



The Influence of The Project Based Learning (PjBL) Model Based on Ethnoscience on Activities and Science Learning Outcomes

Widyani¹, Firdaus Daud^{1*}, Hartono¹, Muhiddin Palennari¹, Syamsiah¹

¹ Pendidikan Biologi, Program Magister, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Makassar, Sulawesi Selatan, Indonesia.

Received: March 05, 2026

Revised: April 30, 2026

Accepted: May 25, 2026

Published: May 31, 2026

Corresponding Author:

Firdaus Daud

firdaus.daud@unm.ac.id

DOI: [10.29303/jppipa.v12i5.14739](https://doi.org/10.29303/jppipa.v12i5.14739)

 Open Access

© 2026 The Authors. This article is distributed under a (CC-BY License)



Abstract: This study aims to analyze the effect of implementing an ethnoscience-based Project-Based Learning (PjBL) model on students' learning activities and learning outcomes. This research employed a quantitative approach with a quasi-experimental design. The research subjects consisted of two classes: an experimental class taught using the ethnoscience-based PjBL model and a control class taught using the conventional PjBL model without ethnoscience integration. The instruments used in this study included an observation sheet to assess students' learning activities and a multiple-choice test administered before and after the treatment to measure learning outcomes. The results showed that the average score of students' learning activities was 78.07, with a standard deviation of 9.17 and an achievement percentage of 78.07%, categorized as very active. The improvement in students' learning outcomes in the experimental class was also higher than in the control class based on the N-gain analysis. The average pretest score was 65.66 (SD = 10.49), which increased to 86.90 (SD = 4.78) in the posttest. The N-gain value of 0.62 was classified as moderate. Inferential analysis using the t-test indicated a significant difference in both learning activities and science learning outcomes between the two classes (Sig. = 0.000). Therefore, the implementation of ethnoscience-based Project-Based Learning has a positive effect on improving students' learning activities and science learning outcomes.

Keywords: Ethnoscience; Learning activities; Project Based Learning; Science learning outcomes.

Introduction

The rapid development of science and technology in the twenty-first century has transformed educational goals worldwide. Schools are expected to prepare students not only with content knowledge but also with critical thinking, problem-solving, collaboration, communication, and lifelong learning skills. Consequently, science education has shifted from traditional teacher-centered instruction toward student-centered learning approaches that actively engage students in constructing knowledge through meaningful experiences (Darling Hammond et al., 2020; Johnson & Johnson, 2009; Prince, 2004).

Student engagement is recognized as one of the most important determinants of academic success. Students who actively participate in classroom activities

tend to demonstrate higher levels of motivation, persistence, and academic achievement than those who are passively involved in learning processes (Wang & Degol, 2020). Therefore, science educators are encouraged to implement instructional strategies that foster active participation and meaningful learning experiences.

One instructional model that has received considerable attention in science education is Project-Based Learning (PjBL). PjBL emphasizes student-centered learning through authentic projects that require learners to investigate problems, gather information, develop solutions, and create tangible products. Previous studies have reported that PjBL positively influences academic achievement, critical thinking skills, problem-solving abilities, collaboration, and self-regulated learning (C. H. Chen & Yang, 2019; English &

How to Cite:

Widyani, Daud, F., Hartono, Palennari, M., & Syamsiah. (2026). The Influence of The Project Based Learning (PjBL) Model Based on Ethnoscience on Activities and Science Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 12(5), 530–536. <https://doi.org/10.29303/jppipa.v12i5.14739>

Kitsantas, 2019; Kokotsaki et al., 2016; Strobel & Barneveld, 2009). Through project activities, students become actively engaged in learning and are encouraged to apply scientific concepts to real-world situations.

The theoretical foundation of Project-Based Learning is closely related to constructivist learning theory, which suggests that knowledge is actively constructed through interactions with the environment and social experiences (J. Chen et al., 2021; Hmelo-Silver, 2004). Within project-based environments, students are given opportunities to investigate authentic questions, collaborate with peers, and develop meaningful products. Such learning experiences contribute to deeper conceptual understanding and increased student engagement (Krajcik & Blumenfeld, 2006). Research has demonstrated that inquiry-based science instruction improves conceptual understanding, scientific literacy, and science process skills (Furtak et al., 2012; Lazonder & Harmsen, 2016; Minner et al., 2010). Because Project-Based Learning inherently involves investigation and problem-solving processes, inquiry practices can be effectively embedded within project activities.

