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Mathematical Self-Efficacy and Creative Thinking in Social Arithmetic: Insight from Junior High School students in Papua

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ABSTRACT

Research on mathematical self-efficacy and creative thinking has grown in recent years. However, studies examining their interaction in fostering mathematical creativity remain limited. Understanding this relationship is crucial, as self-efficacy influences students' responses to open-ended challenges and their ability to generate creative solutions. This research gap is particularly relevant in the context of Papua, where cultural and contextual factors shape students' thinking patterns and problem-solving strategies. This study investigates the relationship between students' mathematical self-efficacy and their creative problem-solving ability within the context of social arithmetic, an area often underexplored. Anchored in Bandura's social cognitive theory, self-efficacy is conceptualized as a key psychological construct that influences student engagement, strategy use, and persistence in mathematical tasks. Employing a descriptive-exploratory design with embedded qualitative insights, this study involved 72 eighth-grade students from West Papua. Data were collected through a validated Likert-scale questionnaire, open-ended problem-solving tasks based on Torrance's creativity framework, and semi-structured interviews analyzed thematically. Results show that 52.8% of students had moderate self-efficacy, while 25% were classified as high. In creative problem-solving, students excelled in fluency and elaboration but struggled with originality and flexibility. A strong positive correlation was found between self-efficacy and creative thinking ($\rho = 0.849$, $p < 0.001$). These findings underscore the importance of designing instructional strategies that enhance both confidence and cognitive flexibility through contextualized, open-ended, and collaborative learning environments.

Keywords: *Mathematical self-efficacy, creative problem-solving, social arithmetic, junior high school students, mathematics education*

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INTRODUCTION

Creative problem-solving is widely recognized as a core competency in mathematics education, essential for preparing students to face complex, real-world challenges that demand not only procedural knowledge but also innovative and adaptive thinking (Torrance, 1974). It enables students to approach complex problems with innovation and critical thinking. In today's dynamic world, where adaptability and originality are key, this skill is increasingly vital. Research indicates that instructional strategies such as inquiry-based and project-based learning can significantly improve students' creative problem-solving abilities. For example, Indarasati et al. (2019) showed that using mathematical tools in an inquiry-based framework improved students' creative thinking in trigonometry, encouraging them to develop original solutions with instruments such as clinometers and meters. Similarly, Khoirunnisa et al. (2024) found that inquiry-based learning approaches in high school mathematics classes bolstered students' problem-solving skills and critical thinking, fostering deeper engagement with mathematical concepts.

Furthermore, project-based learning has been shown to foster creativity in mathematical contexts. Djam'an et al. (2021) examined how designing and constructing model cities enhanced students' creativity. This involved applying mathematical concepts, such as geometry and measurement, in real-world scenarios. This hands-on approach deepened students' understanding of mathematical principles and encouraged innovative thinking and collaboration. Collectively, these studies underscore the importance of incorporating pedagogical methods that promote creative problem-solving in mathematics education. This prepares students to navigate and address complex challenges within and beyond the classroom.

In the context of social arithmetic, students' ability to engage in creative problem-solving is crucial for academic success. This ability is closely linked to mathematical self-efficacy, defined as students' belief in their ability to accomplish mathematical tasks (Bandura, 1997; Pajares, 2002). According to Bandura’s social cognitive theory, self-efficacy influences cognitive processes and learning outcomes, including mathematics learning (Bandura, 1997; Schunk & Zimmerman, 2008). A high level of self-efficacy is associated with increased motivation, perseverance, and resilience in dealing with academic challenges.

Previous studies have indicated that students frequently face challenges when solving social arithmetic problems, which feature real-life situations such as taxes, interest, and discounts. These challenges are often attributed to limited conceptual understanding, poor interpretation of problem language, and a reluctance to consider alternative solution strategies (Suryandari et al., 2018; Oktaviasari & Khotimah, 2023). Such circumstances typically result in decreased student engagement and diminishing confidence in tackling mathematical problems.

Self-efficacy plays a crucial role in shaping these responses. Students with high self-efficacy tend to be more persistent when facing mistakes, are willing to accept challenges, and show traits that support creativity, such as curiosity, risk-taking, and tolerance for ambiguity (Gu et al., 2014; Moore & Ronau, 2024). On a global scale, creative thinking has become a primary goal, and improving students’ creative thinking skills is a significant trend in current educational reform (Choeriyah et al., 2021). In contrast, students with low self-efficacy are more prone to avoidance behaviors, such as depending on peers for answers or even participating in dishonest practices (In’am & Sutrisno, 2021; Oktaviasari & Khotimah, 2023).

Solving mathematical problems creatively requires more than just accurate calculations. It also involves adaptable thinking, originality, and the ability to connect mathematical ideas (Wapa, 2020).

Students who are confident in their math abilities tend to explore multiple strategies and engage more deeply in the problem-solving process (Rahayuningsih et al., 2022; Niu et al., 2022). This confidence is crucial when students are confronted with real-life contexts, especially in social arithmetic.

