

Science Kit-Assisted Problem-Based Learning: Its Impact on Students' Problem-Solving Skills

Asti Dwi Safitri¹, Nugroho Prasetya Adi^{2,*}

^{1,2}*Pendidikan Fisika, Universitas Sains Al-Qur'an, Wonosobo, Jawa Tengah, Indonesia*

*E-mail korespondensi: nugroho@unsiq.ac.id

Artikel Info: Abstract

Sent:
[June 09, 2026](#)

Revision:
[July 18, 2026](#)

Accepted:
[July 19, 2026](#)

Keywords:

[Learning Model,](#)
[Problem Based](#)
[Learning, Science](#)
[KIT, Problem](#)
[Solving Skills](#)

This study aimed to determine the difference in problem-solving skills between students who learned using the Problem-based Learning model assisted by a Science Kit and students who learned using a conventional learning model. This research was a quantitative study employing a non-randomized quasi-experimental design, in which the sample was selected using a purposive sampling technique. The study was conducted at SMP N 1 Kejajar, with the research subjects consisting of Class VIII A as the experimental class (25 students) and Class VIII D as the control class (24 students). Data were collected through observation, tests, documentation, and questionnaires. The research instruments used were a problem-solving skills test and a student perception questionnaire. Data were analysed using validity and reliability tests, normality and homogeneity tests, an independent t-test for hypothesis testing, and an N-Gain test to measure the improvement in problem-solving skills. The results showed that, prior to the implementation of the Science Kit-assisted Problem Based Learning model, the learning process was still teacher-cantered, causing students to be relatively passive. After the model was implemented, students became more active in discussions, conducting experiments, and solving the given problems. The analysis revealed a significant difference between the experimental and control classes, as indicated by an independent t-test value of 0.746 and a calculated significance value of 0.000, which is smaller than 0.05. The implementation of the Science Kit-assisted Problem Based Learning model was also able to improve students' problem-solving skills, as shown by the N-Gain calculation for the experimental class of 0.761, categorized as high.

© 2026 State Islamic University of Mataram

INTRODUCTION

Education is one of the efforts that can be made to improve a nation's future. Education is an effort to nurture children's souls, both physically and spiritually, guiding them from their natural disposition toward a better standard of humanity [1]. Through education, learners are expected to develop their thinking abilities, skills/soft skills, and the attitudes required in daily life. The educational process canters on learning activities, which are the core means of achieving educational goals. Good learning is learning that actively engages students so that they do not merely receive information from the teacher but are also able to discover and construct their own knowledge [2].

Science (IPA) learning is a type of instruction that emphasizes scientific processes and direct experience. Science learning requires students not only to understand concepts and theories but also to apply those concepts in daily life [3]. Beyond understanding concepts and theories, science learning also requires students to develop critical, creative, and logical thinking skills, as well as problem-solving ability [4], [5]. Science learning provides students with opportunities to explore their potential through the processes involved.

One skill that can be developed to face the demands of the times is problem-solving skill. Problem-solving skill is a fundamental ability that students need in order to deal with various problems, both at school and in daily life [6]. This ability involves critical, logical, systematic, and creative thinking processes in finding solutions to a problem [7]. In reality, however, Indonesian students' problem-solving ability remains relatively low. The results of the 2022 Programme for International Student Assessment (PISA) showed that Indonesia ranked 73rd out of 80 participating countries in the scientific literacy category [8]. One of the indicators assessed in scientific literacy is students' problem-solving skill [9].

The low level of students' problem-solving ability found in the PISA test results is consistent with the observation results at SMP N 1 Keajar. The observations showed that students' problem-solving ability was still relatively low. This was based on the results of daily tests and midterm examinations of Grade VIII students in science learning, most of which had not reached the minimum mastery criteria. In addition, the observations showed that the science learning process was still dominated by the teacher as the center of learning. Students mostly listened to the teacher's explanations and took notes, resulting in a lack of direct experience in developing their problem-solving ability.

