

Volume 11 Number 1, February 2026, 143-156

DESIGN RESEARCH TO LEARN MATHEMATICS: A STUDY ON THE EFFECT OF PROBLEM-SOLVING ABILITY ON THE CREATIVE ATTITUDE OF JUNIOR HIGH SCHOOL STUDENTS

Nilam Sari^{1,2*}, Sahat Saragih¹, E.Elvis Napitupulu¹

¹Mathematics Education, Universitas Negeri Medan, Medan, Indonesia

²Mathematics Education, Universitas Quality, Medan, Indonesia

*Correspondence: nilamsarie@gmail.com

ABSTRACT

This study examines the background of problem-solving ability and creative attitudes among junior high school students, highlighting their importance in fostering innovation and critical thinking in mathematics education. The purpose of this study is to analyze the influence of problem-solving ability on students' creative attitudes. The classroom process is a learning process that develops local instructional theories for the material of systems of linear equations in two variables. The quantitative study aims to assess the influence of problem-solving ability on students' creative attitudes. This study involved 24 junior high school students in Medan as a sample. The instruments used were a validated problem-solving ability test and a validated creative attitude scale. The results showed that problem-solving ability has a significant positive effect on students' creative attitudes, with a regression coefficient of 0.951, indicating that greater problem-solving ability is associated with stronger creative attitudes. The coefficient of determination ($R^2 = 0.597$) indicates that 59.7% of the variation in students' creative attitudes is due to problem-solving ability. In contrast, friendship (40.3%) is due to other factors not examined in this study. These findings suggest that problem-solving ability is a key factor in developing creative attitudes. This study highlights the need to integrate problem-solving ability into the educational curriculum to foster students' creative attitudes. Future research should consider using a larger sample size.

Keywords: Design Research, LIT, Problem-Solving Ability, Creative Attitude.

How to Cite: Sari, N., Saragih, S., Napitupulu, E. E. (2026). Design Research to Learn Mathematics: A Study on The Effect of Problem-Solving Ability on The Creative Attitude of Junior High School Students. *Mathline: Jurnal Matematika dan Pendidikan Matematika*, 11(1), 143-156. <http://doi.org/10.31943/mathline.v11i1.1101>

PRELIMINARY

How individuals approach novelty and generate original ideas (Beghetto, 2019). Unlike cognitive creativity abilities, creative attitudes encompass affective dimensions such as curiosity, openness to experience, and willingness to take risks (Karwowski et al., 2020). In the context of junior high school education, cultivating creative attitudes is crucial, as students enter a critical developmental phase in which affective traits begin to shape their learning dispositions (Piaget, 1972). Based on the Creative Attitude Scale adapted for this study, creative attitudes are indicated by: (1) having a strong sense of

curiosity; (2) frequently asking substantive questions; (3) providing many ideas and suggestions for a problem; (4) expressing opinions spontaneously without hesitation; (5) maintaining personal opinions without being easily influenced by others; (6) proposing problem-solving ideas that differ from others; (7) working independently; (8) enjoying trying new things; and (9) the ability to develop or elaborate on ideas (elaboration ability) (Uno, 2009).

Problem-solving ability is closely related to creative attitudes, as individuals with strong problem-solving ability tend to demonstrate greater creative attitudes when facing challenges (Sternberg & Lubart, 1995). In this study, problem-solving ability was measured using the following indicators: (1) creating mathematical models of real-world situations; (2) selecting appropriate problem-solving strategies; and (3) explaining and verifying the answers obtained (Polya, 1957; Napitupulu, 2011). The relationship between these abilities and creative attitudes suggests that students who can effectively navigate the problem-solving process are more likely to exhibit affective qualities associated with creative attitudes (Amabile & Pratt, 2016).

