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# THE EFFECT OF DEEP LEARNING ON THE SCIENCE LITERACY ABILITIES OF GRADE 4 ELEMENTARY SCHOOL STUDENTS

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## ABSTRAK

Literasi sains merupakan kemampuan penting bagi peserta didik sekolah dasar untuk memahami, menganalisis, dan menjelaskan fenomena alam melalui penalaran ilmiah. Namun, pembelajaran yang masih berpusat pada guru berpotensi membatasi keterlibatan peserta didik dalam kegiatan pengamatan, eksplorasi, dan pemecahan masalah. Penelitian ini bertujuan menganalisis pengaruh penerapan pendekatan *Deep Learning* terhadap kemampuan literasi sains peserta didik kelas IV SDN Windusari. Penelitian menggunakan pendekatan kuantitatif dengan desain *pre-experimental one-group pretest-posttest* yang melibatkan 22 peserta didik melalui teknik *purposive sampling*. Data dikumpulkan menggunakan tes pilihan ganda yang telah melalui pengujian validitas dan reliabilitas, serta didukung oleh observasi dan dokumentasi. Analisis data dilakukan melalui uji normalitas *Shapiro-Wilk* dan uji hipotesis menggunakan *Paired Samples t-Test*. Hasil menunjukkan bahwa data berdistribusi normal dengan nilai signifikansi pretest sebesar 0,104 dan posttest sebesar 0,125. Pengujian hipotesis menghasilkan nilai signifikansi kurang dari 0,001 dengan peningkatan rata-rata skor sebesar 30,818 poin. Temuan ini menunjukkan adanya peningkatan kemampuan literasi sains setelah penerapan pendekatan *Deep Learning*, meskipun keterbatasan desain penelitian perlu dipertimbangkan dalam menafsirkan hasil.
**Kata Kunci:** *Deep Learning, Literasi Sains, Sekolah Dasar*

## ABSTRACT

Scientific literacy is an essential skill for elementary school students to understand, analyze, and explain natural phenomena through scientific reasoning. However, teacher-centered learning may limit students' participation in observation, exploration, and problem-solving activities. This study aimed to analyze the effect of implementing the Deep Learning approach on the scientific literacy skills of fourth-grade students at SDN Windusari. The study employed a quantitative approach with a pre-experimental one-group pretest-posttest design involving 22 students selected through purposive sampling. Data were collected using a multiple-choice test that had undergone validity and reliability testing, supplemented by observation and documentation. Data analysis was conducted using the Shapiro-Wilk normality test and the Paired Samples t-Test. The results indicated that the data were normally distributed, with pretest and posttest significance values of 0.104 and 0.125, respectively. Hypothesis testing yielded a significance value of less than 0.001, accompanied by a mean score increase of 30.818 points. These findings indicate an improvement in students' scientific literacy skills following the implementation of the Deep Learning approach, although the limitations of the research design should be considered when interpreting the results.
**Keywords:** *Deep Learning, Scientific Literacy, Elementary School*

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## INTRODUCTION

Scientific literacy is a competence that enables students to understand natural phenomena, apply scientific knowledge to explain problems, and make decisions based on relevant evidence. In elementary education, this competence needs to be developed from an early age because science learning should not be limited to factual knowledge acquisition but should also foster logical, critical, and systematic thinking. Gultom and Alwi (2024) discuss the implementation of scientific literacy in elementary science learning, while Cahyani and Djudin (2024) examine environment-based science learning for elementary school students. These studies provide a foundation for understanding that scientific literacy should be developed through learning contexts closely related to students' experiences. Therefore, science instruction should be designed to encourage students not merely to memorize concepts but also to connect scientific knowledge with situations encountered in their daily lives.

