The Effect of Project-Based Learning Model with a Multimodal Approach on Student Creativity

Windy Zaerani[1]*, Gunawan[1], & Kosim[1]
[1]Physics Education Study Program, University of Mataram, Indonesia
*Coresponding Author: windyzaerani628@gmail.com

Received: 29th May 2026; **Accepted**: 29th June 2026; **Published**: 30th June 2026
DOI: https://dx.doi.org/10.29303/jpft.v12i1.12563

Abstract - *This study aims to examine the effect of the project-based learning model with a multimodal approach on students' creativity. This study used a quasi-experimental method with a nonequivalent control group design. The study was conducted at SMA Negeri 7 Mataram in class XI of the even semester of the 2025/2026 academic year. Sampling used purposive sampling technique, selecting class XI A3 with 30 students as the experimental class and class XI A2 with 29 students as the control class. The research instrument used a creativity test consisting of 4 essay questions covering indicators of fluency, flexibility, elaboration, and originality. Data analysis was performed using the t-polled variance test. The results showed that the project-based learning model with a multimodal approach significantly influenced students' creativity, as indicated by a tvalue of 4.196 greater than ttable of 2.002 at a 5% significance level. The average posttest score of the experimental class reached 86, higher than the control class at 71. Thus, the project-based learning model with a multimodal approach is effective in improving students' creativity.*

Keywords*: Creativity; Multimodal Approach; Project-Based Learning.*

INTRODUCTION

Schools play a vital role in shaping high-quality, adaptive, and competitive human resources in the era of globalization and the Industrial Revolution 4.0 (Abdillah, 2024). The challenges of the 21st century require students to possess critical thinking, communication, collaboration, and creativity skills, collectively known as the 4C skills (Sudirman et al., 2023). Among these, creativity has become an important ability that needs to be developed in the physics learning process (Pare & Sihotang, 2023).

Creativity in the context of physics education is defined as students' ability to solve problems in a unique, effective, and original manner (Dewi, Harjono & Gunawan, 2016). This ability encourages students to view problems from a broader perspective, making them better prepared to face diverse learning situations. Ridha et al. (2022) state that creativity is a person's ability to generate new ideas to solve problems in an innovative way. Gunawan et al. (2018) affirm that creativity is one of the higher-order thinking skills that needs to be developed in students.

However, research indicates that students' creativity in physics learning remains low (Laverdho, 2024; Rahmadani & Putri, 2021). Physics is often considered difficult and challenging due to its abstract concepts and unattractive presentation. One contributing factor is the use of teacher-centered and monotonous learning models, which have not provided sufficient space for students to explore and develop their creativity (Fitriana, 2024; Hutabarat & Hasibuan, 2020).

Based on observations at SMA Negeri 7 Mataram, physics learning in class XI has adopted the Merdeka Curriculum and implemented project-based learning with a multimodal approach through media such as videos, digital applications, and laboratory activities. However, observations showed that students' creativity had not developed

evenly. Low learning motivation due to external distractions and suboptimal instructional design were identified as the main inhibiting factors.

One promising alternative to address these issues is the implementation of the project-based learning model. This model is student-centered and encourages students to conduct in-depth investigations into real and relevant topics in daily life (Widiawati et al., 2024). Research by Gunawan et al. (2017) showed that project-based learning assisted by virtual media can enhance students' creativity. Furthermore, most previous studies have focused on a single variable or specific learning medium, leaving a research gap in the application of project-based learning integrated with a multimodal approach.

The multimodal approach is important because each student has a different learning style. By integrating various modes of learning such as text, visual, audio, and kinesthetic, abstract physics material can be presented more concretely and understandably. Gunawan et al. (2025) explain that integrating multimodal approaches through text, images, video, simulations, and verbal explanations significantly improves students' creativity in science. The combination of project-based learning with a multimodal approach is expected to maximize students' learning potential holistically, increase engagement in the learning process, and produce more innovative and comprehensive work (Al Fajri, 2020).

The creativity indicators measured in this study refer to Sahidu et al. (2018): fluency, flexibility, elaboration, and originality. Based on the foregoing, this study aims to examine the effect of the project-based learning model with a multimodal approach on students' creativity.

RESEARCH METHODS

This study employed a quasi-experimental method with a non-equivalent control group design. It involved two groups: the experimental class receiving the project-based learning model with a multimodal approach, and the control class using conventional learning methods.

