Jurnal Theorems (*The Original Reasearch Of Mathematics*)
Volume 11, Number 2, May 2026
URL: http://ejournal.unma.ac.id/index.php/th

e-ISSN: 2528-102X
p-ISSN: 2541-4321

THE IMPACT OF INTERACTIVE MEDIA WITH PROBLEM-BASED LEARNING (PBL) ON STUDENT'S MATHEMATICAL CREATIVE THINKING ABILITY IN TERMS OF SELF-EFFICACY

Arbingatu Rahmawati[1], Mutia[2*], Syaripah[3]
Department of Mathematics Education, State Islamic Institute of Curup, Indonesia;
mutia@iaincurup.ac.id

***Corresponding Author**:**
Mutia
Institut Agama Islam Negeri (IAIN) Curup
mutia@iaincurup.ac.id
Contact Person: 0812-7398-8117

Article Info:
Received 2026-02-05
Revised 2026-03-04
Accepted 2026-04-27

How to Cite:
Rahmawati, Arbingatu., Mutia, Mutia., & Syaripah, Syaripah. (2026). The Impact of Interactive Media with Problem-Based Learning (PBL) on Student's Mathematical Creative Thinking Ability in Terms of Self-Efficacy. *Jurnal Theorems (The Original Research of Mathematics)*, *11*(2), 90-99.

ABSTRACT

Mathematical creative thinking ability is an essential skill to be developed in 21st-century learners. However, observations indicate that this ability is still relatively low, as students tend to produce limited, less original, and less detailed ideas. One of the approaches that can be applied to improve creative thinking ability is Problem Based Learning (PBL) assisted by interactive media. This study aims to examine the effect of the PBL model integrated with Google Sites interactive media on students' mathematical creative thinking ability in terms of their self-efficacy levels. This research employed a quasi-experimental method with a 2x3 factorial design. The subjects were eighth-grade students of SMP IT Rabbi Radhiyya in the academic year 2024/2025. The sample was determined using purposive sampling: class VIII.A was designated as the experimental group, which received instruction with the interactive Google Sites-based PBL model, and class VIII.C was designated as the control group, which received PBL instruction without the interactive media. The instruments used were a mathematical creative thinking test and a self-efficacy questionnaire. Data were analyzed using two-way ANOVA. The findings revealed significant differences in mathematical creative thinking ability between students taught with PBL using Google Sites interactive media and those taught with PBL without interactive media. Furthermore, differences were also found based on students' self-efficacy levels (high, medium, low). However, no interaction was found between the learning model and self-efficacy levels on students' mathematical creative thinking ability.

Keywords: Problem Based Learning (PBL); Interactive Media; Google Sites; Mathematical Creative Thinking; Self-Efficacy

INTRODUCTION

Education plays a fundamental role in developing a generation capable of thinking creatively, innovatively, and adaptively in response to the rapid advancement of the era. In mathematics education, creative thinking is an essential competency as it enables students to develop innovative solutions, approach problems from diverse perspectives, and connect mathematical concepts to real-words contexts. Nevertheless, numerous studies consistently demonstrate creative thinking abilities of students in Indonesia remain suboptimal. This persistent challenge is substantiated by data from the 2015 Global Creativity Index, which ranked Indonesia 115th out of 130 countries, indicating a lack of creativity, particularly among students. Previous studies by (Darusman, 2014; Anggoro, 2015) show

e-ISSN: 2528-102X
p-ISSN: 2541-4321

that students' creativity is often limited because teachers mostly use traditional methods with little use of interactive media. Similar observations at SMP IT Rabbi Radhiyya support this, as students tend to use only one method when solving open-ended problems and do not show much originality or detailed explanations. This clearly shows a lack in the key areas of creative thinking in math, like fluency, flexibility, originality, and elaboration. Also, students' beliefs about their own abilities, like self-efficacy, have not been properly supported. These beliefs are important because they affect confidence, persistence, and overall success in school (Bandura, 1997; Pajares, 2002).