One step that can be taken to develop students' problem-solving ability is by using appropriate learning models and media. A learning model that can be used to develop problem-solving skills is Problem Based Learning [10],[13]. This is consistent with the findings of [14]–[18], which showed that the Problem Based Learning model is highly effective in improving students' problem-solving ability. The Problem Based Learning (PBL) model presents real-world problems as the basis of learning, requiring students to actively seek solutions to the given problems. In addition, this model also requires students to develop critical thinking skills, collaboration, and discussion abilities [19].

In addition to the Problem Based Learning (PBL) model, problem-solving ability can also be developed through the use of interactive learning media. Research has shown that the use of learning media in the learning process can improve students' problem-solving ability in science learning [4], [20], [21], [22]. One medium that can be utilized to support problem-solving ability in science learning is the Science Kit. The use of a Science Kit can provide students with more authentic learning experiences, thereby making it easier for them to understand concepts, as well as increasing their learning interest [23], student activity [24], critical thinking ability [25], and problem-solving ability [26].

Previous studies have extensively discussed the use of the Science Kit-assisted Problem Based Learning model in science learning. Surur et al. [26] showed in their research that the use of a Problem Based Learning-based Science Kit can help students understand concepts more meaningfully and improve their problem-solving skills, as reflected in an N-Gain calculation of 0.3, categorized as moderate. Mokoagow et al. [27] explained in their study that the use of the Problem Based Learning model with Science Kit media had a significant effect on science concept learning outcomes, as indicated by a calculated t-value greater than the table t-value. Izharifa et al. [25] found in their research that the implementation of the Problem Based Learning model assisted by a Science Kit could improve critical thinking ability, as reflected in an N-Gain percentage of 67%, categorized as moderate.

Based on the problems identified and the existing research findings, a novelty emerges: while many studies have combined the Problem Based Learning model with the Science Kit, none has specifically measured problem-solving skills in science learning. Therefore, this study is expected to contribute to improving the quality of science learning.

METHODS

This study employed a quantitative approach using a quasi-experimental research design. The research design used was the pretest–posttest control group design [28]. In this design, there were two research classes: an experimental class, which received treatment using the Science Kit-assisted Problem Based Learning (PBL) model, and a control class, which used a conventional learning model. Both classes were given a pretest before treatment and a posttest after treatment to determine the improvement in students' problem-solving skills.

The study was conducted at SMP N 1 Kejajar among Grade VIII students. The population in this study consisted of all Grade VIII students, while the research sample was selected using a purposive sampling technique. The sample consisted of one experimental class and one control class. The experimental class in this study was Class VIII A, while the control class was Class VIII D.

Data were collected using a test technique. The test was used to measure students' problem-solving skills through pretest and posttest items. The instrument used in this study was a problem-solving skills test, which had been tested for validity and reliability prior to use. The indicators of problem-solving skills included the ability to understand the problem, plan a solution, implement the solution, and evaluate the results of the solution [29].

Data analysis was carried out in several stages: validity and reliability testing, normality and homogeneity testing, hypothesis testing using a t-test, and an N-Gain test to measure the magnitude of the improvement in students' problem-solving ability after the implementation of the Science Kit-assisted Problem Based Learning model.

RESULTS AND DISCUSSION

1. Instrument Validity and Reliability Test

The validity test was used to determine whether the items in the constructed instrument had validity or not. This was done to ensure that the instrument could measure what it was intended to measure [30]. The type of validity used in this study was empirical validity, conducted to determine whether the questionnaire items on the instrument matched the ability level of the trial subjects. The validity test used in this study was the point-biserial correlation, calculated using the following equation:

$$r_{pbis} = \frac{M_p - M_t \sqrt{\frac{p}{q}}}{St} \quad (1)$$

The instrument used in this study consisted of an essay test comprising 10 questions. The instrument was tested on 30 students selected based on the needs of the research. This number is consistent with the minimum number required to measure the validity of an instrument [31]. The results of the item validity calculations are presented in Table 1 below.

Table 1. Item Validity Test Results

No. Soal	r hitung	r Tabel	Keterangan
1	0.332	0.361	Tidak valid
2	0.415		Valid
3	0.517		Valid
4	0.616		Valid
5	0.444		Valid
6	0.379		Valid
7	0.460		Valid
8	0.415		Valid
9	0.641		Valid
10	0.523		Valid

The calculation results showed that the r-table value for 30 respondents at a 5% significance level was 0.361. An item is considered valid if the calculated r-value is greater than the r-table value, or invalid otherwise [28]. Based on Table 1, the calculated r-value was below the r-table value only for item number 1, so this item was declared invalid, while the other nine items were declared valid because their calculated r-values exceeded the specified r-table value.