Ethnoscience refers to the integration of indigenous knowledge, local wisdom, and cultural practices into science learning through the reconstruction of traditional knowledge into scientific concepts (Aikenhead, 2006; Sudarmin, 2014). Ethnoscience-based learning enables students to understand scientific concepts within familiar cultural contexts, thereby increasing the relevance and meaningfulness of learning.

Several studies have demonstrated the educational benefits of ethnoscience integration. Ethnoscience-based instruction has been found to improve students' conceptual understanding, scientific literacy, critical thinking skills, and appreciation of local culture (Arfianawati et al., 2016; Parmin et al., 2017; Rahmawati et al., 2019). By linking scientific concepts with local wisdom, students are encouraged to explore scientific phenomena from both cultural and scientific perspectives, resulting in richer learning experiences.

The integration of ethnoscience into Project-Based Learning offers a promising approach for enhancing science learning. Through ethnoscience-based projects, students investigate local phenomena, analyze traditional practices scientifically, and develop products that reflect both scientific understanding and cultural knowledge. Such activities are expected to increase student participation because learning becomes more contextual and personally meaningful. Furthermore, active involvement in project activities may contribute to improved learning outcomes by promoting deeper understanding and long-term retention of scientific concepts.

The integration of ethnoscience into PjBL is particularly important in science education, as it bridges the gap between scientific knowledge and local wisdom. Such integration not only enhances relevance but also promotes deeper learning and long-term retention of knowledge. However, empirical studies examining the combined effect of ethnoscience-based PjBL on both student learning activities and learning outcomes remain limited, especially at the junior secondary level.

Therefore, this study aims to investigate the effect of ethnoscience-based Project-Based Learning on students' learning activities and learning outcomes in conventional biotechnology topics.

Method

This study employed a quasi-experimental research design. The research design used was a non-equivalent control group design with a pretest-posttest approach, involving two groups (experimental and control) to examine the effect of the ethnoscience-based Project-Based Learning (PjBL) model on students' learning activities and learning outcomes.

The population of this study consisted of all Grade IX students of SMP Pesantren IMMIM in the 2025/2026 academic year, comprising four classes: Class IX A with 29 students, Class IX B with 27 students, Class IX C with 24 students, and Class IX D with 21 students. The sample was selected using a random sampling technique. All Grade IX classes were considered to have relatively similar characteristics. The classes were assigned using a lottery technique to determine which would serve as the experimental and control groups. The control class was taught using the conventional PjBL model, while the experimental class was taught using the ethnoscience-based PjBL model. The selected sample consisted of Class IX B as the control group and Class IX A as the experimental group.

The data collection techniques used in this study included test and non-test methods. Test data were collected through pretest and posttest instruments administered to the students who were part of the research sample. Non-test data were collected using an observation sheet to assess students' learning activities.

The pretest and posttest were used to measure learning outcomes. These instruments consisted of a set of questions and exercises designed to assess students' knowledge skills. The data obtained from these instruments were quantitative in nature. The learning activity observation sheet was used to evaluate students' learning activities. The observation was conducted by observers based on indicators aligned with the ethnoscience-based PjBL model.

The collected data were analyzed using two types of statistical analysis: descriptive and inferential statistics. Descriptive statistical analysis was used to describe the characteristics of the scores for each variable, while inferential statistical analysis was employed to test the research hypotheses.

Result And Discussion

The research findings were obtained from the entire series of research procedures that had been systematically designed beforehand. The collected data were analyzed systematically to address the research questions and to test the proposed hypotheses.

Descriptive Analysis Results

Description of students learning activities using the PjBL Model without ethnosience intergration

The results of the descriptive analysis of students' learning activities using the Project-Based Learning (PjBL) model without ethnosience integration are presented in Table 1.

