Vol 43, No 1 (2026): April 2026

**Jurnal Penelitian Pendidikan**
https://journal.unnes.ac.id/journals/JPP

# Implementation of PBL Model with Ethnomathematical Nuances on Mathematical Problem-Solving Ability Reviewed from Confidence

Dwi Arifa*, Zaenuri

Universitas Negeri Semarang, Indonesia

*Corresponding Author: dwiarifaa@students.unnes.ac.id

## Abstract
This study aims to analyze the effectiveness of the application of the Problem Based Learning (PBL) model with ethnomathematical nuances in improving mathematical problem-solving skills and examining the role of students' confidence. This study uses a mixed method with the design of the Contol Group Posttest. The population in this study is all students of class XI of SMA Negeri 6 Semarang. The research sample consisted of two classes XI of SMA Negeri 6 Semarang which were selected based on the cluster random sampling technique, with the provision of one experimental class with treatment and one control class. The instruments used included a test of problem-solving ability based on Polya's steps, a confidence questionnaire, and interview guidelines. Data were analyzed using SPSS. The results of the analysis prerequisite test showed that the data was normally distributed and had a homogeneous variance. The one-sample t-test resulted in an average experimental class score of 87.36 which is significantly higher than the KKM in schools of 75 with a significance value of 0.000. The independent sample t-test showed a significant difference between the experimental class and the control class, thus emphasizing that the application of the PBL model with ethnomathematical nuances was effective in improving mathematical problem-solving ability. Based on the results of the analysis of the percentage of questionnaire indicators and interviews with students, results were obtained at a high level of confidence, showing more optimal problem-solving achievement compared to students with medium and low levels of confidence. The results of this study show that the ethnomathematical PBL model not only has a significant impact on improving students' ability to solve mathematical problems, but also contributes to increasing students' confidence.

**Keywords**: ethnomathematics, problem based learning, self-confidence, troubleshooting

## INTRODUCTION

Meaningful mathematics learning will help students relate concepts to real situations in the environment (Gumelar et al., 2023). Mathematical problem-solving skills are one of the key competencies that students must have in facing the challenges of the 21st century. This ability does not only require calculation skills, but also includes the ability to understand problems, formulate solutions, and implement solutions, as well as evaluate the solutions obtained. This allows for interaction between students, teaching materials, and teachers (Ardanari et al., 2024). This is in line with the goals of the Independent Curriculum in emphasizing the development of concept understanding, procedural skills, reasoning, communication, problem-solving, and mathematical disposition.

Based on the results of learning observations at SMA Negeri 6 Semarang, teaching practices in schools are still dominant using a conventional teacher-centered approach. Initial observations and interviews with grade XI mathematics teachers of SMA Negeri 6 Semaang show that students are still having difficulty understanding problems, determining solution steps, and solving non-routine problems independently. Learning by emphasizing routine procedures makes students less active and trained in dealing with complex problems. This condition is a factor in low problem-solving skills, as found by Disparrilla and Afriansyah (2022). The results of PISA 2023 show that Indonesia ranks 69th out of 81 known countries where it has an average score of 366, far from the international average of 472 (OECD, 2023), which gives the urgency of improving mathematics learning.

An alternative learning that can be implemented is PBL. Learning from contextual problems in daily life encourages students to be more active in searching for information, discussion processes, and developing solution strategies. It is proven that the application of PBL can increase students' activeness, material understanding, and critical thinking skills (Musliha & Revita, 2021). In the research of Elsyavalia, Indiati, & Fatoni (2023), it is shown that PBL is able to increase learning motivation and mathematical problem-solving skills in a relevant manner as a solution to students' low ability to solve problems. Abilities that aim to help students solve problems that exist in real life in daily life (Rahmadhani et al., 2024).

The relevance of PBL is strengthened through an ethnomathematical approach, linking mathematical concepts with local culture and community empowerment activities. Cultural integration makes learning more contextual and easy to understand (Marleny et al., 2020). The application of local cultural elements, such as Dugderan culture in Semarang and learning materials in class XI Lingkaran allows students to learn through experiences close to life so that they can deepen their understanding of concepts. Problem-based learning or PBL is a learning model that encourages students to be active and collaborate in the learning process (Sinaga, C. V. R., 2020).

