptive overview of the outcomes in both groups; however, they are insufficient to determine the practical magnitude of the treatment

effect without considering score variability and effect size.

Table 5. Average Creativity Scores

Class	n	Pretest	Posttest	Improvement
Experimental	19	41	84	43
Control	18	40	79	39

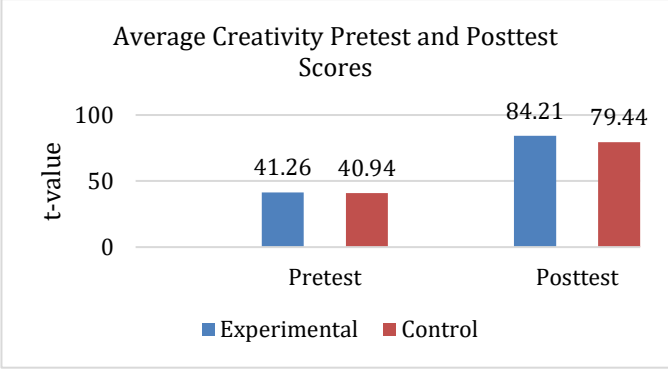


Figure 1. Average Creativity Pretest and Posttest Scores

Prerequisite Tests and Hypothesis Testing

The pretest and posttest data for both classes were normally distributed, as the calculated χ^2 values were lower than the critical χ^2 value of 5.99 (Table 6). The homogeneity test indicated that the variances were homogeneous for both the pretest (calculated F-value = 1.121) and posttest (calculated F-value = 1.316), as both values were lower than the critical F-value of 2.203 (Table 7). Therefore, the t-test could be applied. The t-test yielded a calculated t-value of 2.269, which was greater than the critical t-value of 2.030 at 35 degrees of freedom (19 + 18 − 2) and a significance level of 5%. Thus, H_0 was rejected and H_1 was accepted.

Table 6. Normality Test Results

Class	Data	χ^2 calculated	χ^2 table	Description
Experimental	Pretest	3,81	5,99	Normal
Experimental	Posttest	4,44	5,99	Normal
Control	Pretest	4,42	5,99	Normal
Control	Posttest	5,32	5,99	Normal

Table 7. Homogeneity Test and t-Test Results

Test	Calculated Value	Critical Value	Decision
Pretest Homogeneity	1,121	2,203	Homogeneous
Posttest Homogeneity	1,316	2,203	Homogeneous
t-Test (db = 35)	2,269	2,030	H_0 Rejected

The t-test results from the preliminary analysis indicated a difference in the mean posttest scores between the experimental and control classes. This finding is consistent with studies reporting that PjBL can support the development of students' creativity (Abdi & Airlanda, 2023; Taliak et al., 2024), as well as a meta-analysis demonstrating the positive effects of PjBL on learning outcomes (Chen & Yang, 2019). Nevertheless, the interpretation of the treatment effect should take into account the initial conditions of both groups and the results of appropriate further analyses.

The control class also showed an increase of 39 points. This is reasonable because direct instruction still provides students with knowledge that supports their responses to open-ended questions, while the experience of taking the pretest may help students become familiar with the question format (testing effect). Therefore, the advantage of PjBL should be interpreted in terms of the difference in score improvements between the classes, namely 4 points (43 compared with 39), or 5 points in the average posttest scores, rather than merely the increase in scores. This relatively small difference suggests that the effect of PjBL is statistically significant but moderate in magnitude, particularly because, in a quasi-experimental study, the influence of external variables cannot be fully controlled (Abraham & Supriyati, 2022; Chen & Yang, 2019; Sugiyono, 2024).

The differences in the results can be explained through the PjBL syntax (Muhibbullah et al., 2024). Fundamental questions related to the energy crisis and the potential of solar energy encourage students to generate multiple ideas (fluency). Project planning under limitations in tools and materials requires students to consider several designs, such as panel arrangements and placement angles (flexibility). During monitoring, differences in experimental results obtained at different positions or times encourage each group to modify its own design (originality). Product presentations and demonstrations require students to explain how solar panels work and the rationale behind their designs in a coherent manner (elaboration), while reflection during the evaluation stage allows for repeated improvements (Bell, 2010; Guo et al., 2020; Nisrina et al., 2025). This explanation is interpretative, as scores for each indicator were not analyzed separately in this study.