One alternative learning strategy that can foster creativity and strengthen self-efficacy is Problem-Based Learning (PBL). PBL affords students the opportunity to confront authentic and complex problems, thereby stimulating divergent thinking and the generation of diverse solutions (Savery, 2006). However, the utilization of interactive media within PBL implementation remains limited. This is notable, as the Multimedia Learning theory (Mayer, 2009) posits that incorporating interactive media can enhance conceptual understanding by integrating visual and auditory channels. Google Sites represents one such promising medium, offering visualization, collaboration, and interactive simulation features that can effectively support student engagement.

Previous research has demonstrated the effectiveness of interactive media in mathematics learning. Wijayanti (2019) found that animation-based media could enhance student creativity, and Pratama & Yulianti (2020) proved that interactive media assists students in solving word problems more effectively. Furthermore, Rahman & Setiawan's (2022) study indicated that digital application-based interactive media can improve both mathematical self-efficacy and creativity.

This research is focused on determining the influence of a Problem-Based Learning (PBL) model, enhanced with interactive media via Google Sites, on the mathematical creative thinking skills of students, analyzed according to their self-efficacy levels. The research problems include: (1) whether there is a difference in mathematical creative thinking skills between students who learn with the PBL model using interactive Google Sites media and students who learn with the PBL model without interactive media; (2) whether there is a difference in mathematical creative thinking skills based on high, medium, and low levels of self-efficacy; and (3) whether there Is there an interaction between the learning model and the level of self-efficacy on students' mathematical creative thinking skills.

This research aims to investigate the effect of an interactive, Google Sites-based Project-Based Learning (PBL) model on students' mathematical creative thinking skills based on self-efficacy levels.

METHODS

This research employs a quasi-experimental method utilizing a 2×3 factorial design. This specific design was selected to analyze the effect of an interactive Google Sites-based Problem-Based Learning (PBL) model and the level of self-efficacy on students' mathematical creative thinking ability.

e-ISSN: 2528-102X
p-ISSN: 2541-4321

The study was conducted at SMP IT Rabbi Radhiyya during the 2024/2025 academic year. The research population consisted of all eighth-grade students. The sample was determined using purposive sampling: class VIII.A was designated as the experimental group, which received instruction with the interactive Google Sites-based PBL model, and class VIII.C was designated as the control group, which received PBL instruction without the interactive media. The independent variable in this study is the learning model (interactive media-based PBL versus non-interactive media-based PBL). The moderating variable is the level of self-efficacy (high, moderate, or low), and the dependent variable is students' mathematical creative thinking ability.

The research include 1) a mathematical creative thinking ability test, structured as an essay task, was designed to measure the four aspects of creative thinking—fluency, flexibility, originality, and elaboration—as established by Torrance (1974); 2) a self-efficacy questionnaire was developed based on the indicators proposed by Hendriana, Rohaeti, and Sumarmo (2017), assessing participants' self-confidence in solving mathematical problems, persistence in confronting difficulties, and willingness to try new strategies; 3) documentation was collected, consisting of school records and the outcomes of learning activities. All instruments were subjected to validation by two mathematics education experts and were subsequently piloted on a 9th-grade class to determine their validity, reliability, discriminating power, and difficulty level. Reliability was computed using Cronbach's Alpha, with an established criterion for a reliable instrument being an alpha value $a > 0{,}70$ (Arikunto, 2013).

This analysis was designed to investigate three primary outcomes 1) the difference in mathematical creative thinking ability between students under the two distinct learning models; 2) variations in this ability based on different self-efficacy categories; and 3) the interaction effect between the learning model and self-efficacy on students' mathematical creative thinking ability. Subsequently, the data were analyzed quantitatively using a two-way ANOVA test with a 5% significance level. This analysis was designed to investigate three primary outcomes: 1) the difference in mathematical creative thinking ability between students under the two distinct learning models; 2) variations in this ability based on different self-efficacy categories; and 3) the interaction effect between the learning model and self-efficacy on students' mathematical creative thinking ability.

FINDINGS

Before conducting the hypothesis tests, the researchers first performed prerequisite analyses, namely the normality and homogeneity tests.