To facilitate this development, the learning environment should be structured in a way that nurtures students' self-efficacy and creative thinking abilities. Studies have shown that approaches such as collaborative learning, open-ended activities, and project-based learning can effectively increase students' confidence and encourage creativity (Zarvianti & Sahida, 2020; Faradillah & Purwitasari, 2022; Manurung et al., 2024). These approaches allow learners to experience incremental achievements, which reinforce their self-belief (Schunk & Zimmerman, 2008).

Furthermore, integrating real-world problems into the curriculum and offering autonomy in problem-solving tasks have proven effective in boosting students' creative engagement and intrinsic motivation (Gu et al., 2014; Suryanto et al., 2021). For instance, open-ended learning tasks can simultaneously promote self-efficacy and creative thinking, as they encourage students to link abstract concepts with practical applications (Parinduri et al., 2018).

Creative problem-solving in mathematics, as conceptualized by Torrance (1974), includes four core components: fluency, flexibility, originality, and elaboration. These dimensions reflect a student's capacity to generate multiple ideas, shift between strategies, propose novel approaches, and explain reasoning in detail. Amabile (1996) further emphasized that creativity in problem-solving emerges from the interaction of domain-relevant skills, creativity-relevant processes (e.g., divergent thinking), and task motivation. In mathematics education, these traits are essential for solving non-routine problems and are best nurtured through tasks that allow for open exploration and adaptive reasoning. Thus, evaluating creative problem-solving through these theoretical lenses allows educators to capture both cognitive and affective aspects of mathematical thinking.

The educational context of Papua presents distinct sociocultural characteristics that influence learning outcomes, particularly in mathematics. Students in this region often demonstrate a strong sense of communal collaboration, reliance on oral communication, and preference for contextual and experiential learning (Wambrauw, 2021). However, geographical isolation and limited access to technological or didactic resources often hinder their exposure to diverse mathematical tasks. These constraints may impact both students' self-efficacy and their opportunities to engage in open-ended problem solving. Mathematics instruction that is meaningful and culturally relevant has been shown to enhance students' engagement and competence. For instance, the use of Jarimatika counting techniques integrated with the local Hatam language in Papua demonstrated that culturally grounded methods can significantly improve students' arithmetic skills and interest (Wyrasti et al., 2022). Therefore, investigating the dynamics of self-efficacy and creative thinking within this context is crucial to inform culturally responsive teaching practices that address local needs while promoting higher-order cognitive skills.

The novelty of this study lies in its specific focus on the intersection between mathematical self-efficacy and creative problem-solving within the domain of social arithmetic—an area that remains underrepresented in both national and international mathematics education research. While prior studies have explored self-efficacy in relation to general academic performance or motivation, few have examined how students' self-beliefs affect their creative capacity in solving context-based, real-world problems, particularly in culturally distinct and under-resourced educational environments such as those in Papua. This study addresses that gap by integrating theoretical insights from social cognitive theory and creative pedagogy to investigate how affective and cognitive dimensions of learning interact in shaping students' mathematical problem-solving behaviors. It further contributes a dual-development perspective that emphasizes the concurrent cultivation of students' confidence and cognitive flexibility—two components critical for 21st-century mathematical literacy. Given the increasing emphasis on adaptive and innovative thinking in mathematics education, this research responds to the urgent need for evidence-based strategies that support both the affective and higher-order cognitive development of students in diverse educational contexts.

Therefore, improving students' mathematical self-efficacy is essential for developing their creative problem-solving skills in social arithmetic. Emphasizing both confidence and creativity not only enhances students' mathematical understanding and prepares them to solve real-world problems with confidence and competence (Kurniawan et al., 2024; Ramdani & Amelia, 2024). This study aims to bridge the gap between psychological constructs and applied mathematical performance while offering practical insights for educators seeking to foster both competence and creativity in the mathematics classroom.

In light of the gaps identified in the literature and the pressing need to explore the interplay between affective and cognitive aspects of learning in mathematics, this study aims to address the following research questions:

1. What is the level of *mathematical self-efficacy* among junior high school students in the context of social arithmetic?
2. How do students demonstrate creative problem-solving in social arithmetic tasks?
3. What patterns emerge between students' self-efficacy levels and their creative problem-solving characteristics?

METHOD

Research Design

This study employed a descriptive-exploratory research design with embedded qualitative analysis, aiming to provide a comprehensive understanding of students' mathematical self-efficacy levels and their creative problem-solving abilities within the context of social arithmetic. The design allowed the researchers to capture both statistical patterns and contextual insights through integration of quantitative data with students' verbal expressions and reasoning processes. The qualitative component was included to enrich the interpretation of findings and to explore student thinking beyond numerical measures.

Participants

The participants in this study consisted of 72 eighth-grade students from a junior high school located in West Papua Province. The selection of participants was carried out using purposive sampling, a non-probability sampling technique in which individuals are deliberately chosen based on specific characteristics aligned with the research objectives. The students selected had completed instruction in social arithmetic as prescribed by the national curriculum, represented a range of academic achievement levels as assessed by their mathematics teachers, and had provided informed consent to participate voluntarily, with approval from their parents or guardians.