The development of scientific literacy is also associated with students' ability to understand information, interpret phenomena, and apply concepts to explain scientific problems. Afrida (2024) examines scientific literacy abilities based on the Programme for International Student Assessment (PISA) framework in integrated science learning, offering a perspective on scientific literacy as a competence involving both knowledge comprehension and application. Putra et al. (2025) discuss the application of science through contextual learning to improve students' scientific literacy. Meanwhile, Fadlurrahman et al. (2026) highlight the role of science learning in developing elementary school students' scientific literacy competencies. These studies demonstrate the relevance of connecting scientific knowledge with students' contexts and competencies, indicating that scientific literacy development requires meaningful learning experiences oriented toward understanding.

Although scientific literacy has become an important objective of science education, its achievement cannot rely solely on informative content delivery. Students need opportunities to observe, formulate questions, connect information, and develop explanations through their own reasoning. Idris et al. (2022) examine strategies for mastering science process skills in experimental activities through a systematic literature review. Their study is relevant to the need for learning experiences that allow students to participate actively in scientific processes rather than merely receive information from teachers. Accordingly, science learning should be directed toward experiences that promote active engagement, conceptual understanding, and the integrated development of scientific skills.

One approach relevant to these educational needs is Deep Learning in the educational context, which emphasizes meaningful learning, learning awareness, and enjoyable learning experiences. This approach should be understood as a pedagogical framework rather than as the application of deep learning technology in artificial intelligence. Ramadhan et al. (2026) examine the improvement of scientific literacy through Deep Learning in a systematic review of science learning models, while Ulumiyah and Pratama (2025) specifically investigate elementary school students' scientific literacy through a deep learning approach. These references are directly related to the present study because they address the relationship between deep learning approaches and scientific literacy in educational settings. This approach offers opportunities to develop science learning that emphasizes not only content mastery but also conceptual meaning and connections to students' everyday experiences.

The development of Deep Learning-based instruction has also been associated with the use of various technologies and learning strategies. Wilujeng et al. (2026) develop the Deep-AI model, which integrates artificial intelligence to support scientific literacy, while Zulkarnaen et al. (2026) explore Deep Learning-based science learning through the SmartEdu application

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among prospective elementary school teachers. Susilowati et al. (2026) discuss the development of electronic modules based on Project-Based Learning and a Deep Learning approach to support problem-solving and scientific literacy. Meanwhile, Sugiarto and Nurohman (2026) develop a Deep Learning- and STEM-based hypermodule to improve scientific literacy among junior high school students. These studies indicate that deep learning approaches can be implemented through various instructional formats and learning media, although the educational contexts, grade levels, and student characteristics differ across studies.

Research on Deep Learning approaches also needs to consider their suitability for elementary school students' characteristics. Majid (2026) examines the implementation of Deep Learning to improve scientific literacy among third-grade students at Yeisowo State Elementary School in Central Halmahera. Furthermore, Suryaningsih and Cahaya (2026) investigate the development of early childhood scientific literacy through Deep Learning-based instruction using simple coding games. These studies provide insights into the implementation of deep learning approaches among young learners and elementary school students. However, differences in grade levels, learning characteristics, and intervention formats should be considered when using their findings as comparisons. Burhan (2026) also discusses Problem-Based Learning as an innovative approach in elementary social studies education, providing supporting insights into active learning strategies at the elementary level. Nevertheless, studies focusing on social studies cannot be directly considered evidence of the effectiveness of Deep Learning in science education.

Based on these studies, research on Deep Learning approaches and scientific literacy has developed through contextual learning, module development, technology integration, and various instructional strategies. Nevertheless, further research is needed to specifically examine changes in the scientific literacy abilities of fourth-grade elementary school students following instruction using a Deep Learning approach. This study aims to analyze the effect of the Deep Learning approach on the scientific literacy abilities of fourth-grade students at SDN Windusari. The research employs a pre-experimental design using a one-group pretest-posttest model, allowing students' scientific literacy abilities to be assessed before and after the instructional intervention. The findings are expected to provide empirical information regarding changes in scientific literacy following the implementation of this approach and to serve as a consideration for the further development of elementary science education.