The reliability test was conducted to determine the level of consistency of the instrument, i.e., whether the instrument used could be relied upon and remained consistent when the measurement

was repeated [32]. The reliability test used in this study was Cronbach's Alpha. The results of the instrument reliability test are presented in Table 2 below.

Table 2. Instrument Reliability Test Results

Cronbach's Alpha	Number of Items
0.820	10

An instrument is considered reliable if the calculation result exceeds 0.60 [32]. Based on Table 2, the calculated Cronbach's Alpha value was 0.820. This result exceeds the lower threshold of 0.60 ($0.820 > 0.60$), so it can be concluded that the instrument is reliable, or consistent.

2. Normality and Homogeneity Test

The normality test was conducted to determine whether the obtained research data were normally distributed. This was done to determine whether the hypothesis test should be conducted using a parametric or a non-parametric test. The normality test used in this study was the Shapiro-Wilk test. This test was chosen because the sample sizes of both the experimental and control classes were fewer than 50 students [33]. The results of the normality calculations are presented in Table 3 below.

Table 3. Normality Test Results

No.	Data	Class	Sig. (Shapiro-Wilk)
1	Pre-Test	Control	0.255
2	Post-Test	Control	0.258
3	Pre-Test	Experimental	0.898
4	Post-Test	Experimental	0.093

The calculation results showed that the significance values of both the pretest and posttest data, for both the control and experimental classes, were greater than the research significance level (5%). Based on this, it can be concluded that the research data were normally distributed, since the calculated significance value was greater than the research significance level [33].

The homogeneity test was conducted to determine whether the variances of the data from the two research groups were equal (homogeneous) or not. The homogeneity test used in this study was Levene's test. This test was selected based on the prerequisite that must be met before conducting a t-test [34]. The results of the homogeneity test are presented in Table 4 below.

Table 4. Homogeneity Test Results

Data	Levene Statistic	df1	df2	Sig.
Score (Based on Mean)	4.240	1	41	0.046

The calculation results showed a calculated significance value of 0.046. Sianturi [33] explained that data are considered homogeneous if the calculated significance value exceeds the specified research significance level of 5% (calculated sig. $> 5\%$). Based on Table 4 above, it can be concluded that the data obtained were not homogeneous, since the calculated significance value exceeded the specified research significance level ($0.146 > 0.05$).

3. Hypothesis Test (T-Test) and N-Gain

The results showed that the implementation of the Science Kit-assisted Problem Based Learning model had a positive effect on students' problem-solving skills. This can be seen from the pretest and posttest results of the experimental and control classes, presented in Table 5 below:

Table 5. Pretest Results Data

Group/Class	Number of Students	Total Score	Mean	Lowest Score	Highest Score
Experimental	20	1195	59.75	45	76
Control	23	1366	59.39	37	73
Group/Class	Number of Students	Total Score	Mean	Lowest Score	Highest Score

Table 6. Posttest Results Data

Group/Class	Number of Students	Total Score	Mean	Lowest Score	Highest Score
Experimental	20	1805	90.25	77	98
Control	23	1527	66.39	43	80

Based on the data analysis in Tables 5 and 6, the mean posttest score of the experimental class was higher than that of the control class. In addition, the results of the hypothesis test using the t-test showed that the significance value (Sig.) was smaller than 0.05, so H_0 was rejected and H_1 was accepted, as shown in Table 7 below.

Table 7. Independent T-Test Results

Data	t-calculated	df	Sig. (2-tailed)	Decision
Posttest (Control vs Experimental)	-9.746	38.365	0.000	Reject H_0

Based on the t-test results above, the significance value was smaller than 0.05 (Sig. < 0.05); therefore, H_0 was rejected and H_1 was accepted. This indicates a significant difference in mean learning outcomes between the control and experimental classes. In this study, the N-Gain calculation was based on the pretest and posttest scores of students in Class VIII A as the experimental class, comprising 23 students, and Class VIII D as the control class, comprising 20 students, as presented in Table 8 below.