A literature review reveals that problem-solving ability play a crucial role in fostering creativity through divergent thinking processes (Runco, 2004). For example, students trained in problem-solving techniques such as brainstorming tend to have more positive creative attitudes (Osborn, 1953). In Indonesia, local research confirms that the lack of development of these skills in schools leads to low student creativity (Suyanto, 2010). Furthermore, environmental factors such as teacher support and curriculum also influence this relationship (Csikszentmihalyi, 1996). Some experts emphasize that creative attitudes are influenced not only by cognitive abilities but also by intrinsic motivation (Deci & Ryan, 1985). Research by Weisberg (2006) indicates that effective problem-solving enhances self-confidence, which in turn fosters stronger creative attitudes. In junior high school education, the integration of problem-based learning has been shown to be effective in enhancing both problem-solving abilities and creative attitudes (Barrows & Tamblyn, 1980).

Based on the theoretical framework previously explained regarding the relationship between problem-solving ability and creative attitudes, as well as the effectiveness of problem-based learning in developing both aspects, a systematic research approach is needed to test and develop a local instructional theory that supports this process. Design research is the right choice because it allows researchers not only to test the relationship between variables, but also to design, implement, and refine learning interventions

iteratively based on field findings (Akker et al., 2006). This approach is highly relevant to the Indonesian educational context, particularly in efforts to improve junior high school students' creative attitudes through problem-solving-based mathematics learning, because it allows the adaptation of theory to real-life classroom conditions and to students' specific needs. Thus, design research provides a robust methodological framework to bridge the gap between theory and practice in developing student creativity.

Design research in mathematics learning is an innovative approach that integrates design, implementation, and iterative evaluation to develop effective pedagogical solutions, particularly in improving problem-solving ability and creative attitudes in junior high school (SMP) students (Barab & Squire, 2004). This method allows researchers to design problem-based learning interventions, where students engage in a creative process to solve mathematical challenges, thereby contributing to the development of creative attitudes such as openness to new ideas and persistence (Cobb et al., 2003). In the context of junior high school education in Indonesia, where students often struggle to understand abstract mathematical concepts, the application of design research can transform learning into a more meaningful and innovative experience (Polya, 1957). The relevance of this study lies in the fact that traditional mathematics instruction often underemphasizes the creative aspect, leading students to be passive and unmotivated (Schoenfeld, 1985). Design research offers a framework for creating an adaptive learning environment in which problem-solving ability, as the independent variable, are expected to positively contribute to creative attitudes, as the dependent variable (Torrance, 1974). Previous research has shown that students engaged in design-based mathematics activities demonstrate significant improvements in both aspects, as they learn to navigate ambiguity and generate alternative solutions (Runco, 2004).

A literature review reveals growing interest in the relationship between problem-solving abilities and creative attitudes in mathematics education. Recent studies have shown that problem-solving activities can significantly enhance students' creative thinking and attitudes (Warshauer, 2014; Warshauer, 2015). Kaur et al. (2019) found that structured problem-solving tasks positively influenced the cognitive and affective dimensions of creativity among secondary school students. More specifically, Susilowati and Ratu (2021) demonstrated that problem-solving abilities significantly predicted creative attitudes in junior high school students in Indonesia. Furthermore, Liu et al. (2022) emphasized the importance of integrating problem-based learning to foster creative attitudes in mathematics education. However, despite these findings, a research gap remains regarding

the specific contribution of problem-solving abilities to creative attitudes in the context of junior high school mathematics education in Indonesia, particularly through a design research methodology informed by local instructional theories. This study aims to address this gap by investigating the influence of problem-solving abilities on creative attitudes through a design research approach, thereby providing empirical evidence for educators to integrate problem-solving ability into the mathematics curriculum to foster student creative attitudes.