## RESEARCH METHODS

This study employed a *pre-experimental* research design using a *one-group pretest-posttest* model to examine changes in the scientific literacy abilities of elementary school students following the implementation of the *Deep Learning* approach. The research was conducted at SDN Windusari and involved 22 fourth-grade students as research participants. The design involved administering a pretest before the learning intervention and a posttest after its implementation to identify differences in students' scientific literacy performance. By comparing the scores obtained at both measurement points, the study sought to determine whether students demonstrated improvements in the science process skills dimension of scientific literacy following the intervention.

The research instruments consisted of pretest and posttest questions designed to assess students' scientific literacy abilities, particularly those associated with science process skills. Before the main research was conducted, an instrument trial was carried out to examine the validity and reliability of the assessment items. Item validity was evaluated using significance values, while instrument reliability was assessed using Cronbach's Alpha coefficients. The

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validity analysis indicated that the pretest and posttest items met the criteria applied in the study, while the reliability coefficients were 0.739 for the pretest and 0.706 for the posttest. Following the instrument assessment, the pretest was administered before the learning intervention, and the posttest was conducted after the implementation of the *Deep Learning* approach.

The collected data were analyzed using descriptive and inferential statistical procedures to examine changes in students' scientific literacy abilities. The Shapiro–Wilk test was performed to assess the normality of the pretest and posttest score distributions. The results indicated that both datasets satisfied the normality assumption, with significance values of 0.104 for the pretest and 0.125 for the posttest. Accordingly, a *Paired Samples t-Test* was employed to determine whether the difference between students' pretest and posttest scores was statistically significant. The analysis produced a mean difference of 30.818 and a significance value below 0.001, indicating a statistically significant difference between the two measurements. The findings were subsequently interpreted to describe changes in students' scientific literacy abilities following the implementation of the *Deep Learning* approach.

## RESULTS AND DISCUSSION

### Results

Prior to the implementation of the study, an instrument trial was conducted to evaluate the validity of the pretest items. The validity analysis aimed to determine whether each question adequately represented the scientific literacy competencies related to science process skills. The results of this analysis were used to establish the suitability of the instrument for assessing students' initial abilities before the learning intervention. The validity test results are presented in Table 1.

**Table 1. Results of the Pretest Question Validity Test**

| No Question | Sig (2-tailed) | Information |
|---|---|---|
| 1 | 0.028 | valid |
| 2 | <,001 | valid |
| 3 | 0.001 | valid |
| 4 | 0.014 | valid |
| 5 | 0.036 | valid |
| 6 | 0.037 | valid |
| 7 | 0.010 | valid |
| 8 | 0.008 | valid |
| 9 | 0.001 | valid |
| 10 | 0.014 | valid |

As presented in Table 1, all ten pretest items obtained significance values below 0.05. These findings indicate that every item met the validity criterion applied in this study. Accordingly, all pretest questions were considered suitable for assessing students' initial scientific literacy abilities before the implementation of the Deep Learning approach.

The validity of the posttest instrument was examined using the same procedure applied to the pretest. This analysis was intended to ensure that the questions could appropriately assess

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students' scientific literacy abilities after the learning intervention. The significance values obtained from the validity analysis are presented in Table 2.

**Table 2. Results of the Posttest Question Validity Test**

| No Question | Sig (2-tailed) | Information |
|---|---|---|
| 1 | 0.035 | valid |
| 2 | 0.004 | valid |
| 3 | 0.017 | valid |
| 4 | 0.023 | valid |
| 5 | 0.015 | valid |
| 6 | 0.021 | valid |
| 7 | 0.003 | valid |
| 8 | 0.050 | valid |
| 9 | <,001 | valid |
| 10 | 0.039 | valid |

The results in Table 2 indicate that all ten posttest items met the validity criterion, with significance values at or below 0.05. This finding suggests that the posttest questions were suitable for evaluating students' scientific literacy abilities following the implementation of the learning intervention. Therefore, the posttest instrument was retained for subsequent data collection.

Following the validity assessment, reliability testing was conducted to examine the internal consistency of the pretest and posttest instruments. Cronbach's Alpha was employed to determine whether the items within each instrument demonstrated an adequate level of consistency. The reliability test results for both instruments are presented in Table 3.