Simple solar panels serve as a concrete learning medium that enables students to directly observe the conversion of light energy into electrical energy and actively engage in the learning process (Arsyad, 2017). Electrical output, which depends on light intensity, angle of incidence, temperature, and shading (Kiswanto et al., 2025), exposes students to physical phenomena that require adjustments, in line with the principles of the photovoltaic effect in solar panels (Susilo et al., 2025). Reports of difficulties in learning physics at the secondary school level (Amalissholeha et al., 2023), along with evidence of the feasibility and positive learning outcomes associated with the use of simple physics teaching aids (Fartina et al., 2022), further

highlight the need for such learning media. The relationship between project activities and the creativity indicators provides a theoretical explanation of the potential of the learning process. Since the scores for each indicator were not analyzed separately, this study cannot yet determine which creativity indicator experienced the greatest improvement.

These findings have practical implications for physics teachers. Simple solar panel projects use relatively basic tools and materials, making them a potential alternative when teaching aids are unavailable, provided that the tools and materials are prepared in advance. The teacher's role shifts from delivering content to facilitating learning by posing guiding questions and providing feedback at each stage of the project (Muhibbullah et al., 2024; Qalbina et al., 2023). Meanwhile, assessment should cover the process, product, and reflection, rather than relying solely on written tests (Guo et al., 2020; Kokotsaki et al., 2016).

The findings of this study should be interpreted with caution. The use of purposive sampling to select classes did not fully control external variables. In addition, the sample was relatively small (19 and 18 students) and drawn from a single school, thus limiting the generalizability of the findings. The treatment was conducted over only three meetings, even though solar panel projects require a longer period to complete, and limited time is indeed recognized as a challenge in implementing PjBL (Kokotsaki et al., 2016). Creativity was also measured using an open-ended test, which may not fully capture creativity demonstrated during the product development process.

Conclusion

Based on the descriptive results and preliminary analysis reported, the average creativity posttest score of the experimental class, which received Project-Based Learning assisted by simple solar panels, was 84, while that of the control class was 79. The t-test yielded a calculated t-value of 2.269, which was greater than the critical t-value of 2.030 at a 5% significance level. However, conclusions regarding the treatment effect should be interpreted with caution because the available analysis has not explicitly controlled for differences in students' initial abilities and has not reported an effect size or confidence interval. Further analysis that takes pretest scores into account is needed to strengthen the evidence regarding the treatment effect. Teachers may consider using simple solar panel projects as an alternative for contextual learning by preparing the necessary tools and materials and planning the activities systematically.

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Author Contributions
Conceptualization, L.S., H., and S.A.; methodology, L.S. and H.; investigation, L.S.; formal analysis, L.S.; writing, original draft preparation, L.S.; writing, review and editing, H. and S.A.; supervision, H. and S.A. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

References

Abdi, G. P., & Airlanda, G. S. (2023). Peningkatan kreativitas belajar peserta didik melalui model pembelajaran project based learning. *Jurnal Penelitian dan Evaluasi Pendidikan Indonesia*, *13*(2), 139–146.

Abraham, I., & Supriyati, Y. (2022). Desain kuasi eksperimen dalam pendidikan: Literatur review. *Jurnal Ilmiah Mandala Education*, *8*(3), 2476–2482.

Alwafi, M. C., & Derta, S. (2024). Pengaruh Model Pembelajaran Mind Mapping Terhadap Hasil Belajar Siswa di SMPN 4 Bukittinggi. *Journal of Educational Management and Strategy*, 3(1), 17-31.

Amalissholeha, N., Rokhmat, J., & Gunada, I. W. (2023). Analisis kesulitan belajar peserta didik pada pembelajaran fisika di SMAN 1 Kediri. *Empiricism Journal*, *4*(2), 356–364.

Arikunto, S. (2024). *Prosedur penelitian: Suatu pendekatan praktik*. Jakarta, Indonesia: Rineka Cipta.

Arsyad, A. (2017). *Media pembelajaran*. Jakarta, Indonesia: Rajawali Pers.

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House*, *83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Chen, C.-H., & Yang, Y.-C. (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review*, *26*, 71–81. https://doi.org/10.1016/j.edurev.2018.11.001

Delima, E. M., Mayub, A., & Nursa'adah, E. (2023). Pengembangan alat peraga energi terbarukan berbasis solar cell pada pembelajaran IPA. *Jurnal Pendidikan MIPA*, *13*(2), 284–290. https://doi.org/10.37630/jpm.v13i2.889

Doyan, A., Wahyudi, W., & Aulia, L. D. (2023). Pengaruh model STEM terhadap kreativitas sains peserta didik pada materi suhu dan kalor. *Jurnal Penelitian dan Pembelajaran Fisika Indonesia*, *4*(1), 2–6. https://doi.org/10.29303/jppfi.v4i1.172

Durisa, A. I., Istiningsih, S., & Widodo, A. (2022). Menciptakan pembelajaran yang aktif, kreatif, efektif dan menyenangkan di sekolah dasar. Elementary Journal: Jurnal Pendidikan Guru Sekolah Dasar, 5(2), 55-63.