Table 1. Description of Students' Learning Activities Using the PjBL Model

N	Mean	SD	Max-min	Percentage %
27	62.37	10.66	43 – 83	62.37

Table 2. Frequency Distribution of Students' Learning Activities Using the PjBL Model

Score Interval	Activity Category	Frequency (f)	Percentage (%)
76 – 100	Very Active	4	14.81
51 – 75	Active	19	70.37
26 – 50	Moderately Active	4	14.81
0 – 25	Less Active	0	0
Total		27	100.0

The results indicate that the majority of students were categorized as Active, comprising 19 students (70.37%). Meanwhile, 4 students (14.81%) were categorized as Moderately Active and Very Active, respectively. No students were classified as Less Active.

These findings suggest that students' learning activities in the PjBL model can be considered good; however, they are still predominantly at the Active level rather than Very Active. Therefore, further instructional interventions are needed to enhance students' learning activities to a higher level.

Description of students learning activities Using The Ethnosience-Based PjBL Model

The results of the descriptive analysis of students' learning activities using the ethnosience-based Project-Based Learning (PjBL) model are presented in Table 3.

Table 3. Descriptive Statistics of Students' Learning Activities Using the Ethnosience-Based PjBL Model

N	Mean	SD	Min-max	Percentage %
29	78.07	9.16	68-98	78.07

Table 4. Frequency Distribution of Students' Learning Activities Using the Ethnosience-Based PjBL Model

Score Interval	Activity Category	Frequency (f)	Percentage (%)
76 – 100	Very Active	13	44.83
51 – 75	Active	16	55.17
26 – 50	Moderately Active	0	0
0 – 25	Less Active	0	0
Total		29	100.00

The results indicate that the majority of students were categorized as Very Active (44.83%) and Active (55.17%). No students were classified as Moderately Active or Less Active. These findings demonstrate that the implementation of the ethnosience-based PjBL model effectively promotes students' engagement during the learning process.

Description Of Students Learning Outcomes Using The PjBL Model

The description of students' learning outcomes was obtained from pretest and posttest scores administered through the PjBL model. The results are presented in Table 5.

Table 5. Descriptive Statistics of Students' Learning Outcomes Using the PjBL Model

Description	Pretest	Posttest	N-Gain
N	27	27	27
Minimum score	44	68	0.43
Maximum Score	80	84	0.20
Mean	65.63	78.22	0.37
SD	3.24	4.03	0.19

Table 6. Frequency Distribution of Students' Learning Outcomes Using the PjBL Model

Interval	Achievement category	Pretest	Posttest
85 – 100	Very High	0	0
75 – 84	High	9	24
65 – 74	Moderate	5	3
55 – 64	Low	8	0
≤ 54	Very Low	5	0
Total		27	27

The pretest results show that 9 students (33%) were categorized as High, 5 students (19%) as Moderate, and 8 students (29%) as Low, while 5 students fell into the Very Low category. These findings indicate that students' initial abilities were relatively low. After the implementation of the PjBL model, there was a noticeable improvement in posttest results. Although no students reached the Very High category, the number of students in the High category increased significantly to 24 students (89%), while 3 students (11%) remained in the Moderate category. This demonstrates a significant improvement in students' learning outcomes following the implementation of the PjBL model.

Description of students Learning Outcomes Using The Ethnoscience-Based PjBL Model

The descriptive analysis of students' learning outcomes using the ethnoscience-based PjBL model is presented in Table 7.

Table 7. Descriptive Statistics of Students' Learning Outcomes Using the Ethnoscience-Based PjBL Model

Description	Pretest	Posttest	N-Gain
N	29	29	29
Minimum Score	44	80	0.64
Maximum Score	84	96	0.75
Mean	65.66	86.90	0.62
SD	10.49	4.78	0.15

Table 8. Frequency Distribution of Students' Learning Outcomes Using the Ethnoscience-Based PjBL Model

Interval	Achievement Category	Pretest	Posttest
85 - 100	Very High	0	14
75 - 84	High	3	15
65 - 74	Moderate	14	0
55 - 64	Low	7	0
≤ 54	Very Low	5	0
Total		29	29

The pretest results show that 3 students were in the High category, 14 students in the Moderate category, 7 students in the Low category, and 5 students in the Very Low category. These findings indicate that students' initial abilities were relatively low. However, after the implementation of the ethnoscience-based PjBL model, students' learning outcomes improved significantly in the posttest. A total of 14 students (48%) were categorized as Very High, and 15 students (52%) as High, with no students remaining in the Moderate, Low, or Very Low categories. This indicates that the ethnoscience-based PjBL model is effective in improving students' learning outcomes.