**Table 3. Test Results Reliability**

| Data | Cronbach's Alpha | Information |
|---|---|---|
| Pretest Questions | 0.739 | Reliable |
| Question Posttest | 0.706 | Reliable |

As shown in Table 3, the pretest and posttest instruments obtained Cronbach's Alpha coefficients of 0.739 and 0.706, respectively. Both values were interpreted as indicating adequate reliability for the purposes of this study. These findings suggest that the instruments demonstrated sufficient internal consistency to support the measurement of students' scientific literacy in the science process skills dimension.

Before conducting the hypothesis test, a normality analysis was performed to determine whether the pretest and posttest scores satisfied the distributional assumption required for the selected statistical procedure. The Shapiro–Wilk test was used because the study involved 22 students. The results of the normality analysis are presented in Table 4.

**Table 4. Normality Test Results**

| Data | Shapiro-Wilk | df | Sig. | Information |
|---|---|---|---|---|
| Pretest | 0.927 | 22 | 0.104 | Normally distributed |
| Posttest | 0.930 | 22 | 0.125 | Normally distributed |

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The Shapiro–Wilk results in Table 4 indicate that the pretest and posttest data were normally distributed, as both significance values exceeded 0.05. Thus, the normality assumption was considered satisfied for both sets of scores. Based on this result, the analysis proceeded using the Paired Samples t-Test to examine differences in students' scientific literacy abilities before and after the implementation of the Deep Learning approach.

To examine whether students' scientific literacy abilities changed following the learning intervention, a Paired Samples t-Test was conducted on the pretest and posttest scores. This analysis was selected because the study compared measurements obtained from the same group of students at two different stages. The results of the hypothesis testing are presented in Table 5.

**Table 5. Test Results Paired Samples t-Test**

| Data | Mean | Standard Deviation | Std. Error Mean | t | Sig. (2-tailed) |
|---|---|---|---|---|---|
| Posttest – Pretest | 30,818 | 4,666 | 0.995 | 30,977 | < 0.001 |

The results in Table 5 reveal a statistically significant difference between students' pretest and posttest scores, with a mean difference of 30.818 and a significance value below 0.001. The positive mean difference indicates that students obtained higher scores after participating in the learning intervention. These findings provide statistical evidence of an improvement in students' scientific literacy abilities in the science process skills dimension following the implementation of the Deep Learning approach.

## Discussion

The findings of this study indicate a statistically significant difference in the scientific literacy abilities of fourth-grade students before and after the implementation of the Deep Learning approach. The Paired Samples t-Test revealed a mean difference of 30.818, with a t-value of 30.977 and a significance level below 0.001. This result suggests that students achieved higher scientific literacy scores following the learning intervention. The improvement is relevant to the development of science process skills, which require students to engage with scientific information, interpret phenomena, and apply knowledge in learning situations. Nevertheless, the findings should be interpreted as evidence of improvement following the intervention rather than definitive proof that the Deep Learning approach alone caused the change.

The observed improvement can be discussed in relation to the role of scientific literacy in developing conceptual understanding and scientific attitudes. Putri et al. (2026) examine scientific literacy as a catalyst for conceptual understanding and scientific attitudes in elementary science learning, providing a relevant conceptual perspective for interpreting the relationship between literacy development and science learning outcomes. Basri (2025) also addresses the relationship between scientific literacy and critical thinking abilities in elementary school IPAS learning. These studies support the relevance of examining scientific literacy beyond students' ability to recall scientific information. In the present study, the significant difference between pretest and posttest scores indicates progress in the assessed science process skills, although the available data do not establish whether conceptual understanding and scientific attitudes improved simultaneously.

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The findings also correspond with research emphasizing the potential of Deep Learning approaches in science education. Majid (2026) investigates the implementation of Deep Learning to improve scientific literacy among Grade III students at Yeisowo State Elementary School, while Zulkarnaen et al. (2026) explore Deep Learning in science education through the SmartEdu application among prospective elementary school teachers. Asih et al. (2026) discuss the transformation of IPAS learning through a Deep Learning approach to support scientific literacy and learning independence. These studies provide relevant contexts for understanding the application of deep learning-oriented instruction across different educational settings. However, differences in participants, learning environments, and instructional procedures mean that their findings should be compared with the present study cautiously rather than treated as directly equivalent evidence.