The study was conducted at SMA Negeri 7 Mataram in class XI during the even semester of the 2025/2026 academic year, covering the topic of sound waves. The study population consisted of all class XI students from XI A1 to XI A5, totaling 169 students. Purposive sampling was used, selecting class XI A3 with 30 students as the experimental class and class XI A2 with 29 students as the control class. Sample selection was based on equivalent learning schedules, the same teacher, balanced class sizes, and comparable academic backgrounds based on previous physics grades.

The independent variable was the project-based learning model with a multimodal approach, while the dependent variable was students' creativity. The research instrument was a creativity test consisting of 4 essay questions designed to measure four creativity indicators: fluency, flexibility, elaboration, and originality. Data were collected through a pretest before treatment and a posttest after treatment.

Prior to use, the instrument was tested for validity, reliability, difficulty level, and discriminating power. Data analysis used prerequisite tests (normality and homogeneity tests) and hypothesis testing using the t-polled variance test at a 5% significance level (alpha = 0.05).

RESULTS AND DISCUSSION

Results

1. Instrument Test

The instrument test was conducted on Monday, March 9, 2026 at SMAN 7 Mataram in class XII A1. Based on the results, all items were declared valid because each item's rxy value exceeded rtable (0.396), with the highest validity coefficient of 0.886. The instrument also demonstrated a very strong consistency level with a reliability value r11 of 1.142. In terms of difficulty level, the instrument was dominated by items in the moderate category. The complete instrument test results are presented in Table 1.

Table 1. Instrument Test Results

No.	Validity			Reliability			Difficulty Level		Discriminating Power		Conclusion
	r_{table}	r_{xy}	Desc.	r_{table}	r_{11}	Ket.	TK	Ket.	DP	Ket.	
1	0,396	0,871	Valid	0,396	1,142	Reliable	0,576	Moderate	0,429	Good	Accepted
2	0,396	0,716	Valid	0,396	1,142	Reliable	0,424	Moderate	0,343	Fair	Revised
3	0,396	0,886	Valid	0,396	1,142	Reliable	0.704	Easy	0,514	Good	Accepted
4	0,396	0,504	Valid	0,396	1,142	Reliable	0,496	Moderate	0,171	Poor	Revised

2. Creativity Data Description

The creativity achievement data showed a significant increase in scores after treatment, especially in the experimental group. Based on Figure 1, both classes started with low and comparable creativity levels, with mean pretest scores of 35 for the experimental class and 32 for the control class. After the learning process, the experimental class using the project-based learning model with a multimodal approach achieved a posttest score of 86, significantly higher than the control class at 71.

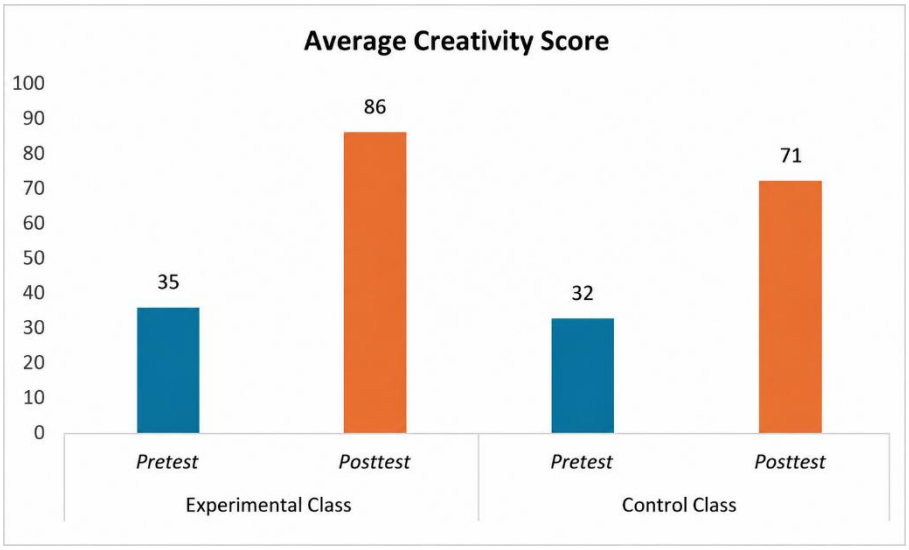

Figure 1. Mean Creativity Scores

In addition to written tests, the creativity of students in the experimental class was also assessed through video products created during the project-based learning process. Eight groups were evaluated using a creativity rubric covering four indicators. Video assessment results showed a mean score of 87.5, with the highest score of 95 (Groups 2 and 3) and the lowest score of 75

(Group 7). Complete video product assessment data are presented in Table 2.

