

The Impact of Industrial Agriculture Based Problem Based Learning Model on the Scientific Literacy and Learning Outcomes of Fourth Grade Elementary Students

Inin Fariana¹, Singgih Bektiarso², Rusdhianti Wuryaningrum³

^{1,2,3} University of Jember, Jember, Indonesia

ABSTRACT: Low student performance in learning outcome and scientific literacy remains a pressing issue in Indonesian elementary education. One contributing factor is the lack of connection between curriculum content and students' everyday experiences. This study addresses this problem by implementing a Problem-Based Learning (PBL) model contextualized within local industrial agriculture, specifically banana farming, to enhance both learning outcomes and scientific literacy among fourth-grade students. A quantitative approach with a posttest-only control group design was used. The participants were 41 fourth-grade students, divided into an experimental group (n = 20) and a control group (n = 21). The experimental group received instruction using the industrial agriculture-based PBL model, while the control group was taught using conventional Direct Instruction. Data were collected through standardized tests measuring learning outcomes and scientific literacy, and analyzed using normality tests and the Mann-Whitney U test. The findings indicated a significant difference between the two groups. The experimental group achieved a higher average learning outcome score (98.55) compared to the control group (89.00), with a significance level of $p = 0.020$. For scientific literacy, the experimental group's mean score was 93.30, significantly higher than the control group's 75.43 ($p = 0.000$). Additionally, 13 students in the experimental group reached Level 6 scientific literacy, demonstrating advanced skills in critical thinking, scientific reasoning, and problem-solving. The industrial agriculture-based PBL model has a significant and positive impact on both learning outcomes and scientific literacy. By embedding real-world, locally relevant problems into science instruction, this model not only boosts academic achievement but also cultivates key 21st-century skills such as reflection, collaboration, and contextual problem-solving. These findings support the broader application of contextual PBL in elementary science education, particularly in rural and agriculturally rich areas.

KEYWORDS: Elementary Education, Industrial Agriculture, Learning Outcomes, Problem-Based Learning, Scientific Literacy.

INTRODUCTION

Scientific literacy is a fundamental competency in 21st-century education, enabling students to understand scientific phenomena, reason with evidence, and make informed decisions in everyday life. According to OECD (2023b), scientific literacy is not only about mastering scientific knowledge, but also the ability to apply that knowledge, evaluate data critically, and communicate scientific reasoning. However, Indonesia's performance in science literacy remains below the global average. Based on the 2022 PISA report, Indonesian students scored 403 in science, ranking 78th out of 81 participating countries—well below the OECD average of 491 (OECD, 2023b).

One factor contributing to this persistent underachievement is the limited use of learning models that promote active engagement and contextual relevance. Most science instruction at the elementary level still relies heavily on direct teaching methods that often fail to connect science content with students' everyday experiences. This disconnection reduces students' ability to understand and apply scientific knowledge meaningfully. While the Problem-Based Learning (PBL) model has been proven to improve conceptual understanding and critical thinking (Hmelo-Silver, 2004), its application in Indonesian elementary classrooms—especially in science subjects—remains limited. This highlights a research gap in the contextual implementation of PBL in primary education, particularly using local content such as agriculture.

Theoretically, PBL is a student-centered instructional approach in which learning occurs as students actively solve real-world problems in collaborative settings. Slavin (2018) states that learning outcomes—defined as students' acquired knowledge, skills, attitudes, and values—are best achieved when instruction is engaging and meaningful. Research by Santi et al. (2023) and Nurhayati

(2024) also demonstrates that the integration of local contexts into PBL enhances student motivation and achievement. Meanwhile, the OECD framework (2023a) outlines scientific literacy as the ability to use science knowledge, identify questions, and draw evidence-based conclusions to understand and make decisions about the natural world and changes that occur as a result of human activities. These competencies are essential to support students' ability to make informed decisions based on scientific reasoning.