Ethnomathematics comes from a combination of the words *ethno* (meaning ethnic or cultural) and *mathematics*, which can be simply interpreted as the study of cultural anthropology related to mathematical concepts (Pratiwi & Pujiastuti, 2020). The application of ethnomathematics in mathematics learning in primary schools supports the objectives of a national curriculum that emphasizes thematic and integrative approaches. By integrating ethnomathematics into Dugderan culture in Semarang, students can strengthen character education and cultural preservation in the school environment. Dugderan culture in Semarang is associated with the Circle material in grade XI to measure students' mathematical problem-solving skills. Mathematical concepts contained in culture make an important contribution to formal mathematics learning in schools (Nursyeli & Puspitasari, 2021). Approaches to foster an understanding of cultural preservation into the curriculum, such as cultivating culture through mathematics learning (Setyani & Amidi, 2022).

Problem-solving skills, according to Ningrum (2020), are one of the abilities where students are given problems both theoretically and in daily life, then students carry out the process of solving these problems. One of the main challenges in mathematics learning today is how to develop problem-solving skills in students (Disparrilla & Afriansyah, 2022). The results of previous research (Adhyan & Sutirna, 2022) show that students' problem-solving skills are still relatively low. Problem-solving skills need to be trained and developed by students. This ability reflects the extent to which students are able to use their knowledge and skills in solving contextual problems. The use of PBL has the effect of increasing mathematical problem-solving skills where students are directly involved in the process of identifying and exploring contextual problems, discussing, and finding solutions to problems collaboratively. George Polya, a Hungarian mathematician, argues that problem-solving is a process of finding solutions to difficulties faced in order to achieve goals that cannot be achieved directly (Nurhayati et al., 2022). By finding the concepts of the material learned, students can more easily solve learning problems and problems in daily life (Widyastuti & Airlanda, 2021).

Psychological aspects such as self-confidence affect students' ability to solve problems. Confidence arises from the condition of the surrounding environment, especially the family that is directly related in daily life (Hasibuan, 2022). In previous research, Arofah (2021) argued that in the mathematics learning process, there were still many students who had not met the confidence indicators. Many students have not dared to present their results and learn in front of the class due to a lack of confidence (Simanjuntak, 2022).

There needs to be learning that is able to present intellectual challenges, cultural relevance, and opportunities for students to explore completion steps. Thus, there is an urgency to apply and test the effectiveness of the PBL model with ethnomathematical nuances. This study is directed to examine the effectiveness of the PBL model with ethnomathematical nuances compared to conventional learning in improving mathematical problem-solving skills, as well as exploring the relationship between students' confidence and students' ability to solve problems. This research is expected to make a theoretical contribution to the development of innovative learning models. This research focuses on problem-solving skills based on polya steps, the application of PBL integrated with Dugderan culture, and students' confidence in their ability to complete mathematical tasks.

## METHOD

This study uses the mixed methods With Desai Posttest-Only Control Group Desgn, where one class was treated with an ethnomathematical PBL model and another class was given conventional learning. After treatment, both classes were given a posttest as a differentiating measure of mathematical problem-solving ability between the two classes. The research was carried out in the odd semester of the 2025/2026 school year at SMA Negeri 6 Semarang during five mathematics learning meetings. The population in this study is all students of class XI of SMA Negeri 6 Semarang. Sample selected using the cluster random sampling, so that two classes are obtained as experimental and control classes. Interview subjects were selected based on purposive sampling techniques where there was a category of confidence.

It begins with the preparation stage for the preparation of learning tools, instrument validation, and coordination with teachers. The implementation in the experimental class was treated with ethnomathematical PBL learning, while the control class followed conventional learning for five meetings. After being given treatment, both classes were given a posttest as a measure of mathematical problem-solving ability, as well as a confidence questionnaire as a measure of students' confidence level. Based on the results of the questionnaire, several students were selected for interviews to explore their experiences, strategies, and perceived obstacles during the learning process. The results obtained are used to draw conclusions about the effectiveness of the applied learning model.

