AN EVALUATION OF MATHEMATICS INSTRUCTION IN FOSTERING CREATIVE PROBLEM-SOLVING SKILLS AMONG GRADE 3 STUDENTS

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ABSTRACT

This research is motivated by field conditions where third-grade elementary school students often associate mathematics learning with feelings of fear, difficulty, and exhaustion, which ultimately hinders the emergence of Creative Problem Solving (CPS) skills. This study aims to describe students' problem-solving processes and difficulties, analyze the teacher's role as a facilitator, and evaluate the implementation of creative problem-solving instruction. A quantitative approach utilizing a Quasi-Experimental Design (Two-Treatment Design) was employed. The research sample consisted of a student group at SDN Jogoyasan receiving the Problem Based Learning (PBL) model and a student group at SDN Keditan receiving the Discovery Learning (DL) model. Data were collected through test techniques (pretest-posttest) and non-test methods (Y-Chart reflection instrument), which were analyzed statistically using SPSS and qualitatively using MAXQDA 2020 software. Hypothesis testing results revealed that both learning models had a highly significant effect on improving students' CPS abilities ($p < 0.001$). The PBL class experienced a Gain Score increase of 20.71 points, while the DL class increased by 18.46 points. Qualitative findings indicated that the use of concrete learning media and the creation of a Joyful Learning environment effectively transformed negative emotions into metacognitive awareness (Mindful Learning), making students braver and more enthusiastic in exploring problem-solving strategies. In conclusion, the integration of PBL and DL models with a Deep Learning approach is effectively implemented to enhance the CPS skills of third-grade elementary school students.

***Keywords**: Creative Problem Solving; Problem Based Learning; Discovery Learning; Deep Learning; Elementary Mathematics*

ABSTRAK

Penelitian ini dilatarbelakangi oleh kondisi di lapangan dimana siswa kelas 3 SD seringkali mengaitkan pembelajaran matematika dengan rasa takut, kesulitan, dan kelelahan, yang pada akhirnya menghambat munculnya keterampilan *Creative Problem Solving* (CPS). Penelitian ini bertujuan untuk mendeskripsikan proses pemecahan masalah dan kesulitan siswa, menganalisis peran guru sebagai fasilitator, serta mengevaluasi implementasi pembelajaran pemecahan masalah kreatif. Pendekatan kuantitatif dengan *Quasi-Experimental Design* (desain dua perlakuan) digunakan dalam penelitian ini. Sampel penelitian terdiri dari kelompok

siswa di SDN Jogoyasan yang menerima model *Problem Based Learning* (PBL) dan kelompok siswa di SDN Keditan yang menerima model *Discovery Learning* (DL). Pengumpulan data dilakukan menggunakan teknik tes (pretest-posttest) dan non-tes (instrumen refleksi Y-Chart), yang dianalisis secara statistik menggunakan SPSS serta secara kualitatif dengan *software* MAXQDA 2020. Hasil pengujian hipotesis menunjukkan bahwa kedua model pembelajaran memberikan pengaruh yang sangat signifikan terhadap peningkatan kemampuan CPS siswa ($p < 0,001$). Kelas PBL mengalami peningkatan *Gain Score* sebesar 20,71 poin, sedangkan kelas DL mengalami peningkatan sebesar 18,46 poin. Temuan kualitatif mengindikasikan bahwa penggunaan media pembelajaran konkret dan penciptaan lingkungan *Joyful Learning* terbukti ampuh mengubah emosi negatif menjadi kesadaran metakognitif (*Mindful Learning*), sehingga siswa lebih berani dan antusias dalam mengeksplorasi strategi pemecahan masalah. Kesimpulannya, integrasi model PBL maupun DL dengan pendekatan *Deep Learning* secara efektif mampu meningkatkan keterampilan CPS siswa kelas 3 SD

Kata Kunci: *Creative Problem Solving*; *Problem Based Learning*; *Discovery Learning*; *Deep Learning*; Matematika Sekolah Dasar

A. Introduction

Mathematics learning at the elementary school level plays an important role in developing students' logical thinking, critical reasoning, and creative problem-solving abilities. In the context of 21st-century education, mathematics instruction is no longer limited to memorizing formulas and procedural calculations, but also emphasizes higher-order thinking skills that enable students to solve contextual problems creatively and independently. The implementation of the Merdeka Curriculum further encourages meaningful and student-centered learning experiences in mathematics instruction (Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi, 2022).