In response to the need for both higher scientific literacy and improved learning outcomes, this study adopts an industrial agriculture-based PBL model, using banana farming as a contextual theme. Lumajang Regency, East Java, is known for its banana production and agro-industrial potential, making it an ideal setting for this research. This model also aligns with the principles of the Kurikulum Merdeka, which emphasizes place-based, student-centered, and locally relevant learning. Therefore, this study aims to investigate the impact of the industrial agriculture-based PBL model on the scientific literacy and learning outcomes of fourth-grade elementary school students.

RESEARCH METHODS

This study adopted a quantitative approach with a quasi-experimental design, specifically the posttest-only control group design. This design was chosen to compare the effects of an industrial agriculture-based Problem-Based Learning (PBL) model on both learning outcomes and scientific literacy among students, relative to those who received conventional instruction. The posttest-only format helped minimize the testing effect and ensured unbiased comparisons between groups.

The research was conducted at SDIT Arrahmah Lumajang, East Java, during the even semester of the 2024/2025 academic year. A total of 41 fourth-grade students were selected using purposive sampling. They were divided into two groups: the experimental group ($n = 20$), which received instruction using the PBL model integrated with local banana farming contexts, and the control group ($n = 21$), which was taught using the Direct Instruction method.

To measure student achievement, two instruments were administered: a learning outcome test and a scientific literacy test. The learning outcome test consisted of multiple-choice items aligned with the curriculum's cognitive objectives, covering students' understanding of science content taught during the intervention. This test was validated through expert judgment and pilot testing for reliability. Meanwhile, the scientific literacy assessment was adapted from the OECD (2023a) PISA Science Framework and included items designed to assess three key competencies: (1) explaining phenomena scientifically, (2) evaluating and designing scientific inquiry, and (3) interpreting data and evidence scientifically.

The learning intervention was delivered across four sessions, each consisting of 2×35 -minute lessons. The experimental group engaged in learning through the five core stages of the PBL model: problem orientation, problem definition, self-directed learning, investigation and solution development, and reflection. The problems were derived from real-life scenarios involving banana cultivation, processing, and environmental issues relevant to the students' local context. Students collaborated in groups and used tools such as Canva to present their findings. In contrast, the control group received the same science content but through Direct Instruction, which relied on lectures and textbook-based assignments.

Data collected from both instruments were analyzed using descriptive and inferential statistical techniques. The Shapiro-Wilk test was applied to assess the normality of the data. Since the data did not meet the assumption of normal distribution, the Mann-Whitney U test was used to determine statistically significant differences between the experimental and control groups. All statistical analyses were conducted using SPSS version 27.

RESULT

SCIENTIFIC LITERACY

To gain a preliminary understanding of student performance following the learning intervention, a descriptive analysis was carried out for both the experimental and control groups. This analysis encompassed measures such as the mean, standard deviation, as well as the highest and lowest scores obtained by students. These statistical descriptions offer a foundational overview of the learning outcomes prior to conducting further inferential analysis. The summary of the descriptive findings is displayed in the table below.



Table 1 Descriptive Statistics of Scientific Literacy

Class	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Eksperimen	20	28	72	100	93,30	8,791	77,274
Kontrol	21	22	67	89	75,43	6,508	42,357

As shown in Table 1, the experimental group, consisting of 20 students, achieved a mean score of 93.30 with a standard deviation of 8.791. The highest score reached 100, while the lowest was 72, resulting in a range of 28. In contrast, the control group of 21 students recorded a lower mean score of 75.43 and a standard deviation of 6.508. Their scores ranged from 67 to 89, with a total range of 22.

The relatively higher mean and wider score distribution in the experimental group suggest that the Problem-Based Learning (PBL) model, contextualized within the theme of industrial banana agriculture, may have led to more varied but overall higher achievement in scientific literacy. Meanwhile, the lower variance in the control group indicates a more uniform, though generally lower, level of performance. These findings offer initial evidence supporting the effectiveness of the intervention prior to confirmatory statistical analysis.

Following the descriptive statistical analysis of students' scientific literacy in both the experimental and control groups, the next step involves examining how literacy achievements are distributed across specific performance categories put forward by Slavin, (2018). To provide a clearer visual representation of this distribution, a bar chart is presented to compare the outcomes between the experimental class taught using the industrial agriculture-based Problem-Based Learning (PBL) model and the control class, which received instruction through the Direct Instruction model. This visual data allows for a deeper evaluation of how the applied instructional models influenced students' levels of scientific literacy. The criteria for scientific literacy achievement are illustrated in the following bar chart.