Based on the results of the analysis of the test question instrument, it was shown that as many as 10 questions were declared valid. The reliability test produced a coefficient of 0.93 which was in the very high category, so the instrument had excellent internal consistency. The differentiating power analysis showed a value between 17%-56% with low-good criteria, thus the question items were able to distinguish the ability of students. The difficulty level analysis shows that 2 questions are classified as difficult, 2 medium, and 6 easy, the distribution of the difficulty level of the instrument is proportional. Based on the results of the questionnaire test analysis of 24 questions, there were 2 invalid questions, so that only 22 questions were used and produced low-high criteria. The reliability test is 0.912. Thus, the test instrument is suitable for use in research.

The data used were in the form of quantitative and qualitative data obtained through posttests on mathematical problem-solving abilities as well as confidence questionnaires and interviews. A data-collection instrument for a problem-solving ability test based on polya steps, a confidence questionnaire using the Likert scale, and a semi-structured interview guideline to explore experiences, strategies, and perceived obstacles during the learning process. Data collection was carried out through written tests, questionnaires, interviews, and documentation. Tests are given after treatment to measure mathematical problem-solving skills, questionnaires are given to measure confidence, and interviews are used to dig into in-depth information about learners' learning experiences.

Quantitative data analysis was carried out through normality tests, homogeneity tests, one-sample t-tests, and independent sample t-tests. Qualitative data analysis is carried out through data reduction, data presentation, and conclusion drawn. The results of the two analyses were then juxtaposed to strengthen the interpretation of the findings. The data was used to assess the effectiveness of the ethnomathematical PBL model and explain the role of students' confidence in the mathematical problem-solving process.

## RESULT AND DISCUSSION

The results of the prerequisite test showed that the mathematical problem-solving ability data had met the parametric statistical assumptions. The normality test is carried out to find out the normally distributed research data so that it can be used in parametric statistical analysis.

Table 1. Normality Test

| Variabel | Statistics K-S | df | Sig. | Remarks |
|---|---|---|---|---|
| Value | 0,100 | 72 | 0,073 | Normal distribution |

Assisted by the SPSS of the Kolmogorov-Smirnov test with decision-making criteria, if the significance value (Sig.) > 0.05, the data is declared to be normally distributed. Based on the results of the normality test, the significance value of Kolmogorov-Smirnov was 0.073. Thus, it can be concluded that the value data is normally distributed.

Table 2. Homogeneity Test

| Variabel | Testing Policy | Statistics Levene | df 1 | df 2 | Say. |
|---|---|---|---|---|---|
| Value | Mean | 0,718 | 1 | 70 | 0,400 |

The homogeneity test was performed to find out whether the data groups had the same variance so that they met the requirements of the parametric statistical test. The test was carried out using Levene Statistic with the decision-making criteria of what significance value (Sig.) > 0.05, then the data was declared to have a homogeneous variance, obtained a significance value Based on Mean of 0.400, the value was more than 0.05. Thus, it can be concluded that the data have the same or homogeneous variance.

Table 3. Test One Sample t-test

| Test Value | t | df | Sig. (2-tiled) | Mean difference | 95% CI Lower |
|---|---|---|---|---|---|
| 75 | 9,946 | 35 | 0,000 | 12,361 | 9,84 |

The One Sample t-test is used to find out whether the average score of students' learning outcomes is significantly different from the specified benchmark or KKM value of 75. With the decision-making criteria, if the significance value of Sig. (2-tailed) < 0.05, there is a significant difference between the sample average and the benchmark value or KKM. If Sig. ≥ 0.05 then there is no significant difference. Based on the results of the output obtained, it showed a Sig. (2-tailed) value of 0.000 which was smaller than 0.05 so that it showed that there was a significant difference between the average posttest value and the benchmark value or KKM of 75. Thus, it can be concluded that the average posttest results of students are dignified higher than the KKM score of 75, so that the research hypothesis is accepted.