However, many elementary students still perceive mathematics as a difficult and frightening subject. These negative perceptions often lead to math anxiety, causing students to become passive, afraid of making mistakes, and reluctant to explore alternative problem-solving strategies. As a result, mathematics learning tends to focus more on memorization than on reasoning and creative thinking processes. This condition is problematic because Creative Problem Solving (CPS) skills require students to think flexibly, generate

multiple ideas, and elaborate solutions systematically (Zairul et al., 2023).

From a developmental perspective, third-grade elementary students are in the concrete operational stage, where logical thinking develops more effectively through concrete and contextual experiences (Handika et al., 2022). Therefore, mathematics instruction requires learning approaches that actively involve students in authentic problem-solving activities using concrete learning media. To examine students' emotional and cognitive experiences during mathematics learning, this study utilizes Y-Chart reflections analyzed using MAXQDA 2020, enabling the identification of learning dynamics related to students' engagement and problem-solving awareness (Relmasira & Thrupp, 2016).

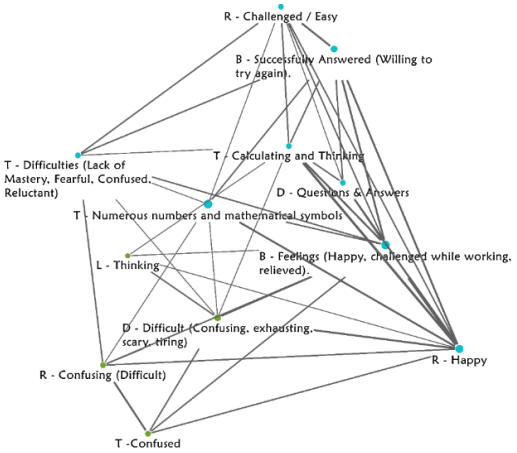

Figure 1. Concept Map of Mathematics Learning Dynamics

(Source: Processed by the Researcher using MAXQDA 2020, 2026)

The concept map above indicates that students' emotional conditions strongly influence the emergence of creative problem-solving abilities during mathematics instruction. Positive emotions such as enthusiasm and confidence encourage students to participate actively in exploring various solution strategies, whereas negative emotions tend to inhibit students' creativity. Unfortunately, creative thinking skills have not yet become the primary focus of mathematics instruction in many Indonesian elementary schools, resulting in a gap between curriculum expectations and classroom practices (Wibowo & Purnomo, 2023). To address this issue, innovative instructional models such as Problem Based Learning (PBL) and Discovery Learning (DL) are considered relevant because both models encourage active participation, collaborative inquiry, and independent exploration during learning activities (Sekarsari et al., 2023). In addition, these models align with the principles of Deep Learning, which emphasize Meaningful Learning, Mindful Learning, and Joyful

Learning in classroom instruction (Wardani, 2025).

Previous studies revealed that the implementation of Creative Problem Solving-oriented instruction significantly improved students' mathematical creative thinking skills (Wibowo & Purnomo, 2023). Problem Based Learning was also found to improve mathematical problem-solving performance through contextual and collaborative activities (Setyaningsih & Rahman, 2022), while Discovery Learning effectively enhanced students' conceptual understanding through guided inquiry processes (Siregar, 2025). However, most previous studies focused primarily on quantitative learning outcomes, with limited attention given to students' individual problem-solving processes and emotional learning experiences.

Therefore, this study aims to evaluate mathematics instruction in fostering Creative Problem Solving skills among third-grade elementary school students through the implementation of Problem Based Learning and Discovery Learning models. The novelty of this study lies in its emphasis on analyzing students' individual problem-solving processes and emotional learning experiences through the integration of quantitative and qualitative approaches.

B. Methods

This study employed a quantitative approach using a quasi-experimental method with a two-treatment research design. The study involved two experimental groups consisting of third-grade elementary school students from the Telomoyo Cluster during the 2025/2026 academic year. Experimental Group 1 received treatment through the Problem-Based Learning (PBL) model, while Experimental Group 2 received treatment using the Discovery Learning (DL) model.