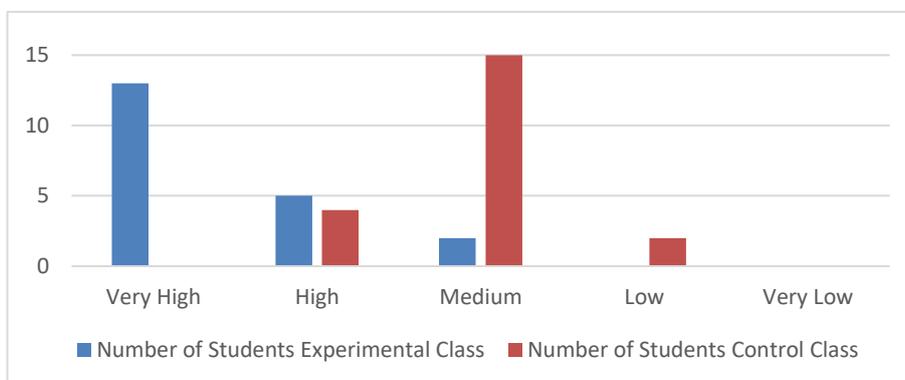


Figure 1 Science Literacy Achievement Criteria

Figure 1 illustrates the distribution of students' scientific literacy achievement levels across both the experimental and control groups. In the experimental class, a majority of students (13 out of 20) achieved a "Very High" level of scientific literacy, while an additional 5 students fell into the "High" category. Only 2 students were classified under the "Medium" category, and none were recorded as having "Low" or "Very Low" literacy levels.

In contrast, the control group demonstrated a markedly different pattern. Most students (15 out of 21) were categorized as having "Medium" scientific literacy. Only 4 students reached the "High" level, and 2 students were in the "Low" category. No students in the control group achieved a "Very High" classification.

These results suggest that the industrial agriculture-based PBL model had a substantial positive impact on student outcomes, shifting the majority toward higher achievement categories. Conversely, the Direct Instruction model resulted in a more moderate distribution, with fewer students reaching advanced levels of scientific literacy. The visual comparison highlights a clear distinction in the effectiveness of the two instructional approaches in fostering higher-order scientific understanding.



To further illustrate the depth of students' scientific literacy development, an analysis was conducted based on proficiency levels outlined by the OECD framework, ranging from Level 1 to Level 6. This level-based categorization provides a more nuanced view of how each instructional model supported students in attaining complex scientific competencies. The following bar chart displays the distribution of students across these six levels in both the experimental and control groups, offering clearer insight into the extent to which the industrial agriculture-based PBL approach enabled learners to reach the highest tiers of scientific literacy.

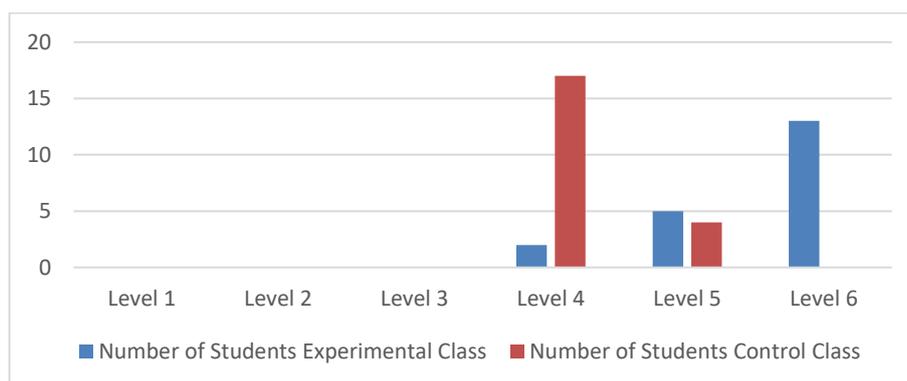


Figure 2 Students' Science Literacy Level

Figure 2 presents the distribution of students' scientific literacy levels in both the experimental and control groups, categorized from Level 1 to Level 6 based on the OECD PISA framework. Notably, students in the experimental group demonstrated a markedly higher level of scientific literacy achievement compared to their counterparts in the control group.