The improvement observed in this study can also be interpreted in relation to instructional strategies that encourage active engagement and meaningful learning. Pradita et al. (2026) examine the integration of Project-Based Learning and Deep Learning approaches in elementary science learning under the Independent Curriculum. Simbolon et al. (2026) investigate the integration of artificial intelligence and Deep Learning-based Project-Based Learning in relation to critical thinking and scientific literacy among primary school teacher education students. Although these studies involve different learning designs and participant characteristics, they illustrate the growing interest in combining deep learning-oriented instruction with approaches that encourage active participation. The present findings provide additional evidence that the implementation of a Deep Learning approach may be associated with improvements in scientific literacy performance among elementary school students.

The development of scientific literacy is also influenced by the learning resources and instructional experiences available to students. Alwanda (2025) reviews the effectiveness of interactive learning media in improving elementary school students' scientific literacy, while Idris et al. (2022) examine strategies for mastering science process skills through experimental activities. These perspectives highlight the relevance of learning experiences that support students' engagement with scientific concepts and processes. In the present study, the improvement in posttest performance may reflect students' increased familiarity with the assessed scientific literacy tasks after participating in the instructional intervention. However, because the study did not include a comparison group or a separate assessment of students' learning experiences, the specific instructional mechanisms responsible for the observed improvement cannot be determined conclusively.

The findings should also be considered alongside research that examines scientific literacy through different analytical and technological perspectives. Sugiarto and Nurohman (2026) discuss a Deep Learning- and STEM-based hypermodule designed to improve scientific literacy among junior high school students. You et al. (2025) investigate machine learning approaches for predicting scientific literacy among students in the United States, focusing on factors associated with different performance levels and socioeconomic backgrounds. These studies differ from the present research in their instructional contexts and analytical approaches, but they demonstrate that scientific literacy can be examined through multiple educational and technological perspectives. The current study contributes to this broader discussion by focusing on changes in scientific literacy scores among fourth-grade students following a classroom-based learning intervention.

Despite the statistically significant improvement, several limitations need to be considered when interpreting the findings. The study involved only 22 fourth-grade students from SDN Windusari and employed a one-group pretest-posttest design without a control

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group, limiting the extent to which the observed improvement can be attributed exclusively to the Deep Learning approach. In addition, the study assessed scientific literacy primarily through the science process skills dimension, meaning that other dimensions of scientific literacy were not necessarily represented in the results. Future research could involve larger samples, comparison groups, longer intervention periods, and additional assessment dimensions to examine the effectiveness of the approach more comprehensively. Overall, the findings provide preliminary empirical support for the potential of the Deep Learning approach to improve elementary students' scientific literacy performance and offer a basis for further investigation into its application in science education.

## CONCLUSION

This study indicates that the implementation of the *Deep Learning* approach was accompanied by a significant improvement in the science literacy abilities of fourth-grade elementary school students at SDN Windusari. The results of the *paired-samples t-test* revealed a statistically significant difference between the pretest and posttest scores, with a mean increase of 30.818 points, ($t = 30.977$), and ($p < 0.001$). These findings suggest that the learning activities implemented during the intervention were associated with better student performance in science literacy. The results also highlight the potential of *Deep Learning* to support science learning that encourages students to engage more actively with scientific concepts and learning experiences.

Despite these encouraging findings, the results should be interpreted within the boundaries of the research design, which involved only 22 students and employed a *one-group pretest-posttest* approach without a control group. Consequently, the observed improvement cannot be attributed exclusively to the *Deep Learning* approach, as other factors may have contributed to students' learning progress. Future studies should involve larger samples, comparison groups, and longer intervention periods to examine the consistency of these findings across different educational contexts. Further research may also investigate specific dimensions of science literacy and explore how *Deep Learning* can be integrated with other instructional strategies to strengthen elementary students' scientific understanding and learning experiences.