The conceptual framework of this study originated from empirical classroom problems in which mathematics was frequently perceived by students as a frightening and stressful subject. This condition caused students to rely mainly on memorization and imitation rather than developing creative problem-solving abilities. Therefore, this study implemented Creative Problem Solving (CPS)-oriented learning integrated with the Deep Learning approach to encourage Meaningful Learning, Mindful Learning, and Joyful Learning during mathematics

instruction. In this process, the teacher acted as a facilitator who guided students through contextual problem-solving activities using concrete learning media.

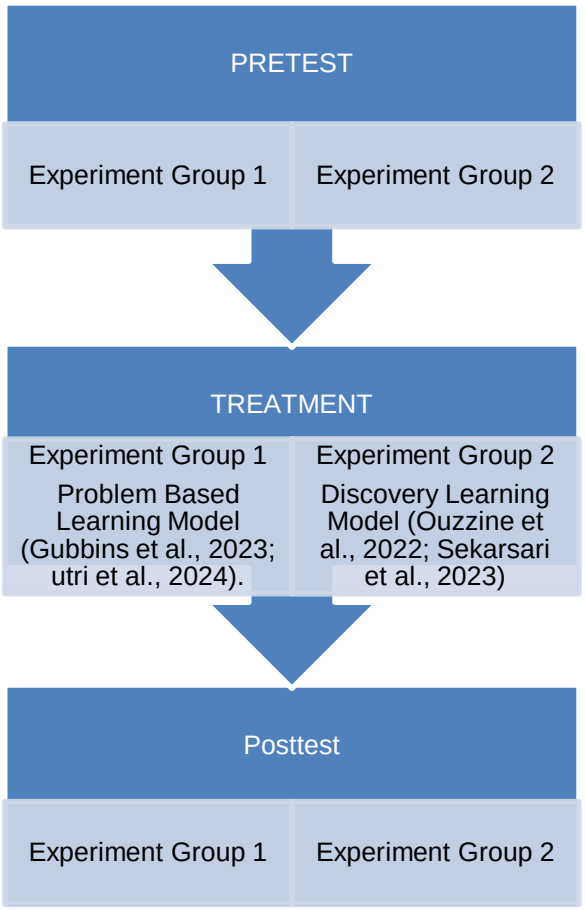

Figure 2. Conceptual Framework of the Study
(Source: Processed by the Researcher, 2026)

The research procedure consisted of three stages: pretest, treatment, and posttest. During the first stage, both experimental groups completed a pretest consisting of 10 multiple-choice questions designed to measure students' initial Creative Problem Solving (CPS) abilities, including fluency, flexibility, elaboration, and requirement analysis indicators. In the second stage, Experimental Group 1 participated in the "Cookies Bazaar" activity using the Problem-Based Learning model, while Experimental Group 2 engaged in the "Cake Showcase" activity using the Discovery Learning model. Finally, both groups completed a posttest using the same assessment indicators with different numerical values to measure students' improvement after the instructional treatments.

Based on the research design above, O1 and O2 represent the pretest scores of students' initial Creative Problem Solving (CPS) abilities, X1 refers to the treatment using the Problem-Based Learning (PBL) model, X2 refers to the treatment using the Discovery Learning (DL) model, while O3 and O4 represent the posttest scores after the treatments were implemented.

Data were collected through test and non-test techniques. The test instruments consisted of pretest and posttest questions, whereas the non-test instrument employed Y-Chart reflections to identify students' emotional and cognitive learning experiences. Quantitative data were

analyzed using descriptive statistics, normality tests, homogeneity tests, N-Gain analysis, and Paired Samples T-Test using IBM SPSS Statistics. Meanwhile, qualitative data from the Y-Chart reflections were analyzed using MAXQDA 2020 through coding and thematic categorization.

C. Results and Discussion

The implementation of Problem-Based Learning (PBL) and Discovery Learning (DL) positively contributed to improving students' Creative Problem Solving (CPS) abilities in mathematics learning. The descriptive statistics of students' pretest and posttest scores are presented in Table 1.