In the experimental class, the majority of students (13 out of 20) achieved Level 6, which reflects the highest level of scientific reasoning, critical thinking, and the ability to apply scientific knowledge to complex, real-world problems. Additionally, 5 students reached Level 5, and 2 students were categorized at Level 4. None of the students fell below Level 4.

Conversely, the control group exhibited a concentration at Level 4, with 17 out of 21 students reaching this intermediate level. Only 4 students in the control group advanced to Level 5, and none achieved Level 6. Similar to the experimental group, there were no students recorded at Levels 1 to 3.

This comparison underscores the effectiveness of the industrial agriculture-based PBL model in promoting higher-order scientific literacy among elementary students. The presence of a large proportion of students at Level 6 in the experimental group highlights the model's capacity to foster deep understanding and analytical thinking, which were less evident in the control group taught using the Direct Instruction approach.

Following the descriptive analysis, the next step involved testing for data normality as a prerequisite for conducting inferential statistics. The Shapiro-Wilk test was employed in this study, as it is recommended for sample sizes under 50 participants. This test was used to determine whether the distribution of students' scientific literacy scores met the assumption of normality. A dataset is considered normally distributed if the resulting p-value is equal to or greater than 0.05; otherwise, it is classified as non-normal. The results of the normality test are presented in the table below.

Table 2 Tests of Normality

		Shapiro-Wilk	df	Sig.
Class		Statistic		
Science Literacy	Experimental Class	,777	20	,000
	Control Class	,767	21	,000

As presented in Table 2, the Shapiro-Wilk normality test yielded significance values (p-values) of 0.000 for both the experimental and control groups. Since both values are below the threshold of 0.05, the data do not meet the assumption of normal distribution. This indicates that the science literacy scores for students in both groups are not normally distributed. Consequently, non-parametric



statistical methods, such as the Mann-Whitney U test, are deemed more appropriate for comparing the groups in the subsequent analysis.

To determine whether there was a statistically significant difference in learning outcomes between the experimental conditions, this study employed the Mann-Whitney U test as the basis for hypothesis testing. The research was guided by the following hypotheses:

Null Hypothesis (H_0): The implementation of the industrial agriculture-based Problem-Based Learning model does not have a significant positive effect on the scientific literacy of fourth-grade elementary students.

Alternative Hypothesis (H_1): The implementation of the industrial agriculture-based Problem-Based Learning model has a significant positive effect on the scientific literacy of fourth-grade elementary students.

This two-tailed hypothesis testing approach aligns with standard statistical procedures, where the null hypothesis assumes no difference in population means, while the alternative hypothesis suggests a meaningful distinction between groups in terms of learning outcomes. The detailed results of this hypothesis test are presented in the following table.

Table 3 Mann-Whitney U Test

		Science Literacy
Most Extreme Differences	Absolute	,712
	Positive	,712
	Negative	,000
Kolmogorov-Smirnov Z		2,279
Asymp. Sig. (2-tailed)		,000

As shown in Table 3, the results of the Mann-Whitney U test indicate a statistically significant difference in scientific literacy scores between the experimental and control groups. The test produced a Kolmogorov-Smirnov Z value of 2.279 with an associated two-tailed p-value (Asymp. Sig.) of 0.000. Since the p-value is well below the conventional threshold of 0.05, the null hypothesis is rejected in favor of the alternative.

These findings confirm that the application of the industrial agriculture-based Problem-Based Learning model had a significant positive effect on students' scientific literacy. The substantial absolute difference (.712) further reinforces the magnitude of the impact observed. In summary, the statistical evidence supports the conclusion that the instructional model implemented in the experimental group led to greater improvements in scientific literacy compared to the traditional Direct Instruction approach.

LEARNING OUTCOMES

To look at the overall academic achievement resulting from the learning intervention, student learning outcomes were analyzed descriptively using measures of central tendency and dispersion. Learning outcomes in this study refer to students' post-instruction performance as measured by a standardized learning outcome test developed based on the cognitive domain by Anderson & Krathwohl (2001). A summary of the descriptive findings is shown in the table below.