This sampling strategy was intended to ensure that the participants had sufficient exposure to the relevant mathematical content and represented diverse levels of self-efficacy and creative thinking abilities. Furthermore, the choice of a school situated in a rural area of Papua allowed the study to capture context-specific influences on students' mathematical learning. The region's unique sociocultural characteristics, including limited educational resources and a strong orientation toward communal and contextual learning, provided a valuable backdrop for exploring how mathematical self-efficacy and creative problem-solving develop in underrepresented educational settings.

Research Instruments

This study employed three primary research instruments:

Mathematical Self-Efficacy Questionnaire:

The indicators of self-efficacy in mathematics were constructed based on Bandura's theory (1997) and adapted from Pajares (2002), encompassing the following three main domains, as presented in Table 1.

This questionnaire used a Likert scale adapted from Pajares (2002), consisting of 20 statements measuring students' confidence in solving mathematical problems. The instrument was validated through expert review and a pilot test, with a Cronbach's Alpha reliability coefficient of $\alpha = 0.89$, indicating high internal consistency.

Sample items from the questionnaire (5-point Likert scale):

- "I am confident that I can solve discount problems in mathematics without help."

- "When I fail to answer a math problem, I will try another method."
- "I can choose a different strategy to solve a math problem if needed."

- **Table 1.** Dimension and Indicators of Mathematical Self-Efficacy

No.	Self-Efficacy Dimension	Indicator
1	Belief in personal ability	Students believe they can complete mathematical tasks independently.
2	Persistence in facing difficulties	Students continue to make efforts even when encountering difficult problems or mistakes.
3	Strategy selection and self-regulation	Students are able to choose and adjust problem-solving strategies based on the situation.

Creative Mathematical Problem-Solving Task Sheet

The indicators of creative thinking in mathematics problem solving were derived from Torrance's model (1974), which is widely used in mathematics education. The four core indicators are shown in Table 2.

Table 2. Indicators of Creative Thinking in the Context of Social Arithmetic

No.	Creative Thinking Dimension	Indicator
1	Fluency	The ability to generate more than one alternative solution to a given problem.
2	Flexibility	The ability to apply various strategies or methods to solve a problem.
3	Originality	The emergence of ideas or methods that are uncommon among peers.
4	Elaboration	The ability to describe solutions in detail and structured reasoning, including justifications or steps.

A set of open-ended contextual problems involving social arithmetic (such as discounts, taxes, profit, and interest) was developed to assess students' creative thinking based on these four indicators. Students' written responses were evaluated using an analytic rubric designed and reviewed by experts in mathematics education.

To ensure scoring consistency, inter-rater reliability testing was conducted with two independent raters. The Cohen's Kappa value was 0.88, indicating very high agreement and strong consistency in evaluation. Sample of Task, as follows:

Mama Rina operates a stall at the Sentani market where she sells betel nuts and betel leaves. She purchases a bundle of betel nuts for Rp15,000 and a bunch of betel leaves for Rp10,000. Each day, she sells 10 bundles of betel nut and 8 bunches of betel leaves, with each item priced at Rp20,000.

1. What is Mama Rina's profit per day?
2. If the price of betel nuts rises to Rp18,000 per bundle, what should Mama Rina do to maintain her profit? Explain.
3. Do you think Mama Rina can increase her income by selling other goods? What would you suggest?

Semi-Structured Interview Guide

Interviews were conducted with selected students representing each self-efficacy category (high, moderate, and low) to collect qualitative data on their thought processes, strategies used, and reflections during problem-solving. The purpose of this interview was to support quantitative findings with deeper insights into students' cognitive and affective experiences.

Data Collection Procedure

Data collection was conducted in three stages. First, students completed the self-efficacy questionnaire. Then, they were given the creative problem-solving task sheet under exam-like conditions. Finally, interviews were carried out with nine students (three from each self-efficacy category) using a semi-structured protocol. All data were anonymized and collected with prior parental and institutional consent.

Data Analysis Techniques

Data analysis in this study combined quantitative and qualitative approaches to provide a comprehensive understanding of students' mathematical self-efficacy and their creative problem-solving abilities. Quantitative data were analyzed using descriptive statistics to provide an overview of students' self-efficacy levels and their performance in creative mathematical problem solving. The statistical measures included mean scores, percentages, and standard deviations, which were used to classify students into low, moderate, and high categories.

To examine the relationship between students' mathematical self-efficacy and their creative thinking skills, the Spearman Rank Correlation test was employed. This non-parametric method was chosen due to the ordinal nature of the data and the results of a normality test indicating that the data were not normally distributed. The correlation test aimed to identify the strength and direction of the relationship between the two variables under study.

Students' responses to the creative problem-solving tasks were evaluated using an analytic rubric based on Torrance's creative thinking indicators: fluency, flexibility, originality, and elaboration. Each dimension was assessed separately, categorized into levels (low, moderate, high), and then analyzed in relation to students' levels of self-efficacy.