Table 8. Mean Gain Score

Class	N	Mean	Median	Std. Deviation	Category
Control	23	0.175	0.156	0.123	Low
Experimental	20	0.768	0.761	0.132	High

Based on Table 8 above, the mean N-Gain for the control class was 0.175, categorized as low, while for the experimental class it was 0.768, categorized as high. The median value for the control class was 0.156, and for the experimental class was 0.761. This shows that the improvement in student learning outcomes in the experimental class was higher than in the control class. In addition, the standard deviations of the two classes were relatively similar, indicating that the data distribution in both groups was fairly balanced.

The research conducted at SMP N 1 Kejajar, implementing the PBL model with Science Kit media to improve problem-solving skills on the topic of Vibration and Waves, proceeded well. This improvement can be seen in students' ability to identify problems, select solution strategies, implement solutions, and evaluate the results obtained. This is consistent with the findings of Surur et al. [26], who stated that the PBL model can train students to think critically and solve problems through the presentation of real-world problems in the learning process.

In addition, the use of Science Kit media provided students with direct learning experiences, making the concepts studied more concrete and easier to understand [25], [27]. This finding is consistent with Jean Piaget's constructivist theory, which explains that knowledge is constructed through students' experiences and interactions with their surrounding environment. Through hands-

on experiments and group discussions, students became more active in finding solutions to the problems given.

CONCLUSION

Based on the research results in Grade VIII at SMP N 1 Kejajar, prior to the implementation of the Problem Based Learning (PBL) model using the Science Kit, the learning process was still dominated by the teacher, resulting in relatively low student activity and problem-solving skills. After the implementation of the PBL model using the Science Kit, students became more active in discussions, experiments, and problem-solving. The t-test results showed a significance value of $0.000 < 0.05$, indicating a significant difference in problem-solving skills between the experimental and control classes. In addition, the N-Gain calculation showed that the experimental class obtained a value of 0.768, categorized as high, while the control class obtained a value of 0.175. Thus, the Science Kit-assisted Problem Based Learning model is effective in improving students' problem-solving skills..