The normality test was applied to the pretest and posttest data from both the experimental and control classes to verify that the data followed a normal distribution, thus justifying the use of parametric statistical analysis. The Shapiro-Wilk test was employed (given the sample size $n > 30$) utilizing SPSS

e-ISSN: 2528-102X
p-ISSN: 2541-4321

16 software. The results from the Shapiro-Wilk test assessing the normality of the mathematical creative thinking ability data for the experimental and control groups are presented in Table 1.

Table 1 displays the outcomes of the Shapiro-Wilk normality test performed on the pretest and posttest data of students' mathematical creative thinking ability in the experimental and control classes. All observed significance values (Sig.) exceeded the 0.05 threshold, specifically 0.137 and 0.345 for the experimental class, and 0.131 and 0.439 for the control class.

Table 1. Results of the Normality Test for Students' Mathematical Creative Thinking Ability in the Experimental and Control Groups.

Class		Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
Test Result	Experiment Class Pretest	.163	20	.171	.937	20	.137
	Control Class Pretest	.164	20	.164	.926	20	.131
	Experiment Class Postest	.129	20	.200*	.949	20	.345
	Control Class Postest	.175	20	.108	.954	20	.439

*. This is a lower bound of the true significance.

a. liliefors significance Correction.

Data Source: SPSS versi 26

Since all significance values were > 0.05, the data are considered normally distributed. This result validates the assumption necessary for proceeding with subsequent parametric statistical analysis, particularly the two-way ANOVA test. Following this, the homogeneity test was executed to determine whether the two or more data samples originated from populations with equal variances (i.e., whether the data are homogeneous). The criterion for the homogeneity test is that if the calculated $F_{count}<F_{table}$, the data are homogeneous. Conversely, if $F_{count}>F_{table}$ the data are considered not homogeneous. The results of the homogeneity test are presented in Table 2.

Table 2. The Result of Homogeneity Test

Instrument	F_{count}	F_{table}	Conclusion
Test	1,36	1,94	Homogeneity

Source:Excel

Table 2 presents the results of the homogeneity test between the experimental and control classes. At a significance level of $a = 0.05$, the calculated F_{count}=1.36 < F_{table} =1.94. Consequently,

e-ISSN: 2528-102X
p-ISSN: 2541-4321

the variances in the data for students' mathematical creative thinking ability across the two groups are concluded to be homogeneous.

Subsequently, a Two-Way ANOVA was performed to test the hypotheses, and the results are presented as follows.

Differences in Students' Mathematical Creative Thinking Skills Between the Implementation of a Problem-Based Learning (PBL) Model Integrated with Interactive Google Sites Media and a PBL Model Without Interactive Media

Based on the results of the first hypothesis analysis, which aimed to examine the significant difference in mathematical creative thinking ability between students taught using the PBL model integrated with Google Sites interactive media and those taught using the PBL model without interactive media, the data used to illustrate the difference between the interactive media-based PBL model and the conventional PBL model in terms of mathematical creative thinking ability are presented in Table 3 below.

Table 3. The Result of Two-Way ANOVA Test

Variand Source	dk	JK	RK	F_h	F_t	Sig
Inter Line (Model) A	1	13,158	13,158	4,249	4,13	0,047

Data Source: SPSS 26

Table 3 reveals that the calculated F_{count} = 4.249 >F_{table} =4.13, with a significance value (Sig.) of 0.047 (< 0.05). This result indicates that the null hypothesis H_0 is rejected and the alternative hypothesis H_a is accepted. Therefore, it can be concluded that there is a significant difference in the mathematical creative thinking ability between students who were taught using the PBL model integrated with interactive media and those who were taught using the conventional PBL model.

This difference indicates that the PBL model integrated with Google Sites interactive media is more effective in enhancing students' creative thinking ability compared to the conventional PBL model. This superior outcome can be attributed to the interactive media providing a more engaging, visual, and flexible learning experience. Students can access materials through images, videos, and interactive quizzes, which aids them in grasping concepts both more deeply and enjoyably.