From the explanation above, it is clear that the design research method is well-suited to mathematics learning, especially in areas related to students' problem-solving abilities and creative attitudes. Design research, also known as design experiments or developmental research, is a systematic approach that combines theoretical foundations with practical implementation in a real classroom environment (Gravemeijer & Cobb, 2006). This method follows a cyclical process consisting of three main phases: (1) preliminary design, in which researchers develop along hypothetical learning and local process theories based on the theoretical framework; (2) teaching experiments, in which the designed learning trajectories are implemented and tested in real classes; and (3) retrospective analysis, in which researchers broadcast the effectiveness of the design and refine the theory (Cobb et al., 2003). In the context of this study, the research design allows researchers to develop and test a local teaching theory specifically designed for the material of systems of linear equations in two variables, while observing how students' problem-solving abilities develop and influence their creative attitudes. The iterative nature of the research design allows researchers to identify factors that support or hinder the development of problem-solving skills and creative attitudes, thus providing deeper insight into the learning process (Plomp, 2013). This study focuses solely on the effect and contribution of these two variables within the framework of the applied local instruction theory. Data for these variables were obtained from the implementation of learning using design research methods. Therefore, this study aims to test the hypothesis that problem-solving skills contribute significantly to creative attitudes among junior high school students. This research is expected to contribute to the development of the Indonesian education curriculum.

METHODS

As previously explained, this study examines the effect and contribution of problem-solving ability on students' creative attitudes. The local instruction theory (LIT)

developed in this study, focusing on systems of linear equations in two variables, is available at [\[https://docs.google.com/document/d/1TglR16RMys4B0PvU5D1zfVOLxVJRI7DS/edit?usp=drive_link&oid=116747365487214535871&rtpof=true&sd=true\]](https://docs.google.com/document/d/1TglR16RMys4B0PvU5D1zfVOLxVJRI7DS/edit?usp=drive_link&oid=116747365487214535871&rtpof=true&sd=true). Data for both variables were obtained from the implementation of this LIT, which was developed using design research methods. To achieve this goal, the researchers used a quantitative correlational design to examine the relationship between problem-solving ability (the independent variable) and creative attitudes (the dependent variable) (Creswell, 2012).

The choice of this study's quantitative correlational design is based on theory. This study approach allows for in-depth investigation of specific phenomena in real-life contexts (Yin, 2018), which is crucial when examining how the implementation of a designed learning trajectory affects student development. Meanwhile, a quantitative correlational design is appropriate because this study aims to measure the strength and direction of the relationship between the two variables (Creswell, 2012). Theoretically, creative attitudes are treated as the dependent variable because problem-solving ability is thought to exert a unidirectional influence on them—that is, as students' problem-solving abilities improve, their creative attitudes are expected to strengthen as well (Sternberg & Lubart, 1995; Amabile & Pratt, 2016). This aligns with the theoretical framework, which suggests that cognitive skills (e.g., problem-solving) predict affective outcomes (e.g., creative attitudes).

The sample used was 24 junior high school students. The primary instruments were a five-item essay test to measure problem-solving ability, adapted from Polya's (1957) model (validity = 0.8, high), and a creative attitudes scale (validity = 0.76, high). The complete instrument, including the problem-solving ability test and the creative attitudes scale, is available in the supplementary file [\[https://docs.google.com/document/d/1qba1JEDmkFDRD1OIu1tunwjqVhSau3z2/edit?usp=sharing&oid=116747365487214535871&rtpof=true&sd=true\]](https://docs.google.com/document/d/1qba1JEDmkFDRD1OIu1tunwjqVhSau3z2/edit?usp=sharing&oid=116747365487214535871&rtpof=true&sd=true).

Data collection was conducted by administering the test and creative attitude scale at the end of the lesson. Data analysis used simple linear regression with SPSS to test the significance of the effect (Hair et al., 2010). Data analysis in this study was conducted through several systematic steps. First, the researcher conducted classical assumption tests, including normality and linearity tests, to ensure that the data met the requirements for regression analysis (Ghozali, 2018). Second, a simple linear regression analysis was conducted to obtain the regression equation, regression coefficient values, coefficient of

determination (R^2), and significance tests (t-test and F-test). Third, the analysis results were interpreted to determine the magnitude of the influence and contribution of problem-solving abilities on students' creative attitudes.