Table 4 Descriptive Statistics of Learning Outcome

Class	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Eksperimen	20	21	79	100	98,55	4,763	22,682
Kontrol	21	21	79	100	89,00	10,747	115,500

The descriptive analysis results are presented in Table 4. Students in the experimental class (n = 20) achieved a mean score of 98.55 with a standard deviation of 4.76, a minimum score of 79, and a maximum of 100. Meanwhile, students in the control class (n = 21) obtained a lower mean score of 89.00, with a higher standard deviation of 10.75, a minimum score of 79, and a maximum also of 100.

These results suggest that although both groups had students achieving the highest possible score, the experimental group exhibited a more consistent level of performance, as reflected in their lower variance (22.68) compared to the control group (115.50).



This consistency indicates that the industrial agriculture-based PBL model not only raised the average performance but also contributed to a more equitable distribution of learning outcomes among students.

To further clarify how learning outcomes are distributed across achievement levels, Figure 4.1 illustrates the Learning Outcome Achievement Criteria in both the experimental and control groups.

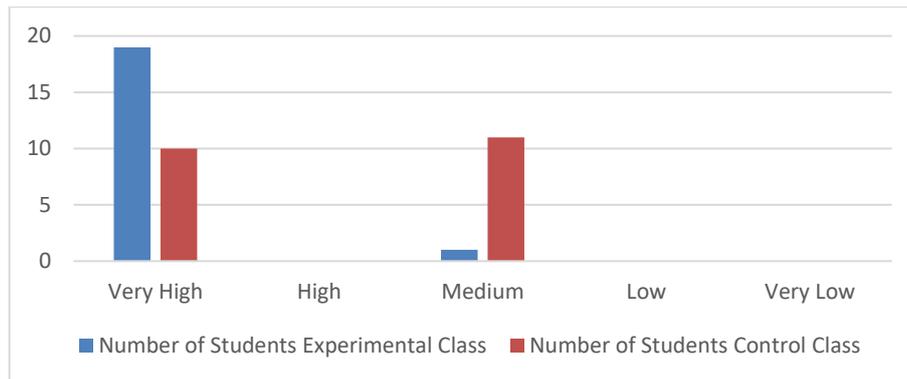


Figure 3 Learning Outcome Criteria

As shown in the bar chart, the experimental group had a significant concentration of students in the “Very High” and “High” achievement categories. In contrast, the control group displayed a more spread-out distribution, with several students categorized in the “Moderate” and “Low” levels. Notably, no students in the experimental class were found in the “Low” or “Very Low” categories, underscoring the PBL model's effectiveness in ensuring consistently high achievement across the class.

Before conducting inferential analysis, a normality test using the Shapiro-Wilk method was performed to determine whether the learning outcome data met parametric assumptions.

Table 5 Tests of Normality

Learning Outcomes	Class	Shapiro-Wilk		
		Statistic	df	Sig.
	Experimental Class	,348	20	,000
	Control Class	,640	21	,000

As shown in Table 5, the significance values for both the experimental ($p = 0.000$) and control ($p = 0.000$) groups were below the threshold of 0.05, indicating that the data were not normally distributed. Therefore, non-parametric tests were required for further statistical comparison. To evaluate whether there was a statistically significant difference in learning outcomes between the two instructional models, the Mann-Whitney U test was applied.

Table 6 Mann-Whitney U Test

		Learning Outcomes
Most Extreme Differences	Absolute	,474
	Positive	,474
	Negative	,000
Kolmogorov-Smirnov Z		1,516
Asymp. Sig. (2-tailed)		,020

Based on Table 6, the test revealed a Kolmogorov-Smirnov Z value of 1.516 and a significance level (Asymp. Sig. 2-tailed) of 0.020. Since this value is below 0.05, it indicates a significant difference between the experimental and control groups. The industrial agriculture-based PBL model produced statistically higher learning outcomes, confirming the positive effect of contextual, problem-driven instruction compared to conventional teaching methods.