Table 1. Descriptive Statistics of Creative Problem Solving (CPS) Scores

School	Assessment	Mean	N	Std. Deviation
SDN Jogoyasan	Pretest	47.50	28	19.74
SDN Jogoyasan	Posttest	68.21	28	17.00
SDN Keditan	Pretest	42.69	26	18.01
SDN Keditan	Posttest	61.15	26	16.81

Based on Table 1, both experimental groups experienced improvement after the instructional treatments. Students at SDN Jogoyasan showed an increase from 47.50 to 68.21 after the implementation of Problem-Based Learning, while students at SDN Keditan improved from 42.69 to 61.15 following Discovery Learning activities. These findings indicate that both instructional models positively supported students' mathematical problem-solving abilities. Prior to hypothesis testing, normality and homogeneity analyses were conducted. The results are presented in Table 2.

Table 2. Normality and Homogeneity Test Results

Test	Sig. Value	Interpretation
Normality (Jogoyasan Pretest)	0.146	Normal
Normality (Jogoyasan Posttest)	0.139	Normal
Normality (Keditan Pretest)	0.251	Normal
Normality (Keditan Posttest)	0.413	Normal
Homogeneity (Pretest)	0.537	Homogeneous
Homogeneity (Posttest)	0.660	Homogeneous

Table 2 shows that all significance values exceeded 0.05, indicating that the data were normally distributed and homogeneous. Therefore, the assumptions for parametric statistical analysis were

fulfilled. To examine the effectiveness of the treatments, a Paired Samples T-Test was conducted. The results are presented in Table 3.

Table 3. Paired Samples T-Test Results

Group	Sig. (2-tailed)	Interpretation
SDN Jogoyasan (PBL)	<0.001	Significant
SDN Keditan (DL)	<0.001	Significant

The Paired Samples T-Test results revealed significance values below 0.05 for both experimental groups, indicating that Problem-Based Learning and Discovery Learning significantly improved students' Creative Problem Solving abilities. This finding supports the study of Sukamti and Mawardi (2024), which reported that contextual learning models effectively improve elementary students' mathematical problem-solving skills. To strengthen the quantitative findings, an N-Gain analysis was conducted, as presented in Table 4.

Table 4. N-Gain Score Results

Group	Gain Score	Category
SDN Jogoyasan	20.71	Moderate
SDN Keditan	18.46	Moderate

Based on Table 4, both instructional models demonstrated moderate effectiveness in improving students' Creative Problem Solving abilities. The PBL group achieved slightly higher improvement compared to the Discovery Learning group. This result aligns with the findings of Afitaningrum and Dewi (2024), which stated that problem-based instruction significantly influences students' creative thinking abilities. Although both instructional models significantly improved students' Creative Problem Solving abilities, the Problem-Based Learning group demonstrated slightly higher improvement compared to the Discovery Learning group. This finding indicates that contextual problem-solving activities involving collaborative discussions and authentic situations may provide stronger stimulation for elementary students' mathematical reasoning development. Nevertheless, Discovery Learning also showed positive effectiveness by encouraging students to independently construct mathematical concepts through exploration activities.

To obtain a deeper understanding of students' learning experiences, qualitative data from the Y-Chart reflections were analyzed using MAXQDA 2020. The coding

results were visualized through concept maps to identify students' emotional and cognitive engagement during mathematics instruction.

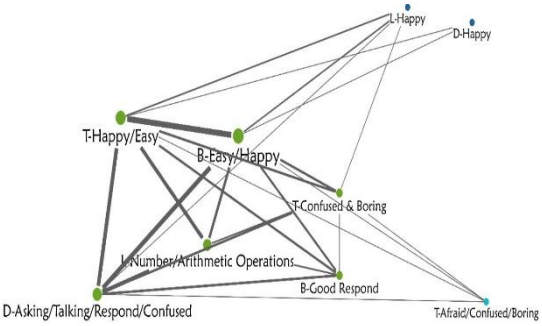

Figure 3. Concept Map of Learning Dynamics at SDN Jogoyasan (Source: Processed Data by Researcher via MAXQDA 2020, 2026)

Figure 3 indicates a strong relationship between the "Happy" and "Easy" codes, showing that positive emotional conditions influenced students' perceptions of mathematics learning. During the "Cookies Bazaar" activity, students actively participated in discussions, confidently asked questions, and explored various problem-solving strategies. These findings indicate that contextual and collaborative activities created a more enjoyable learning atmosphere. This finding supports the study conducted by Afitaningrum and Dewi (2024), which emphasized that students' creativity develops more optimally when they feel emotionally engaged in learning activities. A similar pattern was identified at SDN Keditan following the implementation of the Discovery Learning model.