Inferential Analysis Result

Inferential statistical analysis was conducted to test the research hypotheses and to determine the effect of the ethnoscience-based Project-Based Learning (PjBL) model on students' learning activities and learning outcomes. Prior to conducting inferential statistical tests, prerequisite tests were performed, including tests of normality and homogeneity.

Normality Test Results

The normality test was conducted to determine whether the research data were normally distributed, which is a prerequisite for applying the t-test. Data are considered normally distributed if the significance value (Sig.) is greater than 0.05.

The results of the normality test indicated that the data on learning activities, as well as pretest and posttest learning outcomes, were normally distributed, thus meeting the requirements for parametric statistical testing.

Table 9. Normality Test Results for Students' Learning Activities Data

Class	Value	Description
Control	0.200	Normal
Experiment	0.173	Normal

The Shapiro-Wilk significance value for the control group was 0.200 (Sig. > 0.05), and for the experimental group was 0.173 (Sig. > 0.05). These results indicate that the activity data in both groups are normally distributed.

Table 10. Normality Test Results for Students' Learning Outcomes Data

Test	Value	Description
Pretest Control	0.081	Normal
Posttest Control	0.200	Normal
Pretest Experiment	0.094	Normal
Posttest Experiment	0.200	Normal

All Shapiro-Wilk significance values for learning outcomes show $p > 0.05$. This indicates that the learning outcome data in both groups are normally distributed and meet the assumptions required for parametric statistical analysis.

Homogeneity Test Results

The homogeneity test was conducted to determine the equality of variances between groups, which is another prerequisite for parametric statistical testing. In this study, homogeneity was tested using Levene's test. Data are considered homogeneous if the significance value (Sig.) is greater than 0.05.

Table 11. Homogeneity Test Results for Students' Learning Activities Data

Data	Value	significance	Description
Learning Activities	0.25	0.05	Homogeneous

Table 12. Homogeneity Test Results for Students' Learning Outcomes Data

Data	Value	significance	Description
Pretest (control-experimental)	0.436	0.05	Normal
Posttest (Control-Experimental)	0.372	0.05	Normal

The results of Levene's test indicate that the significance values for both learning activities and learning outcomes are greater than 0.05. This demonstrates that the variances of the two groups are homogeneous, thus fulfilling the assumptions required for hypothesis testing.

Hypothesis Testing Result

Inferential statistical analysis in this study was conducted using an independent samples t-test to determine the significance of the improvement in students' learning outcomes after the implementation of the ethnosience-based Project-Based Learning (PjBL) model. The t-test was used to compare the mean scores of the pretest and posttest to determine whether the observed improvement was statistically significant.

t-Tes Results for Students Learning Activities

The results of the t-test on students' learning activities are presented in Table 13.

Table 13. t-Test Results of Students' Learning Activities Using the Ethnosience-Based PjBL Model

Group	Mean	SD
Experimental	78.07	9.16
Control	62.37	10.66

t-value	value	significance
5.81	0.000	0.05

The results indicate that the significance value is $0.000 < 0.05$, which means that there is a statistically significant effect of the ethnosience-based PjBL model on students' learning activities ($t = 5.81; p < 0.05$).

Thus, it can be concluded that the treatment applied to the experimental group had a significant impact on students' learning activities compared to the control group. These findings confirm that the ethnosience-based PjBL model is effective in enhancing students' learning engagement.

t-Test Results for Students Learning Outcomes

The results of the t-test on students' learning outcomes are presented in Table 14.