DISCUSSION

SCIENTIFIC LITERACY

The findings of this study provide compelling evidence that the industrial agriculture-based Problem-Based Learning (PBL) model significantly enhances scientific literacy among fourth-grade students. The observed differences in posttest scores between the experimental and control groups—both in terms of mean scores and proficiency level distributions demonstrate the effectiveness of embedding local, real-world contexts into science instruction.

This improvement is closely aligned with the OECD (2023a) PISA Science Framework, which emphasizes three key competencies: explaining phenomena scientifically, evaluating and designing scientific inquiry, and interpreting data and evidence scientifically. The dominance of students at Level 6 in the experimental group, where 13 out of 20 students reached the highest level, suggests that the PBL model fostered deeper analytical thinking and metacognitive skills that are rarely achieved through traditional methods.

One of the main strengths of this PBL approach lies in its contextual foundation. Learning activities were grounded in the industrial banana farming practices of Lumajang, which served as an open laboratory where students could directly observe and analyze scientific phenomena, such as irrigation systems, pest-plant interactions, and environmental impact. This is consistent with Hmelo-Silver's (2004) assertion that problem-based learning becomes more meaningful when rooted in real-life contexts, making abstract concepts more accessible to young learners.

Moreover, the learning process encouraged active engagement and collaboration. Students worked through the five essential PBL stages: problem identification, analysis, independent investigation, solution synthesis, and reflection guided by their own curiosity and supported by teacher facilitation. This aligns with the constructivist learning theory of Vygotsky, which emphasizes the role of social interaction and experiential learning in knowledge construction (Mumtahanah, 2014; Joyce et al., 2015).

In addition, the study supports previous empirical findings. Pasiri (2023) observed a similar increase in students' scientific literacy following the integration of technology into PBL, while Fatmawati et al. (2024) and Azka et al. (2023) reported consistent improvements in student outcomes when PBL strategies were applied in ecology and biodiversity education. Santi et al. (2023) also reported a notable increase in science literacy rates from 57% to 79% among elementary students taught using PBL.

Importantly, this study goes beyond previous research by combining PBL with a local industrial context—specifically, banana agriculture which has been largely overlooked in prior studies. Hafid et al. (2019) and Linville et al. (2016) acknowledged the value of industrial partnerships in education, but this research extends that premise into primary science classrooms, providing a more grounded, culturally relevant learning experience.

This approach also aligns with the vision of Indonesia's Kurikulum, which emphasizes the development of 21st-century competencies through contextual and student-centered learning. Integrating industrial agriculture into science instruction not only enriches the learning process but also prepares students to think critically about sustainability, technology, and food systems—issues that are highly relevant to their communities.

Overall, the PBL model applied in this study successfully supported cognitive, procedural, and epistemic aspects of scientific literacy as outlined in the PISA framework, while also reinforcing the importance of integrating local wisdom into curriculum design. It offers a promising model for primary education that is both academically rigorous and socially meaningful.

LEARNING OUTCOMES

The findings of this study indicate that the industrial agriculture-based Problem-Based Learning (PBL) model had a significant and positive impact on students' learning outcomes. The experimental group achieved a higher mean score and demonstrated a more consistent performance than the control group, as confirmed by the Mann-Whitney U test. These results suggest that the PBL model created a more effective learning environment for promoting knowledge acquisition, comprehension, and application.

This improvement can be largely attributed to the active and student-centered nature of the PBL approach. Hmelo-Silver (2004) asserts that PBL supports deep learning by immersing students in problem-solving processes where they construct understanding through investigation and collaboration. In this study, the problems were situated within the context of industrial banana farming, which helped students connect abstract scientific concepts with real-world experiences. Contextualized learning, as emphasized by Arigiyati et al. (2023), increases motivation and relevance, which in turn enhances learning outcomes.



The structure of the PBL model comprising stages of problem identification, analysis, inquiry, and reflection also encouraged the development of higher-order thinking skills. This is in line with Slavin (2018), who explains that meaningful instruction must activate students' cognitive engagement through exploration and discussion. By working in teams and engaging with authentic problems, students in the experimental group not only acquired scientific knowledge but also practiced self-directed learning, communication, and critical thinking.