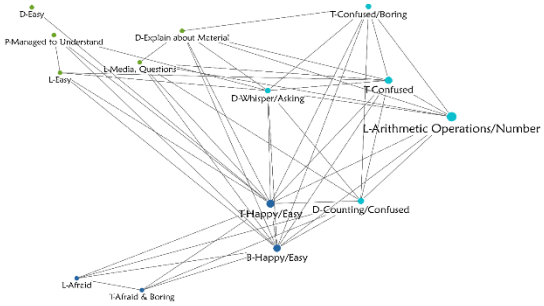

Figure 4. Concept Map of Learning Dynamics at SDN Keditan (Source: Processed Data by Researcher via MAXQDA 2020, 2026)

Figure 4 demonstrates that students focused more on independent concept discovery during the "Cake Showcase" activity. The dominant code "Managed to Understand" reflects students' awareness of their own thinking processes while solving mathematical problems. Through the use of concrete learning media, students perceived mathematics as easier to understand and became more confident in exploring alternative solution strategies. According to Parisu and Aopmonaim (2025), discovery-oriented learning models provide broader opportunities for students to develop divergent thinking and independent exploration skills.

The findings also demonstrate the successful integration of Deep

Learning principles during mathematics instruction. Joyful Learning emerged when students experienced positive emotions and active classroom engagement, while Mindful Learning was reflected through students' awareness of their reasoning processes during problem-solving activities. Furthermore, Meaningful Learning was achieved as students connected mathematical concepts with authentic situations through contextual learning media and collaborative exploration.

Overall, the integration of quantitative SPSS analysis and qualitative MAXQDA findings indicates that Problem-Based Learning and Discovery Learning effectively improved elementary students' Creative Problem Solving abilities in mathematics learning. The novelty of this study lies in its emphasis on students' problem-solving processes and emotional learning dynamics rather than focusing solely on learning outcomes.

D. Conclusion

This study concludes that the implementation of Problem-Based Learning (PBL) and Discovery Learning (DL) effectively improved the Creative Problem Solving (CPS) abilities of third-grade elementary school students in mathematics learning. The findings revealed significant improvements in students' posttest scores after the instructional treatments were implemented. Students at SDN Jogoyasan who received the Problem-Based Learning treatment demonstrated an increase in the mean score from 47.50 to 68.21, while students at SDN Keditan who participated in Discovery Learning activities improved from 42.69 to 61.15. Furthermore, the Paired Samples T-Test results showed significance values of $p < 0.001$ in both experimental groups, confirming that both instructional models had a statistically significant effect on students' Creative Problem Solving abilities.

The findings also indicate that contextual learning activities supported by concrete learning media successfully encouraged students to become more active, confident, and independent during mathematics instruction. The Problem-Based Learning model demonstrated slightly higher improvement compared to the Discovery Learning model, indicating that collaborative problem-solving activities and authentic learning situations provide stronger stimulation

for elementary students' mathematical reasoning development.

In addition to the quantitative findings, the qualitative analysis using Y-Chart reflections and MAXQDA 2020 demonstrated that students experienced positive emotional and cognitive engagement during the learning process. The emergence of the "Happy," "Easy," and "Managed to Understand" codes reflects that students not only improved their mathematical achievement but also developed awareness regarding their own problem-solving processes. These findings confirm that the integration of Joyful Learning, Mindful Learning, and Meaningful Learning within the Deep Learning framework successfully transformed students' perceptions of mathematics from a stressful subject into a more meaningful and enjoyable learning experience.

Therefore, this study confirms that the integration of Problem-Based Learning and Discovery Learning with contextual activities and concrete learning media can effectively support the development of elementary students' Creative Problem Solving abilities in mathematics learning. The novelty of this study lies in its emphasis on analyzing students' individual problem-solving processes and emotional learning dynamics rather than focusing solely on quantitative learning outcomes

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