Table 2. Creativity Video Assessment Results of Experimental Class Students

Group	Fluency	Flexibility	Elaboration	Originality	Score
1	4	5	4	5	90
2	5	5	4	5	95
3	5	5	4	5	95
4	4	4	4	5	85
5	5	4	4	5	90
6	3	5	5	5	90
7	4	3	4	4	75
8	4	3	4	5	80
Average					87,5

3. Prerequisite Analysis Tests

The normality test was conducted using the chi-square equation. Results showed that all data from both classes were normally distributed. The χ^2calculated values for the experimental class were 1.58 (pretest) and 3.61 (posttest), and for the control class 5.61 (pretest) and 6.89 (posttest), all smaller than χ^2table of 11.07. Normality test results are presented in Table 3.

Table 3. Creativity Normality Test Results

Group	Data	χ^2calculated	χ^2table ($\alpha = 0.05$)	Description
Experimental	*Pretest*	1,58	11,07	Normal
Experimental	*Posttest*	3,61	11,07	Normal
Control	*Pretest*	5,61	11,07	Normal
Control	*Posttest*	6,89	11,07	Normal

The homogeneity test was conducted using the F-test. For the pretest data, Fcalculated of 1.72 was smaller than Ftable of 1.86, so the pretest data were declared homogeneous. For the posttest data, Fcalculated of 1.32 was smaller than Ftable of 1.86, so the posttest data were also declared homogeneous. With both normality and homogeneity requirements met, hypothesis testing could proceed using parametric statistics.

4. Hypothesis Test Results

Hypothesis testing used the t-polled variance test because the data were normally distributed and homogeneous with unequal sample sizes. The analysis showed tcalculated of 4.196 greater than ttable of 2.002 at a 5% significance level with degrees of freedom (df) = n1 + n2 − 2 = 29 + 30 − 2 = 57. Based on the hypothesis testing criteria, since tcalculated ≥ ttable, Ha was accepted and H0 was rejected. Hypothesis test results are presented in Table 4.

Table 4. Hypothesis Test Analysis Results

Group	**Number of Students (n)**	**Mean**	**Variance (S^2)**	$t_{\text{calculated}}$	t_{table}
Experimental	30	86	124,62	4,196	2,002
Control	29	71	218,34		

Discussion

Based on the hypothesis test results, tcalculated of 4.196 was greater than ttable of 2.002, so Ha was accepted. These results indicate that the project-based learning model with a multimodal approach had a significant effect on the creativity of students at SMA Negeri 7 Mataram. The more significant improvement in the experimental class indicates that the application of this model was able to enhance students' creativity more optimally compared to conventional learning.

The increase in creativity in the experimental class was influenced by the characteristics of the project-based learning model, which encourages students to think creatively and produce learning outcomes. In the process of creating a sound wave experiment video, students were required to demonstrate fluency in generating ideas, flexibility in determining various forms of presentation, elaboration in developing ideas in detail, and originality in producing unique and different works (Sahidu et al., 2018). Developing these four creativity indicators tends to be more difficult through teacher-centered conventional learning, where students play a more passive role as information recipients.

The role of the multimodal approach in fostering students' creativity cannot be overlooked. When students are exposed to various material representations ranging from images, videos, audio, and simulations, they have more sources of inspiration to express their understanding creatively. Lata & Bhatnagar (2023) explain that students' interaction with various modes of representation not only strengthens conceptual understanding but also stimulates creativity in finding solutions and expressing ideas. Gunawan et al. (2025) similarly stated that integrating multimodal approaches significantly improves students' creativity in science.

Furthermore, the mean video product assessment score of the experimental class reached 87.5 across eight groups. This provides additional evidence that students' creativity developed significantly through the project-based learning process supported by the multimodal approach. The tcalculated value of 4.196 indicates that the application of this model had a large effect on students' creativity. This occurred because project activities in the form of video gave students opportunities to explore ideas more broadly, develop original concepts, and present their work creatively.

These findings are consistent with the results of Gunawan et al. (2015), who concluded that project-based learning assisted by virtual media can enhance students' creativity. Dewi, Harjono, and Gunawan (2016) also affirmed that creativity in the context of physics education is the ability to solve problems in a unique and original way, which can only develop through learning experiences that provide space for exploration and experimentation, as facilitated by the project-based learning model.