Independent Samples Test

| | | Levene's Test for Equality of Variances | | | | |
|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) |
| nilai | Equal variances assumed | 9.406 | .003 | 4.721 | 70 | .000 |
| | Equal variances not assumed | | | 4.721 | 53.771 | .000 |

Figure 1. Independent Samples Test

The Independent Samples t-test was used to find out if there was a difference in the average posttest results between the experimental class and the control class with the decision-making criteria, if Sig. (2 tailed) < 0.05 then there was a significant difference between the two groups, if Sig. (2-tailed) ≥ 0.05 then there was no significant difference. Based on Group Statistics, it is known that the average posttest score of the experimental class is 87.36 with a standard deviation of 7.457 and the average posttest score of the control class is 75.00 with a standard deviation of 13.828. Descriptively, it can be seen that the average value of the experimental class is higher than that of the control class. Since the Sig. < 0.05, it can be concluded that there is a significant difference between the results of the posttest of the experimental class and the control class. This shows that the treatment given in the experimental class is effective in improving learning outcomes.

The experimental class obtained a higher score compared to the control class because the experimental class was given treatment using the PBL model with ethnomathematical nuances that made students active in the learning process. With contextual mathematical problem solving that is close to the culture in the surrounding environment and daily life, students find it easier to understand the material, have high curiosity, and are enthusiastic about solving problems. Meanwhile, in the control class, students are less active, this can affect the learning outcomes obtained to be relatively lower.

The PBL model has a very close continuity with ethnomathematics because both go through a learning process with contextual problems. PBL provides a systematic framework in the problem-solving process, while ethnomathematics provides a meaningful local cultural context. The combination of PBL and ethnomathematics constructs mathematical concepts in a more real, relevant, and applicative way.

**Table 4.** Table Presented (%)

| Category | Indicator 1 | Indicator 2 | Indicator 3 | Indicator 4 |
|---|---|---|---|---|
| Height | 100% | 100% | 100% | 100% |
| Medium | 96,30% | 88,89% | 0% | 88,89% |
| Low | 100% | 25% | 0% | 50% |

Based on the analysis of the percentage of achievement indicators, mathematical problem-solving ability indicators were reviewed from the Confidence category (High, Medium, Low). In the High category, all students showed maximum achievement in each indicator. The achievement percentage of indicators 1, 2, 3, and 4 is 100%, respectively. This shows that students with high confidence are able to solve problem-solving problems thoroughly.

In the Medium category, the achievement in indicator 1 was 96.30%, indicators 2 and 4 were 88.89%, respectively, while indicator 3 was 0%. However, there are difficulties in Indicator 3, which is usually related to the process of implementing strategies or core steps of problem solving. The Low category indicates varied achievements. Indicator 1 has a percentage of 100%, indicator 2 of 25%, indicator 3 of 0%, and indicator 4 of 50%. These findings indicate that low self-confidence has a significant impact on students' inability to continue the problem-solving process to a more complex stage.

In the low category in indicator 1 gets 100%, the achievement of 100 shows that most students are able to identify the information obtained in the question. Students are able to make strategic decisions, but low confidence has an impact on the planning and implementation stages of completion strategies, so that students still have difficulty in completing the next process. Thus, it can be concluded that self-confidence is an important factor that affects the success of students in the mathematical problem solving stage.

## CONCLUSION

Based on the results of research and discussion, the PBL model with ethnomathematical nuances is effective in improving students' mathematical problem-solving skills. It is proven that the average problem-solving ability of the experimental class is significantly higher than the predetermined KKM of 75. The t-test in the experimental class was higher than in the control class. Confidence affects the achievement of problem-solving indicators, students with a high level of confidence show more optimal achievement at each stage of problem-solving. Based on these data, the application of the PBL model with ethnomathematical nuances not only increases mathematical problem-solving skills, but also provides an increase in the development of students' confidence in mathematics learning.

## REFERENCES

Adhyan, A. R., & Sutirna, S. (2022). Kemampuan Pemecahan Masalah Matematis Siswa Mts Pada Materi Himpunan. *JPMI* (*Jurnal Pembelajaran Matematika Inovatif*), 5(2), 451-462.

Ardanari, M. S., Wantoro, J., Riyanti, R. F., & Siswanto, H. (2024). Model Problem Based Learning ( PBL ) untuk Meningkatkan Kompetensi Materi Pengurangan Mata Pelajaran Matematika bagi Siswa Sekolah Dasar Kelas Rendah. *JIKM: Jurnal Ilmiah Kampus Mengajar*, 4(1), 1–13.