Fartina, F., Hizbi, T., Zahara, L., & Mudrikah, M. (2022). Pengembangan alat peraga fisika sederhana berbahan bekas pakai pada materi gerak lurus. *Kappa Journal, 6*(1), 113–118. https://doi.org/10.29408/kpj.v6i1.5778

Fauziah, A. N., & Sulisworo, D. (2022). Pembelajaran fisika dengan memanfaatkan teknologi guna meningkatkan minat belajar. *Jurnal Genesis Indonesia*, *1*(2), 79–86. https://doi.org/10.56741/jgi.v1i02.93

Gunawan, G., Harjono, A., Kosim, K., Zainuri, B. N. S., & Qothrunnada, Q. (2025). Multimodal approaches in problem-based, project-based, and inquiry-based learning models in science education: A systematic literature review. *Indonesian Journal of STEM Education*, *7*(1), 1–17.

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, *102*, 101586. https://doi.org/10.1016/j.ijer.2020.101586

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

Muhibbullah, M. M., Alviani, V. Z., Natasya, D., Rahmadini, A. R., & Trilisiana, N. (2024). Analisis kesesuaian implementasi sintaks project based learning dalam proses pembelajaran. *Epistema*, *5*(1), 42–57.

Nisa, A. R. K. (2021). Efektivitas model pembelajaran berbasis proyek dalam PJJ terhadap pemahaman materi. *Alinea: Jurnal Bahasa, Sastra, dan Pengajaran*, *10*(1), 61. https://doi.org/10.35194/alinea.v10i1.1186

Nisrina, N., Verawati, N. N. S. P., & Hikmawati, H. (2025). Enhancing scientific creativity of prospective physics teachers through guided-inquiry-based electricity and magnetism materials with blended learning. *Lensa: Jurnal Kependidikan Fisika*, *13*(1), 148–157. https://doi.org/10.33394/j-lkf.v13i1.16125

Qalbina, P., Melta, D., & Diliarosta, S. (2023). Penggunaan model pembelajaran project based learning (PjBL) untuk meningkatkan kemampuan dan motivasi siswa. *Natural: Jurnal Ilmiah Pendidikan IPA*, *10*(1), 30–35. https://doi.org/10.30738/natural.v10i1.14037

Sa'diyah, H., & Sunarsih, A. (2021). Analisis kesulitan belajar siswa pada materi elastisitas dan getaran harmonik dalam pembelajaran fisika berbasis inkuiri di sekolah menengah atas. *Jurnal Pendidikan IPA dan Keilmuan*, *1*(1), 7–11.

Sianturi, R. (2022). Uji homogenitas sebagai syarat pengujian analisis. *Jurnal Pendidikan, Sains, Sosial, dan Agama*, *8*(1), 386–397. https://doi.org/10.53565/pssa.v8i1.507

Sugiyono. (2024). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Bandung, Indonesia: Alfabeta.

Susilo, R. A., Bima, L., Suherman, D., Ramadan, G. N., Arijal, A., & Pamungkas, B. (2025). Pemasangan panel surya off-grid sebagai sumber listrik mandiri di Desa Tani Baru Kab. Kutai Kartanegara. *Jurnal Pengabdian Masyarakat Teknik*, *8*(1), 23–34. https://doi.org/10.24853/jpmt.8.1.23-34

Syahrial, A. H., Deliana, W., Cahyani, V. D., & Husaini, A. F. (2022). Pembelajaran fisika materi mekanika benda tegar: Review media, model, dan metode. *Mitra Pilar: Jurnal Pendidikan, Inovasi, dan Terapan Teknologi*, *1*(2), 119–140. https://doi.org/10.58797/pilar.0102.06

Taliak, J., Farisi, T. A., Sinta, R. A., Aziz, A., & Fauziyah, N. L. (2024). Evaluasi efektivitas metode pembelajaran berbasis proyek dalam mengembangkan kreativitas siswa. *Journal of Education Research*, *5*(1), 583–589. https://doi.org/10.37985/jer.v5i1.876

Usmadi, U. (2020). Pengujian prasyarat analisis (uji homogenitas dan uji normalitas). *Inovasi Pendidikan*, *7*(1), 50–62.