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IMPLEMENTATION OF OPEN-ENDED APPROACH TO IMPROVE MATHEMATICAL CREATIVE THINKING SKILLS AND SELF-EFFICACY

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ABSTRACT

This study looks at mathematical thinking and self-efficacy, which is a wonderful idea because everyone needs to be innovative and creative to keep up with technology advancements in the age of society 5.0. Additionally, each student's self-efficacy may rise as a result. The study employed quantitative methodologies, with a sample size of thirty individuals for both the experimental and control groups. The researchers developed two instruments to facilitate the measurement of abilities. One of the instruments is a test with questions that are intended to assess the creative mathematical thinking skills of the subjects, including Agility (flexibility), Authenticity (originality), and Details (elaboration). Based on the study's findings, it can be concluded that the research findings indicate that students taught mathematics through the Open-Ended approach demonstrated a higher level of development of creative mathematical thinking skills compared to those taught through traditional approaches. end up outperforming others who were educated utilizing conventional approaches. The research discussion results revealed that students who were taught mathematics using an Open-Ended approach demonstrated a greater development in creative mathematical thinking abilities than those who were taught using a conventional method. This conclusion was reached based on the research findings and the debate that followed. completed the task more successfully than those instructed using conventional ways. The study's results and the discussion that followed led to the conclusion that, in terms of developing students' potential for mathematical creativity, there was no connection between the learning technique and students' baseline mathematical proficiency. There is no correlation between beginning mathematical competency and learning methodologies and increasing pupils' self-efficacy, according to research and discussion.

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INTRODUCTION

The advent of rapid innovation and growing knowledge led to the birth of society 5.0. A technology-based model of society that is focused on the human social environment is known as "society 5.0." As a result, in order to improve quality of life in this day and age, humans need to be able to innovate with the technology that already exists. To put it another way, technological advancement is now a part of the human condition and can be utilized to reduce inequalities in life rather than only a source of knowledge (Ruchiyat et al., 2024). Education in the contemporary period 5.0 places a strong emphasis on education. and refine imagination to enable pupils to reveal the aspects of invention that fall within their purview. This does not preclude the potential for actions Either with or without a teacher present, learning can happen at anytime and anyplace (Mu'minah, 2021).

According to Manurung et al. (2023) mathematics is a science that helps people develop their logical reasoning, critical thinking abilities, systematic, analytical, and creative thinking. It also plays a significant role in people's lives, as noted by Noor & Amidi (2024), who assert that having strong mathematical skills is essential for problem-solving in everyday life. Furthermore, mathematics is essential to the advancement of science and technology. One of the objectives of learning mathematics in the independent Curriculum is the capacity for creative thought (Kemendikbud, 2024). This includes demonstrating a rational approach, critical, cautious, and complete creative analysis, responsibility, responsiveness, and a refusal to give up on a subject even when it seems impossible. Creative thinking is a method that we utilize when we originate or come up with a new concept or integrate previously thought-of ideas that have not yet been created, according to Nurfajri (2022) Developing a novel idea entails offering something out of the ordinary or solving an issue by drawing connections between previously existing but unexplored ideas for pupils. It is necessary to explore students' creative thinking potential and look for alternatives to help teachers foster their creative thinking skills. If not, the person's untapped creative potential is not established and developed (Faturohman & Afriansyah, 2020).

The deliberate ability to guide someone through the process of solving a mathematical problem is known as mathematical thinking. The truth, however, is that students' creative thinking skills in mathematics are still lacking. This is demonstrated by the findings of a study by Priangga (2021) which found that only 39% students' answers in the system of linear equations in two variables material reached the maximum score, with the percentage of the flexibility indicator being 48%, the fluency indicator (fluency) being 36%, the authenticity indicator being 22%, and the percentage of the elaboration indicator, which is 3, being the lowest on the indicator question the student's elaboration was unable to answer. A person's performance in enhancing creativity in innovation is influenced by psychological factors in addition to creative thinking skills. One facet of psychology is self-efficacy. According to Subaidi, (2016), efficacy will boost student achievement in two ways: first, it will encourage interest in oneself for things that one finds fascinating, Second, someone will organize themselves and have a strong commitment to achieving goals. Youngsters who think that intelligence is unchangeable won't make many attempts to alter it. If someone lacks mathematical intelligence, he won't try to comprehend the subject matter or attempt to solve arithmetic issues. not yet resolved. An individual must set a goal or target for themselves, assess their level of effort toward that goal, their resilience in the face of setbacks, and their strength in overcoming obstacles. Success in completing a task will depend on one's level of self-efficacy. They are more capable of learning, take more initiative, are strongly encouraged to respond to difficult questions, are more resilient in the face of adversity, and are better equipped to function at higher and more elevated levels.

