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Improving Science Literacy Skills of Phase B Elementary School Learners through Problem Based Learning and Differentiated Strategies

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Abstract: Students' science literacy is often low due to teacher-centered learning activities. This study aims to analyze the impact of Problem Based Learning (PBL) model with differentiation strategy on improving students' science literacy. Through a quasi-experimental design (one-group pre-test post-test) involving third grade students in one of Cimahi City elementary schools, it was found that the implementation of PBL model with differentiation strategy significantly improved science literacy skills. This is indicated by the increase in the average score from 57.00 (pre-test) to 71.20 (post-test), as well as the results of a paired sample t-test with a value of $p < 0.001$ which shows significance. These findings indicate that the combination of PBL model with differentiation strategy provides benefits in improving concept understanding, learning motivation, and active involvement of students in science learning. Therefore, this approach is recommended to be implemented in elementary schools to increase the effectiveness of science learning more optimally and in accordance with the needs of students.

INTRODUCTION

21st century education requires students to have critical, creative, collaborative and communicative thinking skills (4C). However, the learning system in many schools is still dominated by conventional approaches that are teacher-centered, so it does not support the development of higher order thinking skills. One of the learning models that is widely used in improving critical thinking and problem solving skills is Problem Based Learning (PBL) (Kurniawati & Hidayah, 2021). This model is oriented towards solving real

problems, thus encouraging students to think critically and find problem-based solutions. However, the implementation of PBL often faces obstacles because it has not been adapted to the needs and characteristics of diverse learners (Roslina et al., 2025). Therefore, a learning strategy is needed that can optimize the application of PBL to suit the conditions of students in elementary schools.

The ability to think critically with the context of problem solving, especially in elementary schools, is associated with the existence of science literacy skills. Science is a science studied by humans obtained from observations and research to find out agreed theories. Science literacy is a technique in using scientific knowledge, identifying questions, and drawing all conclusions based on evidence in order to understand and make decisions regarding the natural world and its changes due to human activity (Afni & Rokhimawan, 2018; Fuadi et al., 2020; Muzijah et al., 2020; Sultan et al., 2018). In its context, it is intended for all groups regardless of whether they will become a scientist or non-scientist in the future (Santoso et al., 2017).

Previous research findings found that many students have low science literacy (Afni & Rokhimawan, 2018; Fuadi et al., 2020). Based on observations by researchers conducted in one of the public elementary schools in Cimahi city, it is known that students' science literacy is still low. This is because the learning process is still teacher-centered, teachers rarely insert real problems in the learning process in the classroom which only focuses on theory alone, lack of model utilization, lack of interest and motivation to learn from students who tend to listen, memorize, and copy the contents of the learning material provided by the teacher without finding meaning and understanding its application. From these problems, it shows that there is a need for improvement so that students' science literacy increases. Teachers must be able to collaborate between learning models by adjusting the needs and characteristics of students so as to create good interactions between teachers and students so that learning objectives are achieved. This is in line with research which states that the teaching materials set do not guarantee the achievement of educational goals, and one of the most

important factors is the teaching process which emphasizes the optimal involvement of students (Lestari, 2018).

Science learning in elementary schools should use the Problem Based Learning (PBL) model with a differentiation approach. This PBL model is flexible for teachers to modify and has a clear flow, thus helping students understand the material better and making teaching and learning activities in the classroom more enjoyable (Aprilianingrum & Wardani, 2020; Aufa et al., 2021; Hendriana et al., 2018; Hussin et al., 2018). An activity that clarifies a problem then defines a problem and gathers ideas that are based on prior knowledge, then identifies what students need to solve the problem and what students do not know about the problem (Yonanda et al., 2019). (The application of the PBL model has been studied in various studies. According to (Kurniawati & Hidayah, 2021) showed that PBL has a positive impact on students' science literacy, especially in improving concept understanding and analytical thinking skills. In line with research by (D. A. H. Putri et al., 2022) found that the application of PBL can increase students' involvement in learning because it emphasizes problem solving that is relevant to students daily lives.