Differences in Students' Mathematical Creative Thinking Abilities Based on High, Moderate, and Low Levels of Self-Efficacy

The results for the second hypothesis, which aimed to determine the significant differences in students' mathematical creative thinking ability based on high, moderate, and low levels of self-efficacy, are presented in Table 4.

e-ISSN: 2528-102X
p-ISSN: 2541-4321

Table 4. The Result of Two-Way ANNOVA Test

Varians Source	dk	JK	RK	F_h	F_t	Sig
Inter Line (Self-efficacy) B	2	26,772	13,386	4,323	3,28	0,021

Data Source: SPSS 26

Based on Table 4, the analysis yielded a calculated F_{count} = 4.323 > F_{table} = 3.28, with an associated significance value (Sig.) of 0.021 (< 0.05). This outcome necessitated the rejection of the null hypothesis H_0 and the acceptance of the alternative hypothesis H_a. Consequently, it is concluded that a significant difference exists in students' mathematical creative thinking ability based on their level of self-efficacy. Students who demonstrated high self-efficacy exhibited superior creative thinking ability compared to those with moderate and low self-efficacy. This finding underscores that a student's confidence in their own abilities significantly influences their capacity to solve open-ended and creative mathematical problems.

The Interaction Effect of the Learning Model and the Level of Self-Efficacy on Students' Mathematical Creative Thinking Ability

The third hypothesis analysis was conducted to examine the significance of the interaction between the interactive media-based PBL model and self-efficacy on students' mathematical creative thinking ability. The data utilized to examine this interaction effect are presented in Table 5.

Table 5. The Result of Two-Way ANNOVA Test

Varians Source	dk	JK	RJK	F_h	F_t	Sig
Interaction (Model & Self-efficacy) AxB	2	0,743	0,371	0,120	3,28	0,887

Data Source: SPSS 26

Table 5 shows that the calculated F_{count} = 0.120 < F_{table} = 3.28, with an associated significance value (Sig.) of 0.887 (> 0.05). This result indicates that the null hypothesis H_0 is accepted and the alternative hypothesis H_a is rejected.

Therefore, it can be concluded that there is no significant interaction between the PBL model integrated with interactive media and self-efficacy regarding students' mathematical creative thinking ability. This means that the effectiveness of the PBL model using interactive media applies uniformly across students regardless of whether they have high, moderate, or low self-efficacy. This suggests that the use of interactive media helps equalize learning opportunities for all students, as the media is engaging, interactive, and can be accessed at each student's own pace. In this context, Google Sites acts as digital scaffolding that aids students in developing their ideas, even with varying levels of self-efficacy.

e-ISSN: 2528-102X
p-ISSN: 2541-4321

DISCUSSION

The research findings indicate that the Problem-Based Learning (PBL) model integrated with Google Sites interactive media significantly influences the enhancement of students' mathematical creative thinking ability. This finding is consistent with Savery's (2015) assertion that PBL places students in the context of authentic problem-solving, which necessitates active engagement, divergent thinking, and collaboration.

According to Mayer (2009), instruction utilizing interactive media strengthens comprehension through a combination of text, images, and digital interaction. Furthermore, Wijayanti (2019) affirmed that animation-based interactive media can foster student creativity through the integration of appealing visual, auditory, and interactive elements. Such support allows students to deeply explore concepts, stimulates their imagination, and encourages the generation of diverse solution ideas. In this context, Google Sites functions effectively as a dynamic and collaborative learning platform.

Furthermore, differences in creative thinking ability were also evident across the self-efficacy categories. Students with high self-efficacy demonstrated better performance than those with moderate or low self-efficacy. This finding aligns with Bandura's (1997) theory, which asserts that self-belief significantly influences a student's effort, persistence, and courage in facing problems. Students with high self-efficacy are more confident in proposing novel ideas, whereas those with low self-efficacy tend to cease exploring beyond a single approach. Consequently, self-efficacy is confirmed as a crucial factor supporting mathematical creativity.