Efforts to improve mathematical and creative thinking abilities as well Self Efficacy is by making changes in the learning process, from conventional (usual) learning to innovative learning models. Realizing the importance of a learning model to improve Mathematical creative thinking abilities and Self Efficacy are required there is learning that emphasizes active students. One of the models effective and efficient learning that can be implemented by teachers' mathematics is a Problem Posing learning model with an approach Open Ended. "Open approach Ended is one approach to learning mathematics giving students freedom to think actively and creatively," according to Hasyim & Andreina (2019). "The Open Ended Approach is a learning approach that builds interaction activities between mathematics and students so that invite students to answer problems in their own way Alone," according to Purbonugroho et al. (2020) The Open approach Ended is a learning strategy that presents problems with multiple answers and/or methods for solving them, as can be inferred from the term above. This explanation makes it clear that the problem-posing learning model and the open-ended method are ineffective in helping students develop their mathematical and creative thinking skills as well as their self-efficacy. Given the background information provided, the author is eager to investigate the topic of "**Implementation Of Open-Ended Approach To Improve Mathematical Creative Thinking Skills And Self-Efficacy".**

METHOD

This study used a quantitative approach, with a non-equivalent control group and a sample that was not selected at random but rather because the researcher accepted the subjects' conditions as they are (Ruseffendi, 2005). deep sample This study involved two classes at Bekasi City Junior High School. The experimental class consisted of 30 students and used an open-ended approach to learning, while the control class used a traditional approach. This research employs four measures of creative thinking ability-fluency, flexibility, originality, and elaboration to assess one's capacity for creative thought in mathematics. In the meanwhile, to determine self-efficacy, researchers created a questionnaire with several criteria, including indicators of self-efficacy that relate to three dimensions: strength, generality, and level. Several markers of self-efficacy include conviction that one can overcome obstacles in order to complete a task, diligent in finishing assignments, resilient in the face of setbacks, able to leverage experiences from life to succeed

RESULTS AND DISCUSSION

Results

After six meetings, class normalized gain data processing utilizing both traditional and open-ended learning will be covered in this portion. The following tests were run by the researcher to complete, First, a normalcy test is conducted to determine which average is superior. Sig criteria are used in conjunction with SPSS 21 software to conduct the normalcy test. If Sig. < 0.05, the data is not normally distributed; on the other hand, 0.05 indicates that the data is regularly distributed. The outcomes of the data processing are as follows:

Table 1. Shapiro-Wilk Class Normality Test Experiment and Control

Class	Statistic	Df	Sig.
Eksperiment	0,729	30	0,93
Control	0,635	30	0.76

Table 1 indicates that the experimental and control classes have Sig values of 0.093 and 0.076, respectively. These values indicate that the experimental class is good, and the distributed control class is normal. After it has been established that the data is normally distributed, go on to the homogeneity test variance between classes using an open-ended, conventional method. Following the normalcy test, the researcher performed a second prerequisite test called the homogeneity test, using the following criteria: if Sig. < Ho is refused, then Ho is accepted, and vice versa. The findings of this second homogeneity test class are listed below:

Table 2. Homogeneity Test

Levene's Test for Equality of Variances	
F	Sig.
0,625	0,618

The Sig value is taken from Table 2. as large as 0.618; this value is 0.05, followed by Stated otherwise, the conclusion is that the second variance homogenous class. The significance test of two differences averaged by t-test will then be used to evaluate the hypothesis with the assistance of SPSS software.

Table 3. Test The Significance of The Difference Between Two Means

Class	**T**	**Df**	**Sig.2 Tailed**
Equal Variances Assumed	2,593	60	0,054

Table 3 displays the Sig value for us to examine. Since the average Sig value is 0.027 and the 2 Tailed is 0.054, it can be stated that students who use Open-ended learn more creatively than those who use the traditional method. Students that have low, medium, and high levels of mathematical self-efficacy are the three categories resulting from calculations made using questionnaires given to experimental classrooms that participate in open-ended learning.

Table 4. Student Self Efficacy Test Results

Category	**Many Student**	**Percentage**
Low	8	26,7
Medium	18	60,0
High	4	13,3

The results of measuring self-efficacy can be analyzed from the above table, which shows that there are three categories: the low category, which has a total of eight students and a percentage of 26.7; the medium category, which has a total of eighteen students and a percentage of sixty; and the low category, which has a total of four students and a percentage of thirteen. Three It is evident that most of students who participate in open-ended learning processes have self-efficacy scores in the medium range. This may have an impact on how well pupils use their mathematical creativity.