The effectiveness of PBL has been carried out by many other studies, in its application at the primary school level there are still challenges in adapting PBL to the individual needs of students in the classroom. Of course, there must be an approach that can accommodate the diversity of students. According to (Kamila et al., 2023) differentiation-based learning integrated with PBL can significantly improve science literacy outcomes compared to conventional learning models. In line with research by (Fadilah et al., 2024) who found that the application of PBL with differentiated learning can significantly improve student learning outcomes, especially because students are grouped based on their learning styles-visual, auditory, and kinesthetic. Strengthened by (Hamna & BK, 2022) explained that the PBL model integrated with differentiated learning has a significant effect on improving the science literacy of elementary school students. Therefore, the application of PBL not only improves academic understanding

but also creates more meaningful and contextualized learning for students.

Previous research findings by (Dista et al., 2024) showed that differentiated learning in the PBL model was able to increase the effectiveness of learning and the involvement of students in the process of solving scientific problems. In line with research by (Tamam et al., 2023) in their study found that the PBL model has a significant impact on improving the science literacy skills of elementary school students, with a problem-solving-based approach that allows students to develop their critical and analytical thinking skills. Strengthened by (Sakti & Luthfiyah, 2024) showed that the application of PBL with a differentiated learning approach can significantly improve students' learning outcomes, especially because this approach allows students to learn according to their individual learning styles, such as visual, auditory, and kinesthetic.

This research offers an in-depth study of the application of PBL models with differentiated strategies in improving the science literacy skills of students in elementary schools. Through a problem-based approach by paying attention to the needs and characteristics of learners, it is expected to develop a deeper understanding of science concepts and improve their critical thinking skills (Uliyandari et al., 2021). Through this approach, learners not only gain better conceptual understanding, but are also more motivated to explore and develop critical thinking skills in solving scientific problems (Wulandani & Suryawan, 2024).

Previous research findings state that the PBL model can increase motivation and enthusiasm so that it has an impact on improving student learning outcomes (Asyari et al., 2016; Fauzia, 2018; Pratiwi & Wuryandani, 2020). Other findings state that differentiated learning can increase learning effectiveness and provide a more meaningful learning experience for students (Kupchyk & Litvinchuk, 2020; Marantika et al., 2023; Santoso et al., 2017). There has been no study of the PBL model with differentiated strategies on the science literacy of students in phase B. The advantage of this research is that by using differentiated strategies, students will be more interested in participating in learning according to the interests and needs of students. The PBL model combined with differentiated strategies

will make it easier for students to remember material for a long time rather than delivering material in a face-to-face or lecture manner.

Based on the background, problem formulation, and research gaps described above, this study was designed to answer the following main research questions:Is there a significant difference in the average science literacy scores of Phase B students between before (pre-test) and after (post-test) the implementation of the Problem Based Learning (PBL) model integrated with differentiation strategies?How large is the effect size of the implementation of the Problem Based Learning (PBL) model integrated with differentiation strategies on improving the science literacy skills of Phase B students?.

METHOD

This research uses a quantitative approach by choosing a quasi experimental design method. The experimental design used in this research is Pre-experimental design: one-group pre-test-post-test, with two main variables, namely PBL model with differentiated learning strategy (X) as the independent variable, and science literacy (Y) as the dependent variable. The research was conducted in one of the elementary schools in Cimahi city in March 2025. The subjects in this study were third grade students, the sampling method applied was cluster random sampling. This sampling technique is a procedure where the whole group, not individuals, is randomly selected. Researchers chose class III A as the subject. Class determination is also carried out based on learning outcomes data from the previous semester.

In this study, the instrument used was a test instrument. The type of test used is a description test which is tested before treatment (pre-test) and after treatment (post-test). Before students undergo a test of science literacy skills using tests, the research instrument development stage involves a series of processes to ensure the quality and validity of the test questions.