## BIBLIOGRAPHY

Afrida, J. (2024). Analisis Kemampuan Literasi Sains Berdasarkan Kerangka Pisa Dalam Mata Pelajaran Ipa Terpadu. *Jurnal Pembelajaran Fisika*, *13*(2), 95-106. https://doi.org/10.19184/jpf.v13i2.47918

Alwanda, M. A. (2025). Efektivitas media pembelajaran interaktif dalam meningkatkan literasi sains siswa sekolah dasar: Systematic literature review (2020–2025). *Advances In Education Journal*, *2*(2), 797-811. https://journal.al-afif.org/index.php/aej/article/view/280

Asih, T. U. S., Rohman, A., Prasetiya, U. A., & Mahmudah, U. R. (2026). Transformasi Pembelajaran IPAS Di Era Digital Melalui Pendekatan Deep Learning Untuk Meningkatkan Literasi Sains Dan Kemandirian Belajar Siswa. *LEARNING : Jurnal Inovasi Penelitian Pendidikan Dan Pembelajaran*, *6*(1), 502–514. https://doi.org/10.51878/learning.v6i1.8629

Basri, A. (2025). Analisis pengaruh literasi sains terhadap kemampuan berpikir kritis siswa pada pembelajaran IPAS di sekolah dasar. *Al-Ubudiyah: Jurnal Pendidikan dan Studi Islam, 6*(2), 228–236.

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https://doi.org/10.51878/elementary.v7i1.16798

https://jurnal.staiddimakassar.ac.id/index.php/aujpsi/article/view/565

Burhan, I. (2025). Problem-based learning as an innovative approach in elementary Social Studies education: A thematic analysis of empirical studies. *Jurnal Pendidikan dan Pembelajaran*, *4*(1), 153-160. https://doi.org/10.59653/jemls.v4i01.2209

Cahyani, C. W., & Djudin, T. (2024). Pembelajaran ipa berbasis lingkungan untuk siswa sekolah dasar: sebuah kajian literatur. *Jurnal Pendidikan Dasar Perkhasa: Jurnal Penelitian Pendidikan Dasar*, *10*(2), 1102-1116. https://doi.org/10.31932/jpdp.v10i2.3842

Fadlurrahman, M., Suastra, I. W., Wibawa, I. M. I., & Arnyan, I. B. P. (2026). Peran Pembelajaran IPA Dalam Membangun Kompetensi Literasi Sains Siswa Sekolah Dasar. *Jurnal Ilmiah Global Education*, *7*(1), 243-255. https://doi.org/10.55681/jige.v7i1.5133

Gultom, L. N., & Alwi, N. A. (2024). Implemensi literasi sains dalam pembelajaran IPA di sekolah dasar. *Jurnal Sadewa: Publikasi Ilmu Pendidikan, Pembelajaran Dan Ilmu Sosial*, *2*(3), 170-179. https://doi.org/10.61132/sadewa.v2i3.952

Idris, N., Talib, O., & Razali, F. (2022). Strategies in mastering science process skills in science experiments: A systematic literature review. *Jurnal Pendidikan IPA Indonesia*, *11*(1), 155-170. https://doi.org/10.15294/jpii.v11i1.32969

Majid, S. (2026). Implementasi Pembelajaran Deep Learning Untuk Meningkatkan Literasi Sains Siswa Kelas III SD Negeri Yeisowo Halmahera Tengah. *IQRA: Jurnal Pendidikan, Sains, dan Humaniora*, *5*(1). https://jurnal.iai-assiddiq.ac.id/index.php/iqra/article/view/87

Pradita, E. K., Winarni, E. W., Wardana, R. W., & Muktadir, A. (2026). Integration project-based learning and *Deep Learning* approaches in elementary school science learning in the Independent Curriculum. *Journal of Primary Education, 6*(1), 189–189. https://doi.org/10.29300/jpe.v6i1.11341