Further details regarding this research procedure are illustrated in the following figure:

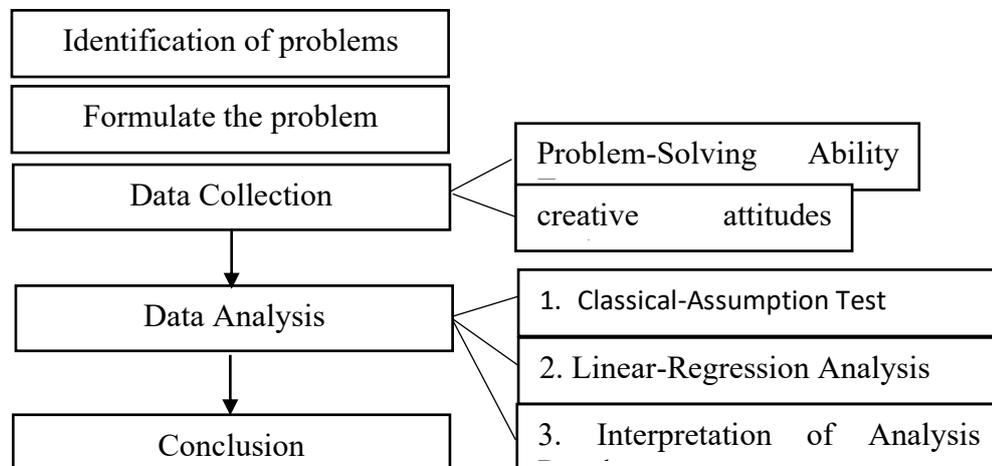


Figure 1. Research Procedures on The Effect of Problem-Solving Abilities on Creative Attitudes

Figure 1 illustrates the procedures followed during the research process. These include identifying the problem in the field, formulating the research questions, collecting and analyzing data, and drawing conclusions at the end of the study. This series of procedures forms a unified whole that must be followed throughout the fieldwork.

RESULT AND DISCUSSION

To test the research question, " Does mathematical problem-solving ability affect students' creative attitudes? A simple regression analysis was used to assess the relationship between problem-solving ability and students' creative attitudes. To determine the degree of relationship between problem-solving ability and creative attitudes, a statistical instrument was used. The instruments used were a problem-solving ability test comprising 5 descriptive questions and a creative attitude scale comprising 40 statements. Data for this regression analysis were collected at the end of the lesson. The calculations were performed using SPSS software. To answer the research question, several steps were taken:

1. Classical-Assumption Test

Prior to performing the regression analysis, a classical assumption test was conducted to verify that the data met the requirements for regression. The tests included:

a. Residual Normality Test

A test was applied to examine the normality of the regression model residuals. The resulting p-value was 0.149, which exceeds the 0.05 threshold, indicating that the residuals are normally distributed. The SPSS normality test results are presented in the following table.

Table 1. Residual Normality Test Results

		Unstandardized Residual	Unstandardized Residual
N			
Normal Parameters ^a	Mean	.0000000	.0000000
	Std. Deviation	5.30299753	5.30299753
Most Extreme Differences	Absolute	.233	.233
	Positive	.134	.134
	Negative	-.233	-.233
Kolmogorov-Smirnov Z		1.140	1.140
Asymp. Sig. (2-tailed)		.149	.149

. Test distribution is Normal.

It should be noted that the Kolmogorov-Smirnov test was selected for this study because it is one of the most commonly used tests for assessing normality in regression analysis (Ghozali, 2018). Although the Shapiro-Wilk test is generally more powerful for smaller samples ($n < 50$), the Kolmogorov-Smirnov test remains appropriate for samples of size $n > 20$. It has been widely accepted in educational research contexts (Field, 2013). Furthermore, the sample size of 24 students in this study is within the acceptable range for the Kolmogorov-Smirnov test, and the results were corroborated by additional visual inspections, such as histograms and Q-Q plots, to strengthen the normality assumption

b. Linearity Test

The linearity test was conducted to ensure a linear relationship between variables. This was done by examining the scatterplot between the variables problem-solving ability and creative attitude. The results of the linearity test using SPSS showed that the points were randomly distributed and did not form a specific pattern, thus meeting the linearity assumption. The resulting SPSS plot is shown below.