Meanwhile, qualitative data gathered from semi-structured interviews were analyzed using **thematic analysis**, following the six-phase procedure outlined by Braun and Clarke (2006). This process included: (1) familiarization with the data by reading transcripts repeatedly, (2) generating initial codes from meaningful segments of text, (3) searching for themes by grouping related codes, (4) reviewing and refining the themes for consistency and coherence, (5) defining and naming each theme to capture its essence, and (6) producing the report by integrating themes into the interpretation of findings. This method was chosen because it allows for flexible, rigorous analysis of patterns in students' reasoning, problem-solving strategies, and perceptions of their learning. Thematic analysis provided deeper understanding of how different levels of self-efficacy influenced students' creative mathematical thinking and complemented the quantitative findings by offering contextualized narratives.Through this integration of quantitative description and qualitative thematic exploration, the study aimed to offer meaningful contributions to understanding the connection between mathematical self-efficacy and students' creative problem-solving capabilities within the context of social arithmetic learning.

RESULTS & DISCUSSION

Result

Students' Mathematical Self-Efficacy Levels

The evaluation of the mathematical self-efficacy questionnaire, which included 20 items on a Likert scale, showed how students' self-efficacy level were distributed in relation to social arithmetic. This survey involved a total of 72 junior high school students, as presented in Table 3.

Table 3. Distribution of students' Mathematical Self-efficacy

No.	Self-Efficacy Category	Frequency (N)	Percentage (%)
1	High	18	25.0 %
2	Moderate	38	52.8 %
3	Low	16	22.2 %
	Total	72	100 %

Table 3 presents information that most students (52.8%) had moderate self-efficacy, meaning they had enough confidence to solve social arithmetic problems, though not always. About 25% of students demonstrated high level of self-efficacy, while 22.2% demonstrated low level, reflecting their doubts and lack of confidence in performing the mathematical tasks. These results suggest that, while the majority of students are fairly confident, many still lack self-confidence when mathematical problem-solving mathematical problems, particularly in contextual applications.

Students' Creative Problem-Solving Abilities

Students' responses to creative problem-solving tasks were assessed based on Torrance's four indicators: *fluency*, *flexibility*, *originality*, and *elaboration*. The Table 4 summarizes the distribution of students across performance levels.

Table 4. Distribution of Students' Creative Problem-Solving Abilities

No.	Creative Thinking Dimension	Low	Moderate	High
1	Fluency	20.8 %	55.6 %	23.6 %
2	Flexibility	25.0 %	52.8 %	22.2 %
3	Originality	30.6 %	50.0 %	19.4 %
4	Elaboration	18.1 %	58.3 %	23.6 %

Table 4 showed that most students had moderate creative problem-solving abilities in all dimensions. Fluency and elaboration were areas of relatively stronger performance, with over 23% of students achieving high scores. Originality, however, was the most challenging aspect. Only 19.4% of students attained high scores in this area, while 30.6% remained in the low category. These results suggest that, although students can generate multiple solutions and elaborate on their reasoning, they often rely on conventional methods and struggle to produce unique approaches.

The Relationship Between Self-Efficacy and Creative Problem-Solving

The results of inferential analysis using the Spearman Rank correlation test indicated a strong and statistically significant positive association between students' overall mathematical self-efficacy and their creative problem-solving performance ($\rho = 0.849$; $p < 0.001$). This outcome supports prior interpretations, emphasizing the pivotal role of self-efficacy in enhancing cognitive flexibility, the formulation of original problem-solving strategies, and the ability to articulate solutions reflectively in the domain of social arithmetic.

To explore this relationship further, a cross-tabulation analysis was conducted to examine the pattern between students' self-efficacy levels and their levels of creative problem-solving. The results are shown in the figure 1.