REFERENCES

- [1] Sujana, *Penilaian Hasil Proses Belajar Mengajar*. Bandung, Indonesia: PT. Remaja Rosdakarya, 2019.
- [2] U. Kalsum, H. Hamzah, and N. M, "Implementasi Model Pembelajaran Berbasis Proyek Pendekatan SETS Terhadap Kemampuan Berpikir Kreatif Peserta Didik," *Jurnal Fisika dan Pembelajarannya*, vol. 2, no. 1, pp. 35–44, 2019.
- [3] C. W. Cahyani and T. Djudin, "Pembelajaran IPA Berbasis Lingkungan untuk Siswa Sekolah Dasar: Sebuah Kajian Literatur," *Jurnal Pendidikan Dasar Perkasha*, vol. 10, no. 2, pp. 1102–1116, 2024.
- [4] J. Siswanto, "Strategi Meningkatkan Keterampilan Pemecahan Masalah Menggunakan E-Worksheet dalam Pembelajaran IPA," *Media Penelitian Pendidikan: Jurnal Penelitian dalam Bidang Pendidikan dan Pengajaran*, vol. 19, no. 2, pp. 475–480, 2025.
- [5] E. S. Karnel and A. R. Purnomo, "Penerapan Model PBL untuk Meningkatkan Keterampilan Pemecahan Masalah pada Materi Pencemaran Lingkungan," *Jurnal Basicedu*, vol. 8, no. 5, pp. 3621–3628, 2024.
- [6] H. P. Ramadhani, "Peningkatan Kemampuan Pemecahan Masalah Pembelajaran IPA tentang Siklus Air melalui Model Pembelajaran Problem Based Learning," *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, vol. 9, no. 1, pp. 148–153, 2021.
- [7] K. Zaharani and F. N. Pertiwi, "Analisis Kemampuan Pemecahan Masalah Peserta Didik Melalui Kelompok Triple Problem Solving Space (TPSS)," *Jurnal Tadris IPA Indonesia*, pp. 255–271, 2025.
- [8] OECD, *Programme for International Student Assessment (PISA) Results: The State of Learning and Equity in Education*. Paris, France: OECD Publishing, 2022.
- [9] Rosdiana, Y. Oktarisa, and Y. R. Denny, "Analisis Kemampuan Pemecahan Masalah Siswa SMA pada Materi Pemanasan Global," *Jurnal Edu Research*, vol. 5, no. 1, pp. 143–149, 2024.
- [10] S. N. Muthia, A. I. Sugandi, and W. Setiawan, "Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa SMP Kelas 7 Melalui Model Problem Based Learning dalam Materi Rasio dan Perbandingan," *Jurnal Pembelajaran Matematika Inovatif*, vol. 7, no. 3, pp. 535–544, 2024.
- [11] A. L. Daeli, "Penerapan Model Pembelajaran Problem Based Learning dalam Meningkatkan Kemampuan Pemecahan Matematis Siswa Kelas V-A SDN 071184 Tetesua," *ELEMENTARY: Jurnal Inovasi Pendidikan Dasar*, vol. 3, no. 1, pp. 18–25, 2023.
- [12] S. Wijayanti, S. Hartono, and N. A. N. Murniati, "Peningkatan Kemampuan Pemecahan Masalah Melalui Model Problem Based Learning (PBL) pada Peserta Didik Kelas III Sekolah Dasar Supriyadi Kota Semarang," *Media Penelitian Pendidikan: Jurnal Penelitian dalam Bidang Pendidikan dan Pengajaran*, vol. 12, no. 2, pp. 128–137, 2018.
- [13] S. Susilawati, "Upaya Meningkatkan Kemampuan Pemecahan Masalah Matematika dan Kreativitas Siswa Melalui Model Pembelajaran Problem Based Learning," *PEDAGOGIA: Jurnal Ilmu Pendidikan*, vol. 17, no. 1, pp. 67–79, 2019.