These findings are consistent with earlier research. Santi et al. (2023) observed that students taught with PBL models showed significantly higher posttest gains than those in traditional classes. Similarly, Nurhayati (2024) emphasized that PBL, when embedded with local contextual elements, improves student learning performance in elementary science. In a broader technological context, Muzakki et al. (2025) demonstrated that the integration of modern pedagogical media can significantly enhance students' cognitive engagement and learning achievements, particularly in critical thinking. Although this study did not employ digital tools like AR or AI, it reinforces the principle that interactive, student-centered, and problem-oriented models are more effective than conventional approaches.

Furthermore, incorporating industrial agriculture as the learning context provided authenticity to the learning experience. Hafid et al. (2019) noted that grounding science instruction in real-world community practices leads to better retention and more meaningful understanding. This supports the idea that instruction must be socially and culturally responsive, particularly in rural areas where agriculture plays a central role in daily life.

This research model also aligns with Indonesia's Kurikulum Merdeka, which advocates for contextualized, flexible, and student-driven instruction rooted in local wisdom (BSKAP, 2024). The strong learning outcomes demonstrated in this study validate the curriculum's vision and provide a practical example of how it can be realized in classroom practice.

In conclusion, the significant gains in learning outcomes observed in this study reflect the pedagogical strengths of PBL: its emphasis on active learning, contextual relevance, and cognitive engagement. The model proved to be not only effective but also adaptable to local contexts, making it a promising approach for improving science education in Indonesian primary schools.

CONCLUSION

The findings of this study provide strong empirical evidence that the implementation of a Problem-Based Learning (PBL) model contextualized within industrial agriculture significantly improves students' scientific literacy. The experimental group outperformed the control group with a mean score of 93.30 compared to 75.43, and the statistical analysis using the Mann-Whitney U test showed a highly significant difference ($p = 0.000$). Additionally, 65% of students in the experimental group achieved the highest literacy level (Level 6), whereas no students in the control group reached that level. These results confirm that the integration of authentic, community-based contexts within the PBL model enhances higher-order thinking, reflective reasoning, and the ability to apply scientific knowledge in meaningful ways.

In terms of learning outcomes, the PBL model also demonstrated a positive and significant effect. Students in the experimental class achieved a higher mean posttest score of 98.55, compared to 89.00 in the control class. The Mann-Whitney U test yielded a p -value of 0.020 ($p < 0.05$), indicating a significant difference in academic performance. These results highlight the model's ability to strengthen conceptual understanding by actively engaging students in collaborative problem-solving, encouraging inquiry, and reinforcing the connection between theoretical knowledge and real-life agricultural practices.

Based on these conclusions, it is recommended that the industrial agriculture-based PBL model be more widely adopted in elementary science education, especially in rural and agrarian communities. Educators should be encouraged to incorporate local wisdom and real-world issues into instructional design to increase student engagement and deepen learning. Further research may explore the long-term effects of this model on various competencies, including creativity, environmental awareness, and socio-scientific reasoning, across different grade levels and subject areas.

REFERENCES

1. OECD. (2023b). PISA 2022 results (Volume I and II), country notes: Indonesia. Organisation for Economic Co-operation and Development. https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/indonesia_c2e1ae0e-en.html



2. Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, 16(3), 235–266. <https://doi.org/10.1023/B:EDPR.0000034022.16470.f3>
3. Muzakki, A., Wuryaningrum, R., & Yuliati, N. (2025). The Effect of Integrated Learning Management System with Augmented Reality and Artificial Intelligence on Critical Thinking Ability and Digital Literacy in Elementary Schools. *European Journal of Education and Pedagogy*, 6(3), 22–28. <https://doi.org/10.24018/ejedu.2025.6.3.930>
4. Redrobán, J. S., & Durán, V. R. (2024). Problem-Based Learning: A Fundamental Pillar for the Training of Competent Physicians. <https://doi.org/10.20944/preprints202410.0955.v1>
5. Slavin, R. (2018). *Educational Psychology*. New York: Pearson Education.
6. OECD. (2023a). PISA 2025 science framework. <https://www.oecd.org/pisa/pisa-2025-science-framework.pdf>
7. Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.
8. Mumtahanah, N. (2014). Penggunaan media visual dalam pembelajaran pai. 4(1), 7. <https://doi.org/10.36835/HJSK.V4I1.511>
9. Joyce, B., Weil, M., & Calhoun, E. (2015). *Models of Teaching (Ninth Edition)*. PEARSON.
10. Pasiri, Y. (2023). Pengaruh penggunaan model problem based learning terhadap kemampuan literasi sains siswa. <https://doi.org/10.62388/jpdp.v3i2.336>
11. Fatmawati, J., Lestari, T., Putri, A. N., & Azhar, A. (2024). THE EFFECT of The PROBLEM BASED LEARNING (PBL) MODEL on STUDENTS' SCIENCE LITERACY SKILLS on INDONESIA'S ECOLOGY and BIODIVERSITY MATERIALS. *Biopendix: Jurnal Biologi, Pendidikan Dan Terapan*. <https://doi.org/10.30598/biopendixvol11issue1page76-82>
12. Azka, N. W., Putri, H. E., & Rahayu, P. (2023). Pengaruh Model Problem Based Learning terhadap Peningkatan Kemampuan Literasi Sains Siswa Sekolah Dasar. *Fondatia*. <https://doi.org/10.36088/fondatia.v7i3.3799>
13. Santi, M. D., Nursyahidah, F., Nugroho, A. A., & Estiyani, E. (2023). Peningkatan Hasil Belajar IPA Melalui Model Problem Based Learning Berbantu Media Canva pada Siswa Kelas V SDN Pandeanlamper 03. *Journal on Education*, 5(4), 12272–12280. <https://doi.org/10.31004/joe.v5i4.2199>
14. Hafid, D., Djohar, A., Abdullah, A. G., & Komaro, M. (2019). Work based learning in vocational education. *Journal of Physics: Conference Series*, 1402(4), 044066. <https://doi.org/10.1088/1742-6596/1402/4/044066>
15. Linville, D., Rogers, M. P., Kelly, C., Spradling, C., & Case, D. M. (2016). Profession-based learning through collaboration and vertical alignment with K12, higher education, and industry: panel discussion. *Journal of Computing Sciences in Colleges*, 31(5), 187–189. <https://dl.acm.org/citation.cfm?id=2904336>
16. Arigiyati, T. A., Kusumaningrum, B., Maysaroh, I. L., Kuncoro, K. S., Pahmi, S., & Özsüt, B. (2023). The effect of self-regulated learning and learning interest on mathematics learning outcomes. *Union: Jurnal Ilmiah Pendidikan IPAS*, 11(2), 317–329. <https://doi.org/10.30738/union.v11i2.15025>
17. Nurhayati Nurhayati, Esra Retorika Simanullang, Fitri Handina Dongoran, & Syahrial Syahrial. (2024). Integrasi Model Pembelajaran Project Based Learning (PJBL) Terhadap Kemampuan Literasi IPAS Pada Siswa Sekolah Dasar. *Jurnal Kajian Penelitian Pendidikan Dan Kebudayaan*, 2(3), 44–50. <https://doi.org/10.59031/jkppk.v2i3.423>
18. Badan Standar, Kurikulum, dan Asesmen Pendidikan. (2024). Keputusan Kepala Badan Standar, Kurikulum, dan Asesmen Pendidikan Nomor 032/H/KR/2024 tentang capaian pembelajaran pada pendidikan anak usia dini, jenjang pendidikan dasar, dan jenjang pendidikan menengah pada Kurikulum Merdeka. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. <http://bskap.kemdikbud.go.id>

Cite this Article: Fariana, I., Bektiarso, S., Wuryaningrum, R. (2025). The Impact of Industrial Agriculture Based Problem Based Learning Model on the Scientific Literacy and Learning Outcomes of Fourth Grade Elementary Students. International Journal of Current Science Research and Review, 8(7), pp. 3380-3388. DOI: <https://doi.org/10.47191/ijcsrr/V8-i7-27>