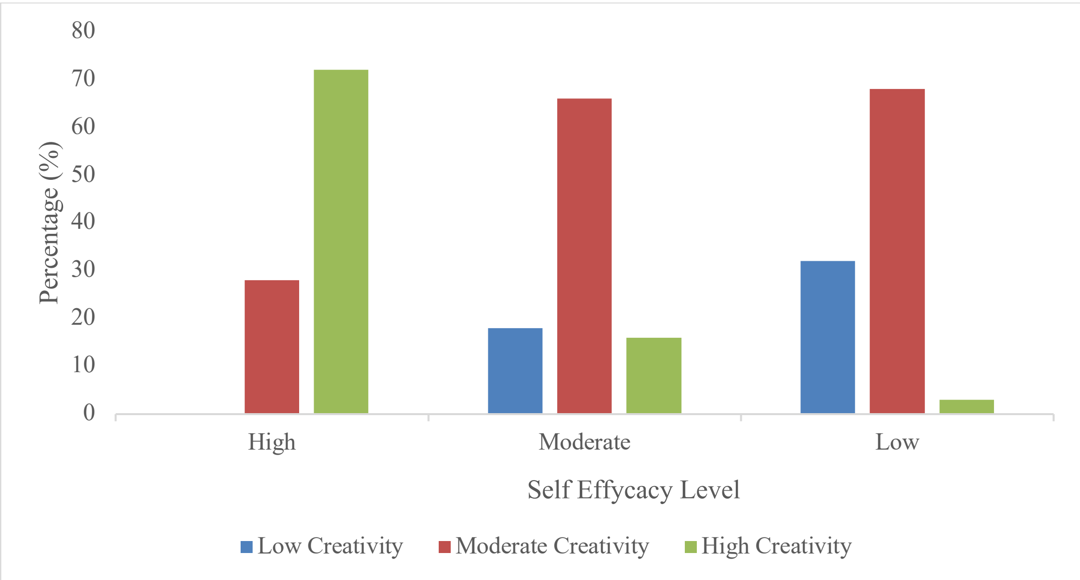

Figure 1: Distribution of Creative Thinking Levels by Self-Efficacy Categories

Figure 1 clearly illustrates the distribution of creative thinking levels across the three self-efficacy categories. Students in the high self-efficacy group demonstrated the highest proportion (72.2%) in the high creativity category, with none falling into the low category. In contrast, the low self-efficacy group showed a markedly different pattern, with 68.8% of students categorized as low in creativity, and none achieving high levels. Students with moderate self-efficacy were mostly found in the moderate creativity category (65.8%), indicating a balanced but less distinct profile. This visual pattern reinforces the observed positive association between self-efficacy and creative problem-solving ability.

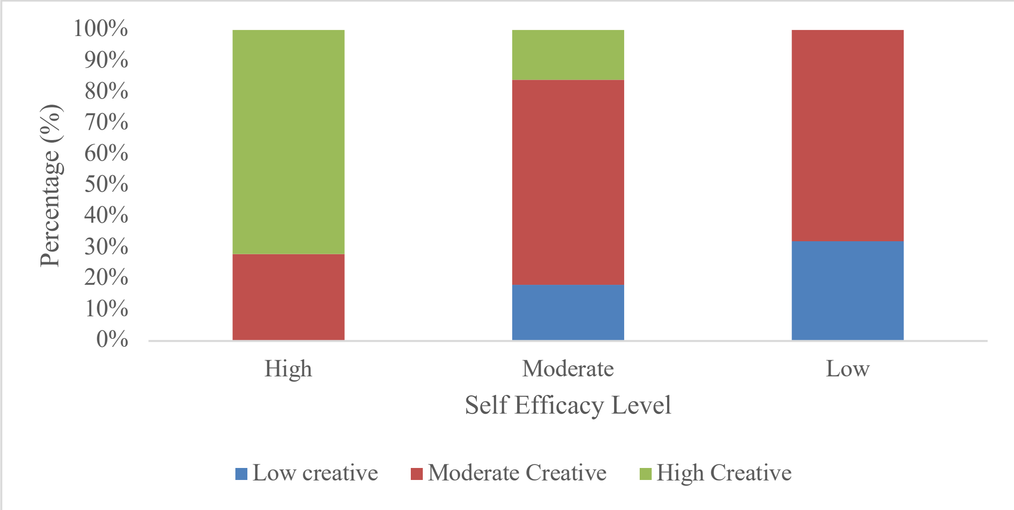

Figure 2. Relationship between Self-Efficacy Level and Creative Problem-Solving

As shown in the Figure 2, there is a notable in problem-solving behavior among students with different levels of self-efficacy. Qualitative data from interviewers support this pattern. Students with high self-efficacy expressed confidence when exploring alternative strategies and demonstrated the capacity for deep reflection on their problem-solving processes. In contrast, students with low self-efficacy often displayed uncertainty and relied on rote or memorized procedures. In some cases, they resorted to copying answers from peers when faced with unfamiliar tasks.

Overall, the findings suggest that most students exhibit moderate levels of mathematical self-efficacy, with approximately one-fourth showing high levels of confidence in solving social arithmetic problems. In terms of creative problem-solving, students generally performed at a moderate level, with strengths in fluency and elaboration, but continuing challenges in originality and flexibility. The observed positive correlation confirms theoretical perspectives asserting that self-efficacy is instrumental in enhancing students' cognitive adaptability and engagement in the creative problem-solving process, particularly in mathematical contexts.

Discussion

Students' Levels of Mathematical Self-Efficacy

The present study examined students' levels of mathematical self-efficacy, revealing that a significant proportion (52.8%) exhibited a moderate level of self-efficacy, while only 25% of the participants demonstrated high confidence in their mathematical abilities. These findings echo Bandura's (1997) assertion that self-efficacy is a multifaceted construct, primarily cultivated through mastery experiences and social reinforcement. In this context, the moderate level of self-efficacy among students suggests a cautious approach to mathematical problem-solving, potentially inhibiting their propensity to engage in risk-taking behaviors necessary for effective learning and mastery of complex mathematical concepts.

Research has indicated that individuals with moderate self-efficacy are often characterized by a reluctance to confront challenging tasks, as evidenced by studies from In'am and Sutrisno (2021), which highlight a propensity for disengagement among students with lower self-efficacy. Specifically, these students might lack resilience when faced with obstacles in learning, preferring to withdraw from difficult mathematical tasks rather than confront them. Such withdrawal could create a cycle of reduced engagement and declining mathematical competence, further entrenching their existing self-efficacy beliefs.

The implications of these findings are multifold, suggesting that educators need to introduce strategies to enhance students' self-efficacy through targeted interventions. For example, cultivating a growth mindset, encouraging mastery experiences through scaffolded problem-solving tasks, and providing timely social reinforcement may help shift students' perceptions of their mathematical abilities. These approaches align with Bandura's (1997) framework, suggesting that such interventions could lead to greater resilience and a willingness to tackle challenging mathematical problems.