Putra, A., Giatman, M., Irfan, D., & Efendi, H. (2025). The application of science in contextual learning to improve students' science literacy. *JURNAL HURRIAH: Jurnal Evaluasi Pendidikan dan Penelitian*, *6*(4), 1322-1328. https://doi.org/10.56806/jh.v6i4.364

Putri, D. C., Widianingsih, D., Barif, Z. A., & Ariiqah, N. (2026). The Scientific Literacy as a Catalyst for Conceptual Understanding and Scientific Attitudes in Elementary Science Learning. *JP (Jurnal Pendidikan): Teori dan Praktik*, *11*(1), 67-74. https://journal.unesa.ac.id/index.php/jp/article/view/51000

Ramadhan, H., Saputro, S., Mahardiani, L., Jati, M. A., & Potabuga, T. I. (2026). Enhancing students' scientific literacy through deep learning: A systematic review of science learning models. *Jurnal Pendidikan Sains Indonesia*, *14*(1), 49-62. https://doi.org/10.24815/jpsi.v14i1.92

Simbolon, D. H., Silalahi, E. K., & br Tarigan, R. M. (2026). Advancing SDG 4 Through AI-Integrated Deep Learning Project-Based Learning: Enhancing Critical Thinking Skills and Scientific Literacy Among Primary School Teacher Education Students. *Jurnal Penelitian Pendidikan IPA*, *12*(6), 970-985. https://jppipa.unram.ac.id/index.php/jppipa/article/view/15005

Sugiarto, W., Nurrohman, S., Wiyarsi, A., & Rahmawati, L. (2026). Hypermodule Deep Learning Inquiry–Steam: A Theoretical Framework And Science Teachers' Perceptions In The Digital Era. *Jurnal Pendidikan Sains Universitas Muhammadiyah Semarang*, *14*(1), 49-58. https://doi.org/10.67686/didaktika.v10i2.2165

Suryaningsih, N. M. A., & Cahaya, I. M. E. (2026). Enhancing early childhood science literacy through deep learning–based instruction using simple coding games. *Indonesian*

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*Journal of Educational Development (IJED)*, *7*(1), 230-243. https://ojs.mahadewa.ac.id/index.php/ijed/article/view/5924

Susilowati, E., Pratiwi, D., Rossa, F. O., & Aththibby, A. R. (2026). Development of PjBL E-Modules with a Deep Learning Approach for Problem Solving and Scientific Literacy. *Journal of Educational Sciences*, *10*(4), 13-27. https://jes.ejournal.unri.ac.id/index.php/JES/article/view/1742

Ulumiyah, D., & Pratama, M. A. (2025). Literasi Sains Siswa Sekolah Dasar Melalui Pendekatan Pembelajaran Mendalam (Deep Learning). *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *10*(04), 258-269. https://journal.unpas.ac.id/index.php/pendas/article/view/35774

Wilujeng, I., Ain, T. N., Rilianti, Adhy, P., Hasyim, F., & Fiqiyah, M. (2026). Deep-AI: An AI-integrated *Deep Learning* model for advancing scientific literacy among Generation Z. *Online Learning in Educational Research (OLER),* *6*(2), 155–167. https://doi.org/10.58524/oler.v6i2.981

You, H., Hong, M., Zhu, L., & Zhenhan, F. (2025). Machine Learning Approaches for Predicting US Students' Scientific Literacy: An Analysis of Key Factors Across Performance Levels and Socioeconomic Statuses: You et al. *International Journal of Science and Mathematics Education*, *23*(7), 2755-2783. https://doi.org/10.1007/s10763-025-10545-y

Zulkarnaen, R. H., Mulyani, H., Ayuni, R., & Nurdin, T. A. (2026). Exploring Deep Learning in Science Education through the SmartEdu Application among Pre-Service Elementary School Teachers. *Jurnal Penelitian Pendidikan IPA*, *12*(8), 122-137. https://doi.org/10.29303/jppipa.v12i8.13718

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https://doi.org/10.51878/elementary.v7i1.16798