However, the interaction test results indicated that there was no interaction between the learning model and self-efficacy (acting as a moderating variable) concerning students' mathematical creative thinking ability. This was evidenced by the two-way ANOVA test, which showed an interaction significance value of (Sig.) = 0.887 (> 0.05) and an $F_{count} < F_{table}$, leading to the acceptance of H_0 and the rejection of H_a. This means that the effect of the PBL model integrated with interactive media on mathematical creative thinking ability is uniform across all categories of self-efficacy. This finding aligns with Lestari and Yudhanegara (2017), who stated that the influence of an innovative learning model on creative thinking ability is independent of certain psychological factors and does not rely on the students' level of self-efficacy.

This result further reinforces the study by Rahman & Setiawan (2022), which suggested that while the use of digital interactive media can enhance creativity, its effect does not always interact with psychological factors. Overall, this research confirms that the PBL model integrated with Google Sites interactive media is an effective learning strategy for improving the mathematical creative thinking ability of junior high school students, and it can be successfully implemented across various levels of self-efficacy.

e-ISSN: 2528-102X
p-ISSN: 2541-4321

CONCLUSION AND SUGGESTION

The research findings indicate that the implementation of the Problem-Based Learning (PBL) model integrated with Google Sites interactive media significantly enhanced students' mathematical creative thinking ability compared to the PBL model without interactive media. This improvement was clearly observed in the experimental class, which achieved higher results after the intervention than the control class. Furthermore, differences in mathematical creative thinking ability were also influenced by the students' level of self-efficacy. Students with high self-efficacy demonstrated better performance than those with moderate or low self-efficacy, confirming that self-belief is a crucial factor supporting success in mathematics learning.

Nevertheless, the interaction test results revealed no combined influence between the learning model and self-efficacy on students' mathematical creative thinking ability. In other words, the PBL model integrated with Google Sites interactive media is effective across all categories of self-efficacy. This finding confirms that the combination of a problem-based learning model and interactive media can serve as a relevant alternative strategy for enhancing the mathematical creativity of junior high school students, without requiring differentiation based on their initial level of self-belief.

REFERENCE

A Rahman, & T. (2022). Media interaktif berbasis aplikasi digital dalam pembelajaran matematika: Dampak pada efikasi diri dan berpikir kreatif. Jurnal Teknologi Pendidikan.

A.A Ziden, E. A. (2011). The impact of interactive media on learning performance. Turkish Online Journal of Educational Technology.

Anggoro, B. S. (2015). Pengembangan modul matematika dengan strategi problem solving untuk mengukur tingkat kemampuan berpikir kreatif matematis siswa. Jurnal Pendidikan Matematika.

Arindra. (2021). Penerapan media Webquest berbasis Google Sites dalam pembelajaran masa pandemi Covid-19 di MI Bilingual Roudlotul Jannah Sidoarjo. Jurnal Bidang Pendidikan Dasar.

Arsyad, A. (2011). Media pembelajaran. Jakarta: Raja Grafindo Persada.

Asri, M. S., & Sanusi, A. S. (2020). Kemampuan berpikir kreatif matematis dengan menggunakan education game berbantuan Android pada barisan dan deret. Jurnal Pendidikan Matematika.

Azizah, M. A. (2020). Pembelajaran tematik SD/MI. Jakarta: Kencana.

Uno, H. B., & Nurdin, M. (2015). Belajar dengan pendekatan PAIKEM. Jakarta: Bumi Aksara.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: W.H. Freeman.

Bhoke, P. A. (2018). Pengaruh model problem-based learning terhadap hasil belajar matematika. Journal of Education.

Darusman, R. (2014). Penerapan metode mind mapping (peta pikiran) untuk meningkatkan kemampuan berpikir kreatif matematik siswa SMP. Jurnal Ilmiah Program Studi Matematika STKIP Siliwangi

e-ISSN: 2528-102X
p-ISSN: 2541-4321

Bandung.

Daryanto. (2016). Media pembelajaran. Yogyakarta: Gava Media.

Dini, D. I. A., & Ansori, A. B. (2017). Penerapan model POM untuk meningkatkan kinerja dan kemampuan berpikir kritis siswa SMA. Jurnal Pendidikan dan Pembelajaran Biologi.