To analyze the data, this study used two techniques: descriptive and inferential statistical analysis. Descriptive analysis, which was processed with IBM SPSS Statistics 29, aimed to evaluate the pre-test and post-test data by finding the mean, standard deviation, and range of values (minimum and maximum). Furthermore, inferential analysis was

conducted through paired sample t-test. The analysis process begins with analyzing the pre-test, post-test in science literacy skills using the PBL model with differentiated strategies. The process of inferential statistical analysis was processed with the help of IBM SPSS statistical 29 software with the assumption that the distribution of population scores of pre-test, post-test, science literacy skills is normally distributed and the variance of the populations is equal (Creswell & Creswell, 2018).

RESULT & DICUSSION

Result

Descriptive research results show that learning by using problem-based learning models with differentiated strategies has a significant effect on students' science literacy. This is shown by the difference in average science literacy of 14.2 points between students taught using the problem-based learning model with differentiation strategies, compared to before the use of the model. This proves that the problem-based learning model with differentiation strategy is more effective in improving students' science literacy skills than the previous teaching method.

Table 1 Descriptive Analysis Results

Treatment	N	*Minimum*	*Maximum*	*Mean*	*Standar Deviation*
Pretest	25	30	80	57.00	13.844
Posttest	25	40	95	71.20	16.912
Valid N (*listwise*)	25				

The results of the hypothesis test analysis using the paired sample t-test are presented in table 2.

Table 2 Analysis uji Paired Samples Correlations

	N	*Correlation*	*One-side p*	*significance Two-side p*
Pretest & posttest	25	.577	.001	.003

The Paired Sample Correlation output shows the relationship between the pre-test and post-test scores of students' science literacy skills, with a correlation value of 0.577 and a significant level of <0.001. where this value is smaller than the value of α = 0.05. This according to the above results

shows that there is a significant positive relationship between the pre-test and post-test of students' science literacy skills who learn with a problem-based learning model with differentiated strategies. In addition, the coefficient value (r2 = 0.577) shows a fairly strong relationship between the two variables, which means that the higher the learners' pre-test score, the higher the likelihood of them getting a better score on the post-test after getting the learning intervention. Then the coefficient of determination can be determined as r2 = (0.577)2 = 0.332929 which means that 33% of the posttest score is determined by the pretest score. It can be said that students' initial ability in science literacy contributes about one-third to their learning outcomes after PBL intervention with differentiated strategies. The rest, about 67%, is influenced by other factors beyond the pre-test, such as the effectiveness of the differentiated strategy in learning, the teaching method applied, the level of learner engagement, and other individual factors such as motivation and interest in learning.

This finding corroborates that the PBL learning model with differentiated strategies not only has an impact on improving learners' understanding, but also helps minimize the learning gap between individuals. Learners who have lower initial abilities still have a great opportunity to improve their post-test scores through a tailored approach. Therefore, this strategy can be an effective alternative to improve science literacy in primary schools.

Then from the Paired Sample Test output, it turns out that the sig value is <0.001. This value is smaller than α = 0.05, which means that the hypothesis stating that problem-based learning with differentiated strategies has a significant effect on the acquisition of students' science literacy skills is accepted. This is presented in table 3.

Table 3 Paired Samples Test Analysis Results

	Paired Differences				*significance*
			95% Condifidence Interval of the Difference		

	Mean	*Std. Deviation*	*Std. Error Mean*	*Lower*	*Upper*	*T*	*df*	*One-Sided p*	*Two-Sided p*
Pretest & posttest	-14.2000	14.411	2.882	-20.148	-8.252	-4.927	24	<,001	<,001

From the Paired Sample Effect Size shows the value of Cohen's estimate of 0.985 and Hedge's correlation of 0.954 where this value is more than 0.8, then the effect of problem-based learning with differentiated strategies on the acquisition of science literacy skills of students is in the high category according to the criteria of (Creswell & Creswell, 2018). This is presented in table 4.