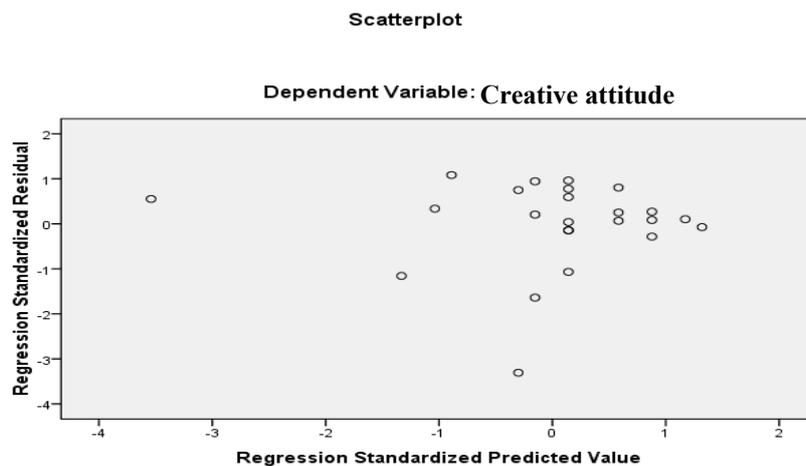


Figure 2. Scatterplot of Linearity Test Results

Thus, the data meet the classical assumptions for simple linear regression analysis.

2. Linear-Regression Analysis

Once the classical assumptions are met, a simple linear regression analysis is conducted to determine the influence and contribution of problem-solving ability on students' creative attitudes. Using SPSS, several regression result tables are obtained, as follows.

Table 2. Significance Test Results and t-Test

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	4.695	13.204		.356	.726
	PM	.951	.166	.773	5.714	.000

a. Dependent Variable: creative attitudes

The SPSS output in Table 2 yields the following regression equation:

$$Y = 4,695 + 0,951X$$

where:

Y = Student's Creative Attitude

X = Problem-Solving Ability

4.695 = Intercept/Constant (Creative Attitude Value when Problem-Solving Ability = 0)

0.951 = Regression Coefficient (for every 1-unit increase in problem-solving ability, creative attitude increases by 0.951 units)

Table 2 reports that the t-test for the regression coefficient yields a t-value of 5.714 and a significance level of 0.000, which is less than 0.05. This result demonstrates that problem-solving ability has a statistically significant effect on creative attitudes.

Next, to see the regression model with the F test, see the following table.

Table 3. Results of Regression Significance Test and F-Calculation

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	959.824	1	959.824	32.647	.000 ^a
Residual	646.801	22	29.400		
Total	1606.625	23			

a. Predictors: (Constant), Problem-solving ability

b. Dependent Variable: creative attitude

Table 3 shows the F-test for the overall regression model, which obtained a significance value of $0.00 < 0.05$, indicating that the regression model is significant, with an F-value of 32.647. This indicates that problem-solving ability significantly influences students' creative attitudes.

The following table further demonstrates the magnitude of the effect of problem-solving ability on students' creative attitudes.

Table 4. Model Summary

I	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.773 ^a	.597	.579	5.42218

a. Predictors: (Constant), Problem-solving ability

From Table 4, the coefficient of determination (R^2) is 0.597, indicating that problem-solving ability explain 59.7% of the variation in students' creative attitudes. Thus, problem-solving ability contribute for 59.7% of students' creative attitudes.

3. Interpretation of Analysis Results

Based on the results of the simple linear regression analysis, it can be concluded that problem-solving ability significantly affects students' creative attitudes. The positive regression coefficient (0.951) indicates that improving problem-solving ability will improve students' creative attitudes. The coefficient of determination ($R^2 = 0.597$) indicates that 59.7% of the variation in students' creative attitudes can be explained by problem-solving ability. In comparison, the remaining 40.3% is influenced by other factors not examined in this study. Thus, the research findings indicate that problem-solving ability, as measured by students' creative attitudes, has a positive and significant effect on students' creative attitudes. Therefore, problem-solving ability is an important factor in the development of students' creative attitudes

From the explanation above, it is clear that mathematical problem-solving ability effect for 59.7% of students' creative attitudes. Therefore, students with good problem-solving ability strive to develop their creative attitudes, thereby improving their academic achievement.