Table 14. t-Test Results of Students' Learning Outcomes Using the Ethnosience-Based PjBL Model

Group	Mean	SD
Control	78.22	4.03
Experimental	86.90	4.78

t-Value	Value	Significance
7.02	0.000	0.005

The results show that the significance value is $0.000 < 0.05$ ($t = 7.02; p < 0.05$). The experimental group achieved a higher mean posttest score (86.90) compared to the control group (78.22).

This indicates a statistically significant difference in learning outcomes between the experimental and control groups. The implementation of the ethnosience-based PjBL model in the experimental group had a significant positive effect on improving students' learning outcomes compared to the conventional PjBL model used in the control group.

These findings support the results reported by Arfianawati et al. (2016), who found that ethnosience-based learning significantly improved students' conceptual understanding and critical thinking skills. Similarly, Sudarmin (2014) argued that ethnosience-based instruction helps students reconstruct local knowledge into scientific understanding, thereby facilitating deeper conceptual learning. Rahmawati et al. (2019) also demonstrated that ethnosience promotes creative and critical thinking while strengthening students' understanding of scientific concepts.

Furthermore, the positive effect of the Ethnosience-Based PjBL model can be attributed to the inquiry-oriented nature of project activities. Inquiry learning encourages students to formulate questions, collect evidence, analyze information, and construct scientific explanations (Council, 2000). Previous studies have consistently reported that inquiry-based instruction improves conceptual understanding and scientific reasoning skills (Furtak et al., 2012; Lazonder & Harmsen, 2016; Minner et al., 2010). Crawford (2014) further emphasized that engaging students in authentic scientific practices promotes deeper understanding of scientific concepts and processes. In the present study, ethnosience-based projects provided opportunities for students to engage in inquiry activities while exploring local cultural practices, thereby enhancing both conceptual understanding and scientific literacy.

The findings also support the view that student engagement is strongly associated with academic

achievement. Wang & Degol (2020) highlighted that students who actively participate in learning activities tend to demonstrate higher levels of achievement. Similarly, Ainley (2019) found that increased engagement contributes positively to students' motivation and learning performance. Since students in the experimental group demonstrated higher levels of learning activities, it is reasonable that they also achieved better learning outcomes.

Overall, the results of this study indicate that the Ethnoscience-Based Project-Based Learning model provides a powerful instructional framework for science education. The combination of project-based activities, inquiry processes, and local cultural contexts creates meaningful learning experiences that enhance both students' engagement and academic achievement. These findings reinforce previous research suggesting that culturally responsive science instruction can improve learning effectiveness while simultaneously preserving local wisdom and cultural heritage (Aikenhead, 2006; Parmin et al., 2017; Rahmawati et al., 2019).

Therefore, the implementation of Ethnoscience-Based PjBL can be recommended as an innovative instructional strategy for science teachers seeking to improve students' learning activities and learning outcomes. By integrating scientific concepts with local cultural knowledge, educators can create learning environments that are not only academically effective but also culturally relevant and meaningful for students.

Conclusions

This study concludes that the implementation of ethnoscience-based Project-Based Learning (PjBL) has a significant positive impact on both students' learning activities and learning outcomes in conventional biotechnology topics. Compared to the conventional PjBL model, the integration of ethnoscience provides a more meaningful and contextually relevant learning experience, which enhances student engagement and facilitates deeper conceptual understanding. The findings indicate that incorporating local cultural knowledge into project-based learning not only strengthens students' active participation but also improves their academic achievement. This suggests that culturally responsive approaches play a crucial role in optimizing the effectiveness of student-centered learning models in science education. Furthermore, this study highlights the importance of connecting scientific concepts with students' real-life experiences to promote meaningful learning. The integration of ethnoscience within PjBL serves as an effective strategy to bridge the gap between abstract scientific knowledge and contextual understanding. Despite its contributions, this

study is limited to a specific context and sample, and therefore, future research is recommended to explore the application of ethnoscience-based PjBL in different educational settings and subject areas. Overall, ethnoscience-based Project-Based Learning can be considered a promising instructional approach for enhancing both student engagement and learning outcomes in science education.

Acknowledgments

The author would like to thank all parties who have supported the implementation of this research, including the principal, teachers, and students who participated in the research.