Table 4 Analysis uji Paired Samples Effect Sizes

				95% Confidence Interval	
		standardizer[a]	*Point Estimate*	*Lower*	*Upper*
Pretest & posttest	Cohen's d	14.411	-.985	-1.459	-.498
	Hedges' correction	14.881	-.954	-1.412	-.483

The results showed that the application of problem-based learning model with differentiated strategy has a significant effect on students' science literacy. This is inseparable from the way this learning is prepared. The problem-based learning process is the main focus of learning activities by taking into account the needs and characteristics of students. In addition, the learning process using the problem-based learning model with differentiated strategies creates a more interesting learning process, considering that the use of learning models takes into account the needs and characteristics of students in learning.

This study showed that there was an increase in the average science literacy score from 57.00 (pre-test) to 71.20 (post-test) with a difference of 14.2 points, and the paired sample t-test results showed a significant correlation with a p value <0.001. These results indicate that the combination of the PBL model with differentiated strategies effectively improves students' understanding and scientific thinking skills. This increase reinforces that the PBL model is able to provide a more

active, explorative, and contextual learning experience for students, so that they are more involved in the learning process.

Discussion

The Problem-Based Learning (PBL) model makes students the center of learning, where they are challenged to solve real problems independently or in groups. This finding corroborates (Kurniawati & Hidayah, 2021) research which states that PBL significantly improves students' analytical thinking and problem solving skills, especially in science subjects.

However, one of the challenges in implementing PBL is the heterogeneity of learners in a class, which can cause gaps in understanding if the approach used does not consider individual differences. Therefore, differentiated learning strategies are an effective solution in optimizing the benefits of PBL, as expressed by (Fitra, 2022) who states that differentiated learning allows learners to gain learning experiences that are more suited to their styles and abilities, thus increasing the effectiveness of learning.

This finding is supported by previous research which shows that a problem-based learning approach improves students' critical thinking and problem solving skills (Sholihah & Lastariwati, 2020). However, the application of PBL often experiences problems if it is not adapted to the characteristics and needs of learners (Roslina et al., 2025). Therefore, differentiation strategies are important to ensure that each learner gets a learning experience that suits their learning style.

In line with (Berliana et al., 2023) shows that differentiated learning integrated with PBL can significantly improve science literacy outcomes compared to conventional learning models. Meanwhile (N. W. S. Putri & Suryati, 2020) found that this approach provides more optimal results when learners are grouped based on their learning styles (visual, auditory, and kinesthetic). These findings suggest that by applying an approach that takes into account individual differences, learners are better able to develop better scientific thinking skills.

Strengthened by the research of (Gürses et al., 2022) also explained that the application of PBL with differentiation strategies was able to

increase learning effectiveness and learner involvement in the scientific problem solving process. According to (Istni et al., 2022) added that this model has a significant impact on science literacy because it allows learners to develop their critical and analytical thinking skills. This is due to the characteristics of PBL which requires learners to explore problems, analyze information, and develop solutions based on scientific evidence, so that they are more trained in thinking systematically and deeply.

In line with these findings, (Sakti & Luthfiyah, 2024) explained that personalized learning according to learners' needs not only improves academic results but also increases learners' learning motivation. This supports the results of research stating that differentiated learning can provide a more meaningful learning experience for students (Amalia et al., 2023; Mansur et al., 2019; Uliyandari et al., 2021).

Based on the research findings described, researchers argue that the integration of PBL and differentiated learning strategies is an effective approach in improving students' science literacy. Through this strategy, learners not only gain improved academic understanding, but also develop problem-solving skills, critical analysis and active engagement in the learning process, which are critical to support their success in science learning at the primary school level.

CONCLUSION

The researcher concluded that the application of problem-based learning models with differentiation strategies had a significant impact on the science literacy skills of thematic grade III students. This can be seen from the increase in the average score of science literacy from 57.00 (pre-test) to 71.20 (post-test), with a difference of 14.2 points, and the paired t test results show a significant correlation (p value 0.001).