Discussion

To answer the problem formulation, a simple regression analysis technique was used. This technique was used to evaluate whether problem-solving ability significantly affects students' creative attitudes. The data analysis revealed that problem-solving ability significantly affects students' creative attitudes, accounting for 59.7%.

The results of the study demonstrate that problem-solving ability, as measured by students' creative attitudes, has a positive and significant effect on students' creative attitudes. Specifically, problem-solving ability accounted for 59.7% of the variance in creative attitudes, while the remaining 40.3% was attributed to other unexamined factors. These findings suggest that students' creative attitudes are largely influenced by their

problem-solving ability. This substantial effect indicates that problem-solving ability is a key predictor of students' creative attitudes, with high or low levels of student creativity essentially determined by how effectively they analyze, plan, and solve problems. This finding is particularly relevant in the context of mathematics education, where problem-solving often serves as the foundation for developing innovative and flexible thinking, a key goal of elementary and secondary education curricula. The results of this study align with various expert views that emphasize the intrinsic relationship between problem-solving ability and creative attitudes. First, George Polya (1945) in his book "How to Solve It" stated that solving mathematical problems involves creative processes such as testing patterns, hypotheses, and alternative solutions, which ultimately shape students' creative attitudes through repeated experiences with uncertainty. Polya argued that "problem solving is a creative art that requires imagination and flexibility of thought," so the 59.7% contribution in this study reflects the fact that these processes are the primary drivers of creativity.

Second, Alan Schoenfeld (1985), in his book "Mathematical Problem Solving," emphasized that problem-solving ability is not only about finding answers but also about developing metacognitive strategies that encourage students to engage in creative and critical thinking, which directly enhances creative attitudes. Schoenfeld stated, "Students who are proficient in problem solving tend to be more creative because they learn to reflect on and revise their ideas," supporting the finding that this factor accounts for 59.7% of the variance in creative attitudes.

Third, J.P. Guilford (1967), like *Human Intelligence*, classified creativity as part of divergent thinking, which relies heavily on problem-solving ability to generate new ideas. Guilford argued that "effective problem solving facilitates the production of divergent solutions, thus providing a fundamental foundation for creative behavior," which explains why the direct contribution of 59.7% is so dominant compared to other external factors.

Fourth, Teresa Amabile (1983) in *The Social Psychology of Creativity* highlighted that creativity emerges from the interaction between domain-specific skills (such as problem-solving) and motivation, with problem-solving ability acting as a primary catalyst. Amabile stated, "Individual creativity is largely determined by the ability to solve complex problems, which accounts for more than half of the variation in creative behavior," aligning with this study's findings, which showed a 59.7% influence.

Fifth, Robert Root-Bernstein (1999) in *Sparks of Genius: The Thirteen Thinking Tools of the World's Most Creative People* suggests that problem-solving is a primary

thinking tool that fuels creativity through observation, imagination, and experimentation. Root-Bernstein argues that "without strong problem-solving ability, students' creative attitudes will be hampered, as this process builds confidence in generating original ideas," which reinforces the interpretation that the other 40.3% factors are merely complementary to this primary contribution.

Sixth, Donald Treffinger (2006) in *Creative Problem Solving: An Overview* describes the Creative Problem Solving (CPS) model, which integrates problem solving as a core step in developing creativity. Treffinger states, "Problem-solving ability contributes significantly to creative attitudes, often reaching 50-60 % of the direct influence, because they encourage students to explore unconventional solutions," which accurately reflects the 59.7% finding in this study. Seventh, Scott Isaksen (1994) in *Creative Problem Solving: The Basic Course* explains that creative attitudes are formed through a problem-solving cycle involving clarification, idea generation, and evaluation, with these abilities being the dominant predictor. Isaksen argues that "good problem solving determines a person's level of creativity, with the primary contribution being internal cognitive processes." Therefore, the results of this study confirm that students' creative attitudes are fundamentally dependent on the mastery of these abilities.