Dkk, M. H. (2021). Media pembelajaran. Klaten: Tahta Media Group.

Edison, A. (2021). Model problem-based learning solusi meningkatkan prestasi belajar. Lombok Tengah: Pusat Pengembangan Pendidikan dan Penelitian Indonesia.

Hendriana, H., Rohaeti, E. E., & Sumarmo, U. (2017). Hard skill dan soft skills matematik siswa. Bandung: Refika Aditama.

Hosnan. (2014). Pendekatan saintifik dan kontekstual dalam pembelajaran abad 21. Bogor: Ghalia Indonesia.

Indonesia, K. P. (2020). Panduan penggunaan Google Sites untuk pembelajaran online. Jakarta: Kemdikbud.

Indrajid, A. B. (2023). Problem based learning. Yogyakarta: Andi.

Lestari, K. E., & Yudhanegara, M. R. (2017). Penelitian pendidikan matematika. Bandung: Refika Aditama.

Marliani, N. (2015). Peningkatan kemampuan berpikir kreatif matematis siswa melalui model pembelajaran Missouri Mathematics Project (MMP). Jurnal Formatif, 5(1), 21.

Masita, F. N. (2022). Pengembangan pembelajaran matematika. Yogyakarta: Nas Media Pustaka.

Maulidy, G. M. (2022). Implementasi LKPD berorientasi mind mapping pada materi redoks untuk meningkatkan kemampuan berpikir kreatif. UNESA Journal of Chemical Education, 11(3), 177–185.

Mayer, R. E. (2009). Multimedia learning: Principles for effective design. Cambridge: Cambridge University Press.

Munandar, U. (2009). Pengembangan kreativitas anak berbakat. Jakarta: Rineka Cipta.

Nugroho, H. (2020). Pengaruh self-efficacy terhadap efektivitas pembelajaran berbasis media interaktif. Jurnal Psikologi Pendidikan.

Pajares, F. (2002). Overview of social cognitive theory and of self-efficacy. Emory University.

Pratama, F., & Yulianti, S. (2020). Peningkatan kemampuan berpikir kreatif melalui media interaktif. Jurnal Inovasi Pendidikan.

Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (2002). Instructional media and technologies for learning. New Jersey: Merrill Prentice Hall.

Ardianti, R., & Susanto, E. (2022). Problem-based learning: Apa dan bagaimana. Diffraction, 3(1), 27–35.

Setyowati, E. (2020). Pengaruh penggunaan multimedia interaktif terhadap pemahaman konsep dalam

e-ISSN: 2528-102X
p-ISSN: 2541-4321

pembelajaran matematika di MTs Darul Ulum Muhammadiyah Galur. Jurnal Intersections, 5(2), 32.

Sinaga, S. J. (2020). Perbedaan kemampuan koneksi matematik dan berpikir kreatif dengan discovery learning dan direct instruction. SEPREN: Journal of Mathematics Education and Applied, 1(2), 16–27.

Sontani, A. A. (2016). Upaya meningkatkan kemampuan berfikir analitis melalui model problem-based learning (PI). Jurnal Pendidikan Manajemen Perkantoran, 1(1), 38.

Suparman, A. (2014). Desain instruksional modern. Jakarta: Erlangga.

Syarifah. (2022). Model problem-based learning dan pembentukan kelompok sosial. Bekasi: Mikro Media Teknologi.

Widiasmoro, E. (2017). Strategi dan metode mengajar siswa di luar kelas (outdoor learning: Secara aktif, kreatif, inspiratif, dan komunikatif). Yogyakarta: Ar-Ruzz Media.

Wijaya, A. (2012). Pendidikan matematika realistik: Suatu alternatif pendekatan pembelajaran matematika. Yogyakarta: Graha Ilmu.

Wijayanti, R. (2019). Pengaruh media interaktif berbasis animasi terhadap kemampuan berpikir kreatif matematis siswa. Jurnal Pendidikan Matematika, 4(1), 25–34.