CONCLUSION

Based on the research results and discussion, it can be concluded that the project-based learning model with a multimodal approach had a significant effect on the creativity of class XI students at SMA Negeri 7 Mataram. Statistically, this is evidenced by $t_{calculated}$ of 4.196 greater than t_{table} of 2.002 at a 5% significance level. The mean posttest creativity score of the experimental class reached 86, far exceeding the control class at 71. The video product assessment of the experimental class also showed a high mean of 87.5. The integration of project-based learning and the use of

various modes of representation proved effective in developing students' creativity aspects, including fluency, flexibility, elaboration, and originality in solving physics problems on the topic of sound waves.

Based on the research findings, the following recommendations are proposed: (1) For teachers, the project-based learning model with a multimodal approach can serve as an alternative for teaching abstract physics topics, with attention to the quality of project design and consistent guidance throughout the learning process. (2) For schools, adequate facilities and infrastructure should be provided, and teacher training should be facilitated to optimally support the implementation of this innovative learning model. (3) For future researchers, it is recommended to expand the population coverage, add relevant research variables such as learning motivation and critical thinking, and extend the intervention duration to obtain more comprehensive results.

ACKNOWLEDGMENT

The authors would like to express their deepest gratitude to SMA Negeri 7 Mataram for granting permission and providing facilities during the research process. Gratitude is also extended to the supervisors at the Physics Education Study Program for providing constructive guidance, criticism, and suggestions in the refinement of this scientific work. Finally, sincere thanks are given to family, fellow students of the Physics Education Study Program at the University of Mataram, and all parties who provided moral and material support until this scientific article was completed.

REFERENCES

Abdillah, F. (2024). Peran perguruan tinggi dalam meningkatkan kualitas sumber daya manusia di Indonesia. *EDUCAZIONE: Jurnal Multidisiplin*, 1(1), 13-24. from https://doi.org/10.37985/educazione.v1i1.4

Al Fajri, T. A. (2020). Pentingnya penggunaan pendekatan multimodal dalam pembelajaran. *WASKITA: Jurnal Pendidikan Nilai Dan Pembangunan Karakter*, 2(1), 57-72. from https://doi.org/10.21776/ub.waskita.2018.002.01.5

Dewi, S. M., Harjono, A., & Gunawan. (2016). Pengaruh Model Pembelajaran Berbasis Masalah Berbantuan Simulasi Virtual Terhadap Penguasaan Konsep dan Kreativitas Fisika Siswa SMAN 2 Mataram. *Jurnal Pendidikan Fisika dan Teknologi*, 2(3), 118–122. from https://doi.org/10.29303/jpft.v2i3.302

Fitriana, I. (2024). *Pengaruh Model Pembelajaran Kooperatif Tipe Talking Stick Terhadap Kemampuan Pemahaman Konsep Siswa* (Doctoral dissertation). IAIN Metro, Metro. from https://repository.metrouniv.ac.id/id/eprint/9884/

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. from https://journal.publication-center.com/index.php/ijse/article/view/1840

Gunawan, G., Harjono, A., & Sutrio, S. (2015). Multimedia Interaktif dalam Pembelajaran Konsep Listrik bagi Calon Pendidik. *Jurnal Pendidikan Fisika dan Teknologi*, 1(1), 9-14. from https://doi.org/10.29303/jpft.v1i1.230

Gunawan, G., Sahidu, H., Harjono, A., & Suranti, N. M. Y. (2017). The effect of project based learning with virtual media assistance on student's creativity in physics. *Cakrawala Pendidikan*, 36(2), 878-812. from

https://doi.org/10.21831/cp.v36i2.13514

Hasibuan, F. A., & Hasibuan, T. (2023). Pengaruh metode project-based learning terhadap peningkatan kreativitas dan inovatif siswa kelas X SMA negeri 3 sibolga. *Ta'rim: Jurnal Pendidikan dan Anak Usia Dini*, 4(1), 84-93. from http://journal.staiypiqbaubau.ac.id/index.php/Tarim

Hutabarat, H. D., & Hasibuan, F. A. (2020). Peningkatan Kreativitas Siswa Melalui Media Pembelajaran Berbasis E-Learning Pada Siswa Kelas X Sma Negeri 1 Angkola Timur. *Universitas Graha Nusantara Padangsidimpuan*, 8(4), 508–512. from https://journal.ipts.ac.id/index.php/ED/article/view/2210/1178