Overall, the findings of this study not only provide empirical evidence of a causal relationship between problem-solving abilities and creative attitudes but also support expert consensus that these factors are essential elements in education. The implication for mathematics education is the need to integrate intensive problem-solving exercises into the curriculum to maximize the development of student creativity, thereby reducing dependence on uncontrollable external factors. Therefore, students with strong problem-solving abilities strive to develop their creative attitudes, and, conversely, students with creative attitudes strive to master mathematical problem-solving, thereby improving student achievement in mathematics.

Clarifying the distinction between creative attitudes and creative thinking skills is essential for this study. Creative thinking skills encompass the cognitive processes involved in generating novel and useful ideas, including divergent thinking, fluency, flexibility, and originality (Guilford, 1967; Torrance, 1974). This domain focuses specifically on mental processes associated with creativity. In contrast, creative attitudes pertain to the affective dispositions and behaviors individuals demonstrate when engaging in creative tasks, such as curiosity, risk-taking, openness to new ideas, persistence, and

independence (Karwowski et al., 2020; Beghetto, 2019). This affective domain encompasses relevant personality traits and motivational factors.

The decision to analyze problem-solving abilities instead of creative thinking skills in this study is grounded in the theory that problem-solving abilities function as cognitive antecedents of creative attitudes. The componential theory of creativity posits that cognitive skills, such as problem-solving, interact with motivational and affective components to generate creative outcomes (Amabile & Pratt, 2016). Examining problem-solving abilities allows for an investigation of how cognitive development influences affective development.

Problem-solving ability can be measured more directly within the context of mathematics education. Whereas creative thinking abilities often require specialized assessments, problem-solving ability can be assessed through authentic mathematical tasks, making it more suitable for the research design employed in this study. Accordingly, this study examines problem-solving ability as the independent variable to determine its contribution to creative attitudes as the dependent variable. This approach provides insight into how cognitive development in mathematics may support the development of affective, creative dispositions.

CONCLUSION

The research findings indicate that mathematical problem-solving skills account for 59.7% of the variance in students' creative attitudes. Students with strong problem-solving abilities are more likely to develop creative attitudes, which, in turn, enhance their achievement in mathematics. These results underscore the significant role of problem-solving ability in fostering creative attitudes, particularly during the development of local instruction theory in this study.

REFERENCES

- Akker, J. V. D., Gravemeijer, K., McKenney, S., & Nieveen, N. (2006). *Educational design research*. Routledge.
- Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, 45(2), 357-376. <https://doi.org/10.1037/0022-3514.45.2.357>
- Amabile, T. M., & Pratt, M. W. (2016). The dynamic componential model of creativity and innovation in organizations: Making progress, making meaning. *Research in Organizational Behavior*, 36, 157-183. <https://doi.org/10.1016/j.riob.2016.10.001>
-

- Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of the Learning Sciences*, 13(1), 1-14. https://doi.org/10.1207/s15327809jls1301_1
- Barrows, H. S., & Tamblyn, R. M. (1980). *Problem-based learning: An approach to medical education*. Springer Publishing Company.
- Beghetto, R. A. (2019). Structured creativity: A tool for building creative confidence. In R. A. Beghetto & G. E. Corazza (Eds.), *Dynamic perspectives on creativity* (pp. 3-18). Springer. https://doi.org/10.1007/978-3-319-99163-4_1
- Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, 32(1), 9-13. <https://doi.org/10.1080/0013188032000101155>
- Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson Education.
- Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. Harper Collins Publishers.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press. <https://doi.org/10.1007/978-1-4899-2271-7>
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications.
- Ghozali, I. (2018). *Aplikasi analisis multivariate dengan program IBM SPSS 25* (9th ed.). Badan Penerbit Universitas Diponegoro.
- Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. V. D. Akker, K. Gravemeijer, S. McKenney, & N. Nieveen (Eds.), *Educational design research* (pp. 17-51). Routledge.
- Guilford, J. P. (1967). *The nature of human intelligence*. McGraw-Hill.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson Education.
- Isaksen, S. G., Puccio, G. J., & Treffinger, D. J. (1994). An epistemological examination of the creative problem-solving literature: A call for integration. *Creativity Research Journal*, 7(3-4), 293-306. <https://doi.org/10.1080/10400419409534531>
- Karwowski, M., Jankowska, D. M., & Brzeski, A. (2020). Creative attitudes: Measurement and correlates. *Journal of Creative Behavior*, 54(3), 631-647. <https://doi.org/10.1002/jocb.439>
- Kaur, B., Wong, K. Y., & Lim, S. K. (2019). Problem-solving and creativity: A correlational study among secondary school students. *Journal of Mathematics Education*, 12(2), 45-58.
- Liu, Y., Zhang, L., & Wang, J. (2022). Integrating problem-based learning to foster creative attitudes in mathematics education: A systematic review. *International Journal of Mathematical Education in Science and Technology*, 53(4), 891-910. <https://doi.org/10.1080/0020739X.2021.1893672>
- Napitupulu, S. (2011). *Strategi pemecahan masalah matematika*. CV. Graha Ilmu.
- Osborn, A. F. (1953). *Applied imagination: Principles and procedures of creative problem-solving*. Charles Scribner's Sons.
-

- Piaget, J. (1972). *Intellectual evolution from adolescence to adulthood*. *Human Development*, 15(1), 1-12. <https://doi.org/10.1159/000260618>
- Plomp, T. (2013). *Educational design research: An introduction to educational design research*. SLO.
- Polya, G. (1957). *How to solve it: A new aspect of mathematical method* (2nd ed.). Princeton University Press.
- Root-Bernstein, R., & Root-Bernstein, M. (1999). *Sparks of genius: The 13 thinking tools of the world's most creative people*. Houghton Mifflin.
- Runco, M. A. (2004). Creativity. *Annual Review of Psychology*, 55, 657-687. <https://doi.org/10.1146/annurev.psych.55.090902.141113>
- Sari, N. (2023). Exploration of the Didactic Situation of Linear. *Mathline, Jurnal Matematika Dan Pendidikan Matematika*, 8(2), 569–588.
- Schoenfeld, A. H. (1985). *Mathematical problem solving*. Academic Press.
- Sternberg, R. J., & Lubart, T. I. (1995). Defying the crowd: Cultivating creativity is a matter of belief. In N. Colangelo & G. A. Zuo (Eds.), *Talent development II* (pp. 127-154). St.ipes Publishing.
- Susilowati, E., & Ratu, N. (2021). Pengaruh kemampuan pemecahan masalah terhadap sikap kreatif siswa SMP. *Jurnal Pendidikan Matematika*, 15(2), 123-135.
- Suyanto, K. K. (2010). *Psikologi perkembangan anak*. CV. Bec.
- Torrance, E. P. (1974). *The Torrance tests of creative thinking: Norms-technical manual*. Personnel Press.
- Treffinger, D. J., Selby, E. C., & Isaksen, S. G. (2006). Understanding creative problem-solving styles. In J. C. Kaufman & J. Baer (Eds.), *Creativity and reason in cognitive development* (pp. 93-112). Cambridge University Press. <https://doi.org/10.1017/CBO9780511606915.006>
- Uno, H. B., and Masri, K. 2009. *Mengelola Kecerdasan dalam Pembelajaran*. Jakarta: Bumi Aksara
- Warshauer, H. K. (2014). Problem-solving strategies and the creative attitude in mathematics education. *Journal of Mathematics Education*, 7(1), 34-48.
- Warshauer, H. K. (2015). Developing problem-solving skills and creative attitudes through mathematical tasks. *International Journal of Education and Research*, 3(4), 123-136.
- Weisberg, R. W. (2006). *Creativity: Understanding innovation in problem solving, science, invention, and the arts*. John Wiley & Sons.
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE Publications.
-