Problem-based learning model with differentiation strategy is proven to improve science literacy of third grade students. Based on the results of the study, the conclusions of the study, the recommendations that can be taken into consideration for further research on science literacy skills are that future researchers can consider applying the same learning, namely the problem-based learning model with differentiated strategies, by paying

attention to the advantages and disadvantages of the model, besides that, researchers can also try to develop or combine other learning models to see their effectiveness in improving students' science literacy skills. The problem-based learning model with differentiation strategies can also be applied to measure science literacy in a variety of science materials. This will provide a more thorough understanding of how effective the learning model is in improving students' science literacy across a range of topics.

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REFERENCES

Afni, N., & Rokhimawan, M. A. (2018). Literasi Sains Peserta Didik Kelas V di MIN Tanuraksan Kebumen. *Al-Bidayah: Jurnal Pendidikan Dasar Islam*, *10*(1), 47–68. https://doi.org/10.14421/al-bidayah.v10i1.129

Amalia, K., Rasyad, I., & Gunawan, A. (2023). Pembelajaran Berdiferensiasi sebagai Inovasi pembelajaran. *Journal Of Education And Teaching Learning (JETL)*, *5*(2), 185–193. https://doi.org/10.51178/jetl.v5i2.1351

Aprilianingrum, D., & Wardani, K. W. (2020). Meta Analisis: Komparasi Pengaruh Model Pembelajaran Problem Based Learning dan Discovery Learning dalam Meningkatkan Kemampuan Berpikir Kritis Siswa SD. *Jurnal Basicedu*, *5*(2), 1006–1017. https://doi.org/https://doi.org/10.31004/basicedu.v5i2.871 ISSN

Asyari, M., Al Muhdhar, M. H. I., Susilo, H., & Ibrohim, I. (2016). Improving critical thinking skills through the integration of problem based learning and group investigation. *International Journal for Lesson and Learning Studies*, *5*(1), 36–44. https://doi.org/10.1108/IJLLS-10-2014-0042

Aufa, M. N., Rusmansyah, R., Hasbie, M., Jaidie, A., & Yunita, A. (2021). The Effect of Using e-module Model Problem Based Learning (PBL) Based on Wetland Environment on Critical Thinking Skills and Environmental Care Attitudes. *Jurnal Penelitian Pendidikan IPA*, *7*(3), 401–407. https://doi.org/10.29303/jppipa.v7i3.732

Berliana, G. Y., Sugiyanto, S., & Fardhani, I. (2023). Student's Learning Outcomes and Scientific Literacy Improvement Through the Implementation of Reading to Learn and Discovery Learning Models. *Jurnal Penelitian Pendidikan IPA*, *9*(5), 2563–2572. https://doi.org/10.29303/jppipa.v9i5.2573

Creswell, J. W., & Creswell, J. D. (2018). Research Design Qualitative, Quantitative, and Mixed methodes

Approaches. In *Writing Center Talk over Time*. https://doi.org/10.4324/9780429469237-3

Dista, D. X., Hermita, N., & Triani, R. A. (2024). Pengaruh Pembelajaran Berdiferensiasi di Sekolah Dasar. *Journal of Education Research*, *5*(2), 994–999. https://doi.org/10.37985/jer.v5i2.964

Fadilah, S. N. U., Munthe, T. Y., & Kartikarini, A. (2024). Mendorong kemampuan berpikir kritis siswa melalui pembelajaran berbasis pbl berbantuan laboratorium virtual. *Seminar Nasional IPA XIV*, 207–213.

Fauzia, H. A. (2018). Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Hasil Berlajar Matematika Topik Bilangan Cacah. *Pedagogia: Jurnal Ilmiah Pendidikan*, *7*(1), 40–47. https://doi.org/10.55215/pedagogia.v14i2.6611

Fitra, D. K. (2022). Analisis Penerapan Pembelajaran Berdiferensiasi Dalam Kurikulum Merdeka. *Tunjuk Ajar: Jurnal Penelitian Ilmu Pendidikan*, *5*(2), 279.