Moreover, the moderate self-efficacy levels reported in the study raise concerns about potential barriers to academic success in mathematics. It is essential for future research to investigate the specific factors contributing to students' self-efficacy levels. This entails examining how classroom environments, instructional practices, and peer influences can either enhance or detract from students' confidence in their mathematical abilities. Understanding these dynamics will be vital in developing effective pedagogical strategies aimed at fostering higher levels of self-efficacy among students.

Discussion on Characteristics of Students' Creative Problem-Solving

The current analysis of student responses has revealed that students exhibit moderate performance across the four key indicators of creativity in problem-solving: fluency, elaboration, originality, and flexibility. Notably, fluency and elaboration emerged as stronger skills among students, reflecting their capability to generate multiple ideas and articulate them clearly. This finding suggests that while students possess a solid foundation for idea generation and explanation, there remains considerable room for growth in areas such as originality and flexibility.

In accordance with Gu et al. (2014), the attributes necessary for effective creative problem-solving extend beyond mere domain knowledge and encompass characteristics such as openness to novelty and the willingness to take risks. Originality, defined as the ability to produce novel ideas, may indeed be hindered by students' limited experiences with open-ended tasks that allow for exploration beyond conventional boundaries. By not engaging in environments where risk-taking is encouraged, students may develop a habitual reliance on familiar solutions, thereby stifling their creative potential.

Furthermore, the observed difficulties in flexibility, or the capacity to adapt one's thinking to new and varied situations, may reflect a tendency among students to become entrenched in specific problem-solving strategies. This limitation can be partially attributed to the traditional educational settings that frequently emphasize convergent thinking—where there is one correct answer—over divergent thinking, which promotes exploring multiple pathways to problem resolution. It is essential for educators to create learning environments that intentionally cultivate flexibility by offering varied challenges and encouraging students to approach problems from different perspectives (Ioannidis, 2007).

The curriculum's lack of exposure to open-ended tasks certainly poses a critical barrier to the development of students' creative problem-solving skills. Open-ended tasks are instrumental in fostering an environment where students are encouraged to explore ideas freely and utilize their imagination. Research within educational psychology underscores the importance of providing students with opportunities to encounter ambiguity and complexity, as these dimensions are fundamental in nurturing creativity (Clarke et al., 2023).

To facilitate growth in students' originality and flexibility, curricular reforms that incorporate more open-ended problem-solving tasks are needed. To foster a classroom culture that encourages innovative thinking and embraces failure as a part of the learning process, educators must understand the dynamics of risk-taking, creativity, and the psychological responses students have to these concepts. Research indicates that creative metacognition plays a significant role in moderating risk-taking behavior related to creative performance among adolescents. This suggests that teachers should reconsider their often-negative views on students' creative risks in the classroom, recognizing that creative risk-taking can enhance educational outcomes when approached thoughtfully (Woo & Lee, 2024).

In terms of pedagogical strategies, teachers could implement collaborative group work, brainstorming sessions, and project-based learning that explicitly focus on creativity indicators. Integrating reflective practices, such as providing constructive feedback on students' creative processes, can further support the development of fluency and originality in their problem-solving skills.

The Relationship Between Self-Efficacy and Creative Thinking

The findings of this study reveal a strong positive correlation ($\rho = 0.849$) between mathematical self-efficacy and creative thinking among students. This significant correlation not only substantiates the theoretical framework but also aligns with existing empirical literature that emphasizes the role of self-efficacy in enhancing students' creative capabilities. Specifically, students who exhibit high levels of self-efficacy demonstrate enhanced flexibility, originality, and depth of reasoning in their creative problem-solving processes.

Support for these findings can be drawn from the work of Schunk and Zimmerman (2008), who articulated that self-efficacy is a vital precursor to effective goal setting, strategic use, and perseverance. These elements are crucial in fostering creative mathematical performance, as they enable students to engage more fully in problem-solving tasks. Students with high self-efficacy are more likely to approach challenges with confidence, explore alternative solutions, and persist when faced with obstacles, thus facilitateng higher creative outputs in mathematics (Ioannidis, 2007).

Conversely, students who report lower self-efficacy tend to default to procedural thinking and demonstrate minimal engagement with creative tasks. This observation resonates with the findings of Rahayuningsih et al. (2022) and Oktaviasari & Khotimah (2023), which demonstrated that students with low self-efficacy often struggle with adopting flexible cognitive strategies and exploring novel ideas (Clarke et al., 2023). The reliance on procedural methods restricts their capacity to think creatively, thereby limiting their overall performance in mathematical contexts. This phenomenon reflects the broader implications of self-efficacy in academic achievement; students' beliefs about their capabilities play a pivotal role in determining their approach to learning and problem-solving (Brutus et al., 2010).

The strong correlation between self-efficacy and creative thinking highlights the importance of fostering a supportive learning environment that enhances students' self-beliefs. Educators can implement various pedagogical strategies to boost self-efficacy, such as providing positive feedback, setting achievable goals, and modeling effective problem-solving processes. Additionally, incorporating activities that encourage creative thinking, such as open-ended tasks and collaborative projects, can reinforce students' self-efficacy beliefs through experiential learning opportunities.