- [14] E. P. Ningsih, S. Rismen, and Y. Haryono, "Efektivitas Problem Based Learning (PBL) dalam Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa," *Journal of Education Research*, vol. 6, no. 3, pp. 670–676, 2025.
- [15] Y. E. Sinaga, Darmaji, and D. A. Kurniawan, "Upaya Meningkatkan Kemampuan Pemecahan Masalah Siswa Melalui Model Pembelajaran Problem Based Learning pada Materi Pengukuran di Kelas X," *Jurnal Ilmiah Ilmu Pendidikan*, vol. 8, no. 4, pp. 4528–4532, 2025.
- [16] I. Khadijah, M. W. Nurhadi, A. Wijaya, R. Baiturrahman, K. Azzahra, and M. S. Hambali, "Pengaruh Problem Based Learning Terhadap Kemampuan Memecahkan Masalah Peserta Didik," *Jurnal Pendidikan Indonesia: Teori, Penelitian, dan Inovasi*, vol. 5, no. 4, pp. 336–345, 2025.
- [17] R. T. Widyastuti and G. S. Airlanda, "Efektivitas Model Problem Based Learning Terhadap Kemampuan Pemecahan Masalah Matematika Siswa Sekolah Dasar," *Jurnal Basicedu*, vol. 5, no. 3, pp. 1120–1129, 2021.
- [18] D. Oktaviana and R. Haryadi, "Pengaruh Model Pembelajaran Problem Based Learning (PBL) Terhadap Kemampuan Pemecahan Masalah Mahasiswa," *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, vol. 9, no. 4, pp. 1076–1085, 2020.
- [19] Muliana, M. Fonna, and H. Nufus, "Pengaruh Penerapan Problem Based Learning (PBL) Terhadap Keterampilan Abad 21," *Ar-Riyadhiyyat: Jurnal Pendidikan Matematika*, vol. 5, no. 1, pp. 22–30, 2024.
- [20] V. M. Soro, M. A. Itu, Y. U. Lawe, and M. Z. Ferdinandus, "Penerapan Media Pembelajaran Berbasis Etnosains untuk Meningkatkan Kemampuan Pemecahan Masalah IPAS pada Siswa Kelas IV," *Jurnal Ilmiah Mandalika Education*, vol. 2, no. 1, pp. 300–309, 2024.
- [21] A. Harjono et al., "Media Tiga Dimensi Sebagai Sarana Meningkatkan Kemampuan Guru IPA dalam Menerapkan Pembelajaran Berbasis Masalah di Kelas," *Jurnal Pendidikan dan Pengabdian Masyarakat*, vol. 8, no. 2, pp. 231–238, 2025.
- [22] S. T. N. Ngandoh, "Papan Belajar (Panjar) IPA pada Pembelajaran Berdiferensiasi untuk Meningkatkan Kemampuan Pemecahan Masalah Peserta Didik Kelas VII," *Jurnal Dikdaktika Pendidikan Dasar*, vol. 8, no. 1, pp. 185–198, 2025.
- [23] Nasharuddin, H. Yansa, and M. Janna, "Pengaruh Penggunaan KIT IPA Terhadap Keterampilan Literasi dan Proses Sains Mahasiswa Pendidikan Guru Sekolah Dasar," *Jurnal Pendidikan MIPA*, vol. 14, no. 2, pp. 50–62, 2024.
- [24] E. P. Handayani and S. Ayub, "Penggunaan KIT IPA dalam Meningkatkan Hasil Belajar IPA Siswa Kelas VI SD N 6 Mataram," *Jurnal Pendidikan Fisika dan Teknologi*, vol. 4, no. 2, pp. 262–268, 2018.
- [25] F. R. Izharifa, F. Fakhriyah, and S. Masfuah, "Efektivitas Model Problem Based Learning Berbantuan Media KIT IPA Terhadap Kemampuan Berpikir Kritis Siswa," *Wasis: Jurnal Ilmiah Pendidikan*, vol. 5, no. 2, pp. 101–108, 2024.
- [26] S. F. Surur, A. E. Saputri, and R. Heryani, "Pengembangan KIT IPA Berbasis Problem Based Learning untuk Meningkatkan Kemampuan Pemecahan Masalah Materi Gaya Peserta Didik Fase B Sekolah Dasar," *Khatulistiwa: Jurnal Pendidikan dan Sosial Humaniora*, vol. 6, no. 1, pp. 627–646, 2026.
- [27] A. Mokoagow et al., "Pengaruh Model Problem Based Learning dengan Media KIT IPA Terhadap Hasil Belajar Konsep IPA," *Jurnal Luminous: Riset Ilmiah Pendidikan Fisika*, vol. 5, no. 2, pp. 1–9, 2024.
- [28] Sugiyono, *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R&D*. Bandung, Indonesia: Alfabeta, 2019.
- [29] S. Hidayah, R. Y. Purwoko, and N. Ngazizah, "Analisis Kemampuan Pemecahan Masalah Berdasarkan Teori Polya Materi Pecahan di Sekolah Dasar," *Jurnal Pendidikan dan Ilmu Sosial*, vol. 1, no. 1, pp. 155–161, 2023.
- [30] A. Suharsimi, *Prosedur Penelitian*. Jakarta, Indonesia: PT. Rineka Cipta, 2006.
- [31] M. Iqbal and S. Salsabila, "Validitas dan Reliabilitas Kuesioner Kebiasaan Menonton Mukbang," *Muhammadiyah Journal of Nutrition and Food Science*, vol. 4, no. 2, pp. 102–109, 2023.

- [32] R. Slamet and S. Wahyuningsih, "Validitas dan Reliabilitas Terhadap Instrumen Kepuasan Kerja," *ALIANSI: Jurnal Manajemen dan Bisnis*, vol. 17, no. 2, pp. 51–57, 2022.
- [33] R. Sianturi, "Uji Normalitas Sebagai Syarat Pengujian Hipotesis," *Jurnal Pembelajaran dan Matematika Sigma*, vol. 11, no. 1, pp. 1–14, 2025.
- [34] Usmadi, "Pengujian Persyaratan Analisis (Uji Homogenitas dan Normalitas)," *Jurnal Inovasi Pendidikan*, vol. 7, no. 1, pp. 50–62, 2020.