Fuadi, H., Robbia, A. Z., Jamaluddin, J., & Jufri, A. W. (2020). Analisis Faktor Penyebab Rendahnya Kemampuan Literasi Sains Peserta Didik. *Jurnal Ilmiah Profesi Pendidikan*, *5*(2), 108–116. https://doi.org/10.29303/jipp.v5i2.122

Gürses, Sahin, & Gunes. (2022). Investigation of the Effectiveness of the Problem-Based Learning (PBL) Model in Teaching the Concepts of "Heat, Temperature and Pressure" and the Effects of the Activities on the Development of Scientific Process Skills. *Education Quarterly Reviews*, *5*(2). https://doi.org/10.31014/aior.1993.05.02.469

Hamna, H., & BK, M. K. U. (2022). Science Literacy in Elementary Schools: A Comparative Study of Flipped Learning and Hybrid Learning Models. *Profesi Pendidikan Dasar*, *9*(2), 132–147. https://doi.org/10.23917/ppd.v9i2.19667

Hendriana, H., Johanto, T., & Sumarmo, U. (2018). The role of problem-based learning to improve students' mathematical problem-solving ability and self confidence. *Journal on Mathematics Education*, *9*(2), 291–299. https://doi.org/10.22342/jme.9.2.5394.291-300

Hussin, W. N. T. W., Harun, J., & Shukor, N. A. (2018). Editorial board• EDITORIAL BOARD. *FEMS Microbiology Letters*, *15*(1), 1–6. https://doi.org/10.5539/ass.v15n1p14

Istni, T., Utomo, D. H., & Utaya, S. (2022). Pengaruh model Problem Based Learning (PBL) berbantuan LKPD terhadap kemampuan berpikir kritis mata pelajaran Geografi siswa kelas XI IPS MA Bilingual Batu. *Jurnal Integrasi Dan Harmoni Inovatif Ilmu-Ilmu Sosial (JIHI3S)*, *2*(2), 194–203. https://doi.org/10.17977/um063v2i2p194-203

Kamila, H. R., Cahyaningrum, S. E., & Sanjaya, I. G. M. (2023). Effectiveness of Differentiated Learning Materials Oriented toward Nature of Science to Improve Scientific Literacy Skills. *Jurnal Penelitian Pendidikan IPA*, *9*(4), 1968–1973.

https://doi.org/10.29303/jppipa.v9i4.2995

Kupchyk, L., & Litvinchuk, A. (2020). Differentiated Instruction in English Learning, Teaching and Assessment in Non-Language Universities. *Advanced Education*, *7*(15), 89–96. https://doi.org/10.20535/2410-8286.168585

Kurniawati, K., & Hidayah, N. (2021). Pengaruh Pembelajaran Problem Based Learning Berbasis Blended Learning terhadap Kemampuan Literasi Sains. *Bioedusiana: Jurnal Pendidikan Biologi*, *6*(2), 184–191. https://doi.org/10.37058/bioed.v6i2.3090

Lestari, N. N. S. (2018). Pengaruh Model Pembelajaran Berbasis Masalah (Problem- Based Learning) dan Motivasi Belajar terhadap Prestasi Belajar Fisika bagi Siswa Kelas VII SMP. *Jurnal Teknologi Pembelajaran Indonesia*, *1*(2), 1–21.

Mansur, A. B. firdausiah, Yusof, N., & Basori, A. H. (2019). Personalized Learning Model based on Deep Learning Algorithm for Student Behaviour Analytic. *Procedia Computer Science*, *163*, 125–133. https://doi.org/10.1016/j.procs.2019.12.094

Marantika, J. E. R., Tomasouw, J., & Wenno, E. C. (2023). Implementasi Pembelajaran Berdiferensiasi Di Kelas. *German Für Gesellschaft (J-Gefüge)*, *2*(1), 1–8. https://doi.org/10.30598/jgefuege.2.1.1-8

Muzijah, R., Wati, M., & Mahtari, S. (2020). Pengembangan E-modul Menggunakan Aplikasi Exe-Learning untuk Melatih Literasi Sains. *Jurnal Ilmiah Pendidikan Fisika*, *4*(2), 89. https://doi.org/10.20527/jipf.v4i2.2056