Recognizing that self-efficacy impacts not only creative thinking but also overall mathematical performance underscores the need for comprehensive educational approaches. Future research could further explore the underlying mechanisms by which self-efficacy influences creative thinking, potentially examining factors such as motivation, emotional regulation, and cognitive strategies. Longitudinal studies that assess changes in self-efficacy and creative thinking over time would provide deeper insights into the dynamic interplay between these constructs.

Despite its contributions to understanding the relationship between self-efficacy and creative thinking in mathematics, this study presents several limitations that should be acknowledged to contextualize the findings and inform future research. First, the study's limited sample size and geographic scope restrict the generalizability of the results. Conducted in a single junior high school in West Papua, the findings may not reflect broader educational contexts with varying curricula, cultural backgrounds, and student demographics. Expanding future research to include multiple schools across diverse regions would enable a more representative understanding of how self-efficacy and creativity manifest in different educational environments. Second, the qualitative component—while enriching—was confined to a small number of student interviews, limiting the depth and variability of insights.

Moreover, the reliance on self-reported data introduces potential biases, such as social desirability and limited introspective accuracy. Incorporating classroom observations or triangulated qualitative methods would enhance data validity and offer richer perspectives on students' actual behaviors, problem-solving processes, and classroom interactions. Third, the study did not account for other influential variables that may moderate the relationship between self-efficacy and creativity, such as teacher support, peer collaboration, and prior academic achievement. These factors have been shown to significantly affect students' confidence, motivation, and cognitive flexibility. For instance, teacher encouragement can strengthen students' self-efficacy (Ioannidis, 2007), while collaborative learning fosters idea exchange and adaptive problem-solving. Future studies should incorporate these variables to develop a more comprehensive model of how contextual and interpersonal factors shape the development of creative mathematical thinking.

CONCLUSION

This study concludes that students' mathematical self-efficacy significantly contributes to the development of creative problem-solving abilities in the context of social arithmetic. The analysis revealed that most students demonstrated moderate self-efficacy, and those with higher self-efficacy showed more adaptive and reflective approaches when solving open-ended problems. While students were relatively strong in fluency and elaboration, they encountered challenges in originality and flexibility—skills essential for creative mathematical thinking. The observed strong positive correlation between self-efficacy and creative problem-solving affirms that students' belief in their capabilities plays a crucial role in shaping how they explore strategies, engage with complex tasks, and express innovative ideas. These findings suggest that efforts to nurture mathematical creativity must include initiatives to strengthen students' self-efficacy through contextualized, open-ended learning experiences that promote confidence and cognitive adaptability, especially in culturally diverse educational environments such as Papua.

REFERENCES

Amabile, T. M. (1996). *Creativity in Context: Update to the Social Psychology of Creativity*. Westview Press. https://psycnet.apa.org/record/1996-97996-000

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman and Company. https://psycnet.apa.org/record/1997-08589-000

Clarke, V., Braun, V., & Hayfield, N. (2023). *Thematic analysis: A practical guide* (2nd ed.). SAGE Publications. https://psycnet.apa.org/record/2023-78956-004

Djam'an, N., Bernard, & Sahid. (2021). Developing students' creativity in building city mathematics through project-based learning. *Journal of Physics: Conference Series*, *1899*(1), 012147. https://doi.org/10.1088/1742-6596/1899/1/012147

Faradillah, A., & Purwitasari, A. (2022). The effectiveness of the missouri mathematics project model on creative thinking ability and self-efficacy. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *11*(1), 170-180. https://doi.org/10.25273/jipm.v11i1.13161

Gu, C., Hu, B.Y, Ngwira, F.F., Jing, Z., & Zhou, Z. (2014). The effect of general creative personality and freedom of task choice on adolescents' social creativity. *Journal of Creative Behavior*, *50*(2), 132–149. https://doi.org/10.1002/jocb.74

In'am, A., & Sutrisno, E. S. (2021). Strengthening students' self-efficacy and motivation in learning mathematics through the cooperative learning model. *International Journal of Instruction*, *14*(1), 395–410. https://doi.org/10.29333/iji.2021.14123a

Indarasati, N. A., Abadi, A., & Lukito, A. (2019). Enhancing students' creative thinking through inquiry-based learning integrating mathematical tools. *International Journal of Trends in Mathematics Education Research*, *2*(2), 91–95. https://doi.org/10.33122/ijtmer.v2i2.113

Ioannidis, E. (2007). The role of the teacher in the development of students' creativity in mathematics. Mediterranean Journal for Research in Mathematics Education, 6(1–2), 95–114.