Junti, F. H. L., Gunawan, G., Harjono, A., Busyairi, A., & Kosim, K. (2021). The validity of project-based learning device on momentum and impulse materials in increasing students creativity. *Jurnal Pijar Mipa*, 16(5), 644-649. from https://doi.org/10.29303/jpm.v16i5.3067

Lata, P., & Bhatnagar, S. (2023). Project-Based Learning with or Without Multimodal Features: Action-Based Research for Developing and Assessing Intercultural Competence. *European Journal of Teaching and Education*, 5(2), 65-79. from https://doi.org/10.33422/ejte.v5i2.1028

Laverdho, M. R., Wanto, D., & Sutarto, S. (2024). *Inovasi Guru PAI DAN Implikasinya Terhadap Kemampuan Berpikir Kreatif Peserta Didik di SMA 4 REJANG LEBONG* (Doctoral dissertation). IAIN Curup, Curup. from http://e-theses.iaincurup.ac.id/id/eprint/7568

Lestari, I., & Ilhami, A. (2022). Penerapan model project based learning untuk meningkatkan keterampilan berpikir kreatif siswa SMP: Systematic review. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, 12(2), 135-144. from https://doi.org/10.24929/lensa.v12i2.238

Mutawally, A. F. (2021). *Pengembangan Model Project Based Learning Dalam Pembelajaran Sejarah*. from https://doi.org/10.31219/osf.io/xyhve

Pangestu, S. R., Syam, M., & Damayanti, P. (2024). Penerapan Model Project Based Learning terhadap Kreativitas Siswa Kelas XI SMA Negeri 3 Samarinda pada Materi Momentum dan Impuls. *Jurnal Literasi Pendidikan Fisika (JLPF)*, 5(2), 149-155. from https://doi.org/10.30872/jlpf.v5i2.3735

Pare, A., & Sihotang, H. (2023). Pendidikan holistik untuk mengembangkan keterampilan abad 21 dalam menghadapi tantangan era digital. *Jurnal Pendidikan Tambusai*, 7(3), 27778-27786. from http://repository.uki.ac.id/id/eprint/13167

Rahmadani, Y., & Putri, T. N. (2021). Bio-Pedagogi: Jurnal Pembelajaran Biologi Profil kemampuan berpikir kritis dan kreatif siswa SMA terhadap revolusi. *Bio-Pedagogi*, 10(1), 40–50. from http://jurnal.uns.ac.id/index.php/pdg/

Ridha, M. R., Zuhdi, M., & Ayub, S. (2022). Pengembangan perangkat pembelajaran PjBL berbasis STEM dalam meningkatkan kreativitas fisika peserta didik. *Jurnal Ilmiah Profesi Pendidikan*, 7(1), 223-228. from https://doi.org/10.29303/jipp.v7i1.447

Riwayatiningsih, R., Prastikawati, E. F., & Muchson, M. (2024). A Study on The Effectiveness of Multimodal Learning, Gamification, and PBL in Academic Writing Classes. *Proceeding of International Seminar Enrichment of Career by Knowledge of Language and Literature*, 12(1),

110-123. from https://doi.org/10.25139/eckll.v12i1.9608

Sahidu, H., Gunawan, G., Rokhmat, J., & Rahayu, S. (2018). Pengembangan Perangkat Pembelajaran Fisika Berorientasi Pada Kreativitas Calon Guru. *Jurnal Pendidikan Fisika dan Teknologi*, 4(1), 1-6. from https://core.ac.uk/download/pdf/234673011.pdf

Sudirman, S., Anggereni, S., Marlinda, N. L. P. M., Silalahi, E.K., Fitrian, A., Siregar, H. T., Pa, R. H. B., Azizah, N. N., Hidayat, H., Saputri, M., Wirda, W., Nasrianty, N., & Karim, S. (2023). *Implementasi Pembalajaran Abad 21 pada Berbagai Bidang Ilmu Pengetahuan*. Bandung: Media Sains Indonesia.

Sukiawati, S., & Nurfaidah, S. (2020). Students' attitude on the Benefits of Project-based Learning in the Multimodal Platform. *AL LUGHAWIYAAT*, 1(2), 85-97. from https://doi.org/10.31332/alg.v1i2.2279

Widiawati, O., Suriansyah, A., & Cinantya, C. (2024). Model pembelajaran project-based learning dalam meningkatkan kemampuan berpikir kritis pada siswa sekolah dasar. *Maras: Jurnal Penelitian Multidisiplin*, 2(4), 2062-2070. from https://doi.org/10.60126/maras.v2i4.555