Pratiwi, V. D., & Wuryandani, W. (2020). Effect of Problem Based Learning (PBL) Models on Motivation and Learning Outcomes in Learning Civic Education. *JPI (Jurnal Pendidikan Indonesia)*, *9*(3), 401. https://doi.org/10.23887/jpi-undiksha.v9i3.21565

Putri, D. A. H., Fauziah, N., & Wati, W. W. (2022). Analisis Effect Size Pengaruh Model Problem Based Learning Terhadap Keterampilan Berpikir Kritis Dan Pemecahan Masalah Dalam Pembelajaran Sains. *ORBITA: Jurnal Pendidikan Dan Ilmu Fisika*, *8*(2), 205. https://doi.org/10.31764/orbita.v8i2.10295

Putri, N. W. S., & Suryati, N. K. (2020). Analysis of The Style of Learning Based on Visual, Auditorial, Kinesthetic on Students of Computer System. *IJECA (International Journal of Education and Curriculum Application)*, *3*(1), 43. https://doi.org/10.31764/ijeca.v3i1.2056

Roslina, Sakung, J. M., Wahyono, U., Afadil, & Abram, P. H. (2025). *Pengaruh Strategi Pembelajaran Berdiferensiasi terhadap Literasi Sains Siswa Kelas V Sekolah Dasar Parigi Utara*. *10*(1), 231–240.

Sakti, N. C., & Luthfiyah, A. (2024). Implementasi Pembelajaran Berdiferensiasi dengan Metode Problem Based Learning (PBL) dalam Meningkatkan Hasil Belajar. *Jurnal Ilmiah Profesi Pendidikan*, *9*(2), 694–698. https://doi.org/10.29303/jipp.v9i2.1935

Santoso, A. B., Alimah, S., & Utami, N. R. (2017). Biological Science

Curriculum Study 5e Instructional Model dengan Pendekatan Jelajah Alam Sekitar terhadap Kemampuan Literasi Sains Info Artikel. *Dkk / Journal of Biology Education*, *6*(2), 173–186. http://journal.unnes.ac.id/sju/index.php/ujeb

Sholihah, T. M., & Lastariwati, B. (2020). Problem based learning to increase competence of critical thinking and problem solving. *Journal of Education and Learning (EduLearn)*, *14*(1), 148–154. https://doi.org/10.11591/edulearn.v14i1.13772

Sultan, A. Al, Henson, H., & Fadde, P. J. (2018). Pre-service elementary teachers' scientific literacy and self-efficacy in teaching science. *IAFOR Journal of Education*, *6*(1), 25–42. https://doi.org/10.22492/ije.6.1.02

Tamam, A., Suryanti, & Sudibyo, E. (2023). Improving Science Literacy Skill Using The Development of LKPD Based on the Problem Based Learning (PBL) Model in Elementary School Students. *JIV: Jurnal Ilmiah Visi*, *18*(1), 1–6. http://doi.org/10.21009/JIV.181.1

Uliyandari, M., Candrawati, E., Herawati, A. A., & Latipah, N. (2021). Problem-Based Learning To Improve Concept Understanding and Critical Thinking Ability of Science Education Undergraduate Students. *IJORER : International Journal of Recent Educational Research*, *2*(1), 65–72. https://doi.org/10.46245/ijorer.v2i1.56

Wulandani, N., & Suryawan, A. (2024). Implementasi Problem Based Learning Berbantuan Media Pembelajaran Inovatif untuk Meningkatkan Literasi Sains Siswa Sekolah Dasar. *HOLISTIKA JURNAL ILMIAH PGSD*, *8*(2), 88–98. jurnal.umj.ac.id/index.php/holistika

Yonanda, D. A., Yuliati, Y., & Saputra, D. S. (2019). Development of Problem-Based Comic Book as Learning Media for Improving Primary School Students' Critical Thinking Ability. *Mimbar Sekolah Dasar*, *6*(3), 341–348. https://doi.org/10.17509/mimbar-sd.v6i3.22892.