Arofah, A. J. & Hidayati, N. (2021). Analisis Kepercayaan Diri Siswa Smp Kelas IX Dalam Pembelajaran Matematika. *Junal MAJU*, 8(2), 330-333.

Disparrilla, Y. N., & Afriansyah, E. A. (2022). Analisis kemampuan pemecahan masalah matematis dan self-efficacy siswa pada materi SPLDV. *SIGMA: Jurnal Pendidikan Matematika*,14(2), 148-161.

Elsyavalia, S., Indiati, I., & Fatoni, A. (2023). Penerapan Model Problem Based Learning (PBL) untuk Meningkatkan Hasil Belajar Tematik Kelas III *SD N Rejosari 01 Semarang. Dalam Prosiding Seminar Nasional Pendidikan Profesi Guru* 1(2), 2672-2683.

Gumelar, R, H.,Yuliawati, L., Yusuf, Y. (2023). Mathematical problem-solving ability of students and student responses in the guided discovery learning (GDL) model. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education*. 8(2), 255-264.

Hasibuan, P. H. (2022). *Pengaruh bimbingan orang tua dalam keluarga terhadap konsep diri remaja di Lingkungan Pekan II Sigambal Kecamatan Rantau Selatan Kabupaten Labuhanbatu*. IAIN Padangsidimpuan.

Marleny, A. S., Somakim, Aisyah, N., Darmawijoyo, & Araiku, J. (2020). Ethnomathematics-based learning using oil palm cultivation context. *Journal of Physics: Conference Series,* 1480(1).

Musliha, & Revita, R. (2021). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Kemampuan Pemecahan Masalah Matematis Ditinjau Dari Self Regulated Learning Siswa. *JRPM (Jurnal Review Pembelajaran Matematika),* 6(1), 68–82.

Ningrum, L. D. (2020). *Analisis Kemampuan Pemecahan Masalah Matematis Siswa SMP pada Materi Segiempat dan Segitiga melalui Kerangka Kerja Polya.* Universitas Pendidikan Indonesia.

Nurhayati, N., Labulan, P. M. L., & Berahman, B. (2022). Kemampuan menyelesaikan masalah sistem persamaan linear pada Siswa kelas X. *Primatika : Jurnal Pendidikan Matematika,* 11(2), 121-128.

Nursyeli, F., & Puspitasari, N. (2021). Studi Etnomatematika pada Cangkuang Leles Garut Candi Jawa Barat. *Plusminus: Jurnal Pendidikan Matematika,* 1(2), 327-338.

OECD (2023), PISSA 2022 *Assessment and Analytical Framework,* OECD Publising.

Pratiwi, J. W., & Pujiastuti, H. (2020). Eksplorasi Etnomatematika Pada Permainan Tradisional Kelereng. *Jurnal Pendidikan Matematika Indonesia,* 5(2), 1–12.

Ramadhani, S. P., Pratiwi, F. M., Fajriah, Z. H., & Susilo, B. E. (2024). Efektivitas Model Problem Based Learning (PBL) untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis terhadap Pembelajaran Matematika. *PRISMA, Prosiding Seminar Nasional Matematika,* 7, 724–730.

Setyani, Y. L., & Amidi, A. (2022). Telaah Model PBL-RME Bernuansa Etnomatematika pada Outdoor Learning terhadap Kemampuan Pemecahan Masalah Matematis Peserta Didik. *PRISMA, Prosiding Seminar Nasional Matematika*, *5*, 520–536.

Simanjuntak, M. O. (2022). *Pengaruh Kepercayaan Diri Terhadap Hasil Belajar Matematika Siswa pada Materi Sistem Persamaan Linear Dua Variabel di Kelas VIII SMP Marisi Medan* (Doctoral dissertation, Universitas HKBP Nommensen).

Sinaga. C. V. R. (2020). *Pengembangan Perangkat Pembelajaran Matematika*. Forum Pemuda Aswaja.

Widyastuti, R. T., & Airlanda, G. S. (2021). Efektivitas Model Problem Based Learning terhadap Kemampuan Pemecahan Masalah Matematika Siswa Sekolah Dasar. *Jurnal Basicedu,* 5(3), 1120-1129.