Author Contributions

Conceptualization, W. and F.D.; methodology, W.; validation, F.D., H and M.P.; formal analysis, W.; investigation, W.; resources, F.D., H and M.P.; data curation, W.; writing—original draft preparation, F.D and W.; writing—review and editing, S. and H.; visualization, S.; supervision, M.P.; project administration, W.; All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Conflict of Interest

The author declares no conflict of interest.

References

- Aikenhead, G. S. (2006). *Science education for everyday life: Evidence-based practice*. Teachers College Press.
- Ainley, M. (2019). Interest and engagement in learning. *Educational Psychology Review*, 31(3), 643–671. <https://doi.org/10.1007/s10648-019-09486-7>
- Arfianawati, S., Sudarmin, S., & Sumarni, W. (2016). Model Pembelajaran Kimia Berbasis Etnosains untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *Jurnal Pengajaran Matematika Dan Ilmu Pengetahuan Alam*, 21(1), 46–51. <https://doi.org/10.18269/jpmipa.v21i1.36256>
- 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>
- Chen, J., Kolmos, A., & Du, X. (2021). Forms of implementation and challenges of PBL in engineering education: A review. *European Journal of Engineering Education*, 46(1), 90–115. <https://doi.org/10.1080/03043797.2020.1718615>
- Council, N. R. (2000). *Inquiry and the National Science Education Standards*. National Academies Press. <https://doi.org/10.17226/9596>
- Crawford, B. A. (2014). From inquiry to scientific

- practices. *Journal of Science Teacher Education*, 25(4), 515–541. <https://doi.org/10.1007/s10972-014-9384-1>
- Darling Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications of Learning and Developmental Science for Educational Practice. *Applied Developmental Science*, 24(2), 97–140. <https://doi.org/10.1080/10888691.2018.1537791>
- English, M. C., & Kitsantas, A. (2019). Supporting student self-regulated learning in problem- and project-based learning. *Interdisciplinary Journal of Problem-Based Learning*, 13(2). <https://doi.org/10.7771/1541-5015.1840>
- Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2012). Experimental and quasi-experimental studies of inquiry-based science teaching. *Review of Educational Research*, 82(3), 300–329. <https://doi.org/10.3102/0034654312457206>
- Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16(3). <https://doi.org/10.1023/B:EDPR.0000034022.16470.f3>
- Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365–379. <https://doi.org/10.3102/0013189X09339057>
- 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>
- Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-based learning. In *Cambridge Handbook of the Learning Sciences*. <https://doi.org/10.1017/CBO9780511816833.020>
- Lazonder, A. W., & Harmsen, R. (2016). Meta-analysis of inquiry-based learning. *Review of Educational Research*, 86(3), 681–718. <https://doi.org/10.3102/0034654315627366>
- Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-based science instruction—What is it and does it matter? *Journal of Research in Science Teaching*, 47(4), 474–496. <https://doi.org/10.1002/tea.20347>
- Parmin, S., Ashadi, S., & Fibriana, F. (2017). Ethnoscience integrated learning. *Jurnal Pendidikan IPA Indonesia*, 6(1), 1–7. <https://doi.org/10.15294/jpii.v6i1.9599>
- Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223–231. <https://doi.org/10.1002/j.2168-9830.2004.tb00809.x>
- Rahmawati, Y., Ridwan, A., Hadinugrahaningsih, T., & Soeprijanto. (2019). Developing critical and creative thinking through ethnoscience. *Journal of Physics: Conference Series*, 1402, 55049. <https://doi.org/10.1088/1742-6596/1402/5/055049>
- Strobel, J., & Barneveld, A. (2009). When is PBL more effective? *Interdisciplinary Journal of Problem-Based Learning*, 3(1), 44–58. <https://doi.org/10.7771/1541-5015.1046>
- Sudarmin. (2014). Pendidikan karakter, etnosains, dan kearifan lokal. *Jurnal Pendidikan IPA Indonesia*, 4(2), 1–10. <https://doi.org/10.15294/jpii.v4i2.4179>
- Wang, M. T., & Degol, J. L. (2020). School motivation and engagement. *Developmental Review*, 58, 100950. <https://doi.org/10.1016/j.dr.2020.100950>