Discussions

The experimental class received therapy in the form of open-ended mathematical instruction. Providing The goal of this treatment is to determine how to improve pupils' capacity for original mathematical thought. The study's findings demonstrate that there is a notable difference. Students were able to get this since they had previously used an open-ended

approach to learning. As a result, the open-ended method has benefits that are applicable to the learning process. Students have greater opportunity to fully use their knowledge and problem-solving abilities when using the open-ended approach (Dahlan et al., 2017). The traditional technique, in contrast to the open-ended approach, is more likely to lack self-confidence, rely on teacher-provided material, and fail to foster individual learning, knowledge discovery, and creative expression. The outcomes of the pupils' assessments of their creative thinking skills demonstrate this. The same as the research findings from Maryani et al., (2019) indicates that, in summary, open-ended learning can boost creative thinking skills based on research data analysis. The percentage of indicators that were observed between cycles 1 and 2 shows that (1) fluency grew from 35.5 to 66.5 percent. The percentage of flexibility rose from 25.5% to 60.6%. The percentage of authenticity rose from 40.2% to 64.8%. The level of intricacy and richness rose from 30% to 55.5%.

Students rarely could practice creative thinking in traditional classroom settings. when students are unable to fully understand the subject that the teacher has explained. since not every student is able to understand the teacher's explanations in the same way. This prevents pupils with poor recall from building on their existing mathematical concepts. The problems that the teacher solves in the control class are typically solved by the students in that class. Like conventional learning, learning activities start with a problem; however, pupils have not yet developed the knowledge necessary to solve problems on their own. For the reason that pupils are guided by the instructor's explanations and only know what the teacher provides them (Lestari & Rahmi, 2019).

According to the findings of study analysis conducted by Ardi Waluyo, (2018) it can be inferred that teaching mathematics to elementary school kids in an open-ended manner can lead to an increase in their capacity for creative thought. Learning is more engaging and enjoyable when using an open-ended method, which increases the likelihood that learning objectives will be met. An open-ended approach outperforms a conventional method in terms of fostering pupils' capacity for creative thought. The preparation of learning that calls for an instructor's creativity is required before open-ended learning is implemented. Using an open-ended approach to the learning process, begin by asking open-ended questions that aim to guide students' developing comprehension of the given problem. Basic open ended questions fall into three categories: open process, which is a question type with multiple correct solutions provided; final result open, which is a question type with multiple answers provided; and ways further development is open, which allows students to solve new problems by altering the parameters of the initial problem after they have completed it (Sa'dijah et al., 2016). When students possess creative thinking skills, they will use all of their thinking abilities to solve challenges. While having too many options can sometimes make it harder for students to get at the desired outcome, having a wide range of options helps students achieve their objectives more easily than students who are unable to solve an issue.

All things considered, pupils who study mathematics through the Open-Ended method have higher levels of creative thinking than those who learn through other methods. Based on starting mathematical proficiency, improvement Students with early mathematics talents in the high and medium categories are more adept at learning through an open-ended method than through open-ended learning because of their creative thinking skills. Furthermore, employing the open-ended method to learning does not improve the creative thinking skills of students with low starting mathematics proficiency (Nasution, 2017). Students require self-efficacy because those with high levels of self-efficacy can motivate their peers to focus on a particular mathematics problem. Regarding the capacity to comprehend mathematical ideas, one of them will improve mathematical issues. The factors that affect self-efficacy are as follows, according (Fadhila & Kurniasari, 2023): 1) family, 2) peers, 3) school, 4) gender, 5)

age, 6) degree of education, and 7) experience. Self-efficacy manifests itself in the classroom, namely in the open-ended learning process. Since it is evident how confident students are in their ability to understand mathematical concepts utilizing an open-ended method, a confident attitude toward students' skills is necessary during the learning process. According to studies by Fitriana & Risnawati (2021) the open-ended approach's qualities can help pupils feel more independent and boost their self-efficacy.

According to Putri & Awalludin, (2024) the research, pupils who exhibit high and moderate levels of self-efficacy are capable of meeting the markers of fluency, elaboration, and originality. Students with poor self-efficacy, on the other hand, can only meet the fluency indicators. Students are unable to complete the questions measuring the flexibility indicator in the best possible way since there is only one method to answer the questions, even though it is made obvious that there is another option. according to studies done by Khatimah & Fatmah (2019) indicates that The results of the study and the analysis of the research lead to the conclusion that there are differences between the stages of creative thought that students with high and low self-efficacy go through. Students with high self-efficacy and students with low self-efficacy have different creative thinking experiences during the preparation stage when choosing potential approaches that are thought to be appropriate for solving problems, during the illumination stage when offering solutions, and during the verification stage when confirming that the approach chosen for solving problems is correct.

CONCLUSION

Students who were taught mathematics utilizing an Open-Ended approach showed a greater development in creative mathematical thinking abilities than those who were taught using a conventional method, according to the research discussion results. performed better at the end than those taught using traditional methods. The study's findings and subsequent debate led to the conclusion that there was no relationship between the learning strategy and students' baseline mathematical proficiency in terms of fostering their capacity for mathematical creativity. Research and debate revealed that there was no relationship between learning strategies and starting mathematical proficiency on raising students' self-efficacy

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