Khoirunnisa, N. U., Haqi, M. I., & Anam, M. S. (2024). Enhancing problem-solving skills in mathematics through inquiry-based learning: A case study in high school education. *International Journal of Mathematics and Science Education*, *1*(2), 26–32. https://doi.org/10.62951/ijmse.v1i2.89

Kurniawan, D., Susiswo, S., & Hafiizh, M. (2024). Fluency and flexibility of students in solving arithmetic sequence problems based on self-efficacy. *Prisma*, *13*(1):113-122. https://doi.org/10.35194/jp.v13i1.3961

Manurung, A., Halim, A., & Nur, S. (2024). Model of mathematical creative thinking ability based on character education for elementary school students Jakarta. *Asatiza Jurnal Pendidikan*, *5*(1), 45–60. https://doi.org/10.46963/asatiza.v5i1.1727

Moore, L., & Ronau, R. (2024). Interactive homework: A tool for parent engagement. *Education Sciences*, *14*(1), 103. https://doi.org/10.3390/educsci14010103

Niu, W., Li, C., Duan, D., & Zhang, Q. (2022). Impact of perceived supportive learning environment on mathematical achievement: The mediating roles of autonomous self-regulation and creative thinking. *Frontiers in Psychology*, *12*, Article 781594.https://doi.org/10.3389/fpsyg.2021.781594

Oktaviasari, A., & Khotimah, R. (2023). Analysis of student's critical thinking ability in solving social arithmetic problems in view of gender. *Prima Jurnal Pendidikan Matematika*, *7*(2), 143. https://doi.org/10.31000/prima.v7i2.8384

Pajares, F. (2002). Overview of social cognitive theory and of self-efficacy. Retrieved from https://people.wku.edu/richard.miller/banduratheory.pdf

Parinduri, H., Rajagukguk, W., & Minarni, A. (2018). The increasing of mathematical creative thinking ability and self-efficacy of junior high school students through open-ended approach. In *Proceedings of the 3rd Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL)*. https://doi.org/10.2991/aisteel-18.2018.131

Rahayuningsih, S., Nurhusain, M., & Indrawati, N. (2022). Mathematical creative thinking ability and self-efficacy: A mixed-methods study involving Indonesian students. *Uniciencia*, *36*(1), 1–14. https://doi.org/10.15359/ru.36-1.20

Rahayuningsih, T., Mulyono, S., & Nugraha, A. (2022). The impact of self-efficacy and learning motivation on mathematical creative thinking skills. *Indonesian Journal of Mathematics Education*, 4(3), 101–112. https://doi.org/10.21009/ijome.v4i3.28930

Ramdani, R., & Amelia, R. (2024). The development of liveworksheet-assisted problem-based learning teaching materials to improve students' learning outcomes on social arithmetic. *JIML (Journal of Innovative Mathematics Learning)*, *7*(1), 57–66. https://doi.org/10.22460/jiml.v7i1.19424

Schunk, D. H., & Zimmerman, B. J. (2008). *Motivation and self-regulated learning: Theory, research, and applications*. Routledge. https://doi.org/10.4324/9780203831076

Sipayung, R. M., & Arifin, S. (2020). Tantangan dan strategi pembelajaran matematika di daerah 3T: Studi kasus di Papua. *Jurnal Pendidikan dan Kebudayaan*, 25(1), 13–24. https://doi.org/10.24832/jpnk.v25i1.1493

Suryandari, K., Fatimah, S., Sajidan, S., Rahardjo, S., & Prasetyo, Z. (2018). Project-based science learning and pre-service teachers' science literacy skill and creative thinking. *Jurnal Cakrawala Pendidikan*. https://doi.org/10.21831/cp.v38i3.17229

Suryanto, H., Degeng, I., Djatmika, E., & Kuswandi, D. (2021). The effect of creative problem solving with the intervention of social skills on the performance of creative tasks. *Creativity Studies*, *14*(2), 323–335. https://doi.org/10.3846/cs.2021.12364

Torrance, E. P. (1974). *Torrance Tests of Creative Thinking: Norms-Technical Manual*. Scholastic Testing Service. https://www.scirp.org/reference/referencespapers?referenceid=1974095

Wambrauw, M. T. (2021). Konteks budaya dan pembelajaran matematika di Papua: Sebuah refleksi etnomatematika. *Jurnal Pendidikan Matematika Indonesia*, 6(2), 87–96. https://doi.org/10.26737/jpmi.v6i2.2369

Wapa, A. (2020). Influence of creative problem solving to study result social sciences study as reviewed from the multicultural attitude of students class V elementary South Kuta. *PrimaryEdu - Journal of Primary Education*, *4*(2), 160–171. https://doi.org/10.22460/pej.v4i2.1774

Woo, J., & Lee, S. (2024). *The moderating effect of creative metacognition on adolescents' risk-taking in creative performance*. Asia Pacific Education Review, 25(1), 99–115. https://doi.org/10.1007/s12564-024-09927-8

Wyrasti, A. F., Haryanto, H., Simamora, E. W., Purwati, P. (2022). Pengenalan berhitung menggunakan metode Jarimatika berbahasa Hatam di Nuhuwei, Papua Barat. JMM (Jurnal Masyarakat Mandiri), 6(5), 3727–3736. https://doi.org/10.31764/jmm.v6i5.10193

Zarvianti, E., & Sahida, D. (2020). Designing comics by using problem-based learning (PBL) to improve students' creative thinking skills. *International Journal of Social Learning (IJSL)*, *1*(1), 75–88. https://doi.org/10.47134/ijsl.v1i1.8