Volume 7 Number 1 (2025)
January-April 2025
Pages: 989-1004

E-ISSN: 2656-4491
P-ISSN: 2656-4548
DOI: 10.37680/scaffolding.v7i1.9403

SCAFFOLDING
Jurnal Pendidikan Islam dan Multikulturalisme

THE INFLUENCE OF CONTEXTUAL APPROACHES ON STUDENTS' MATHEMATICAL CREATIVE THINKING SKILLS IN ELEMENTARY SCHOOL

Rina Indriani[1], Devi Rahmiati[2], Ari Metalin Ika Puspita[3]
[12]Universitas Pasundan; Indonesia
[3]Universitas Negeri Surabaya; Indonesia
Correspondence E-mail; rinaindriani@unpas.ac.id

Submitted: 12/01/2025 Revised: 13/03/2025 Accepted: 11/04/2025 Published: 26/04/2025

Abstract

This study aims to examine the influence of the contextual approach on elementary school students' mathematical creative thinking skills at SD Negeri 2 Surodakan, Trenggalek, East Java. This research used a quantitative approach with a quasi-experimental design involving an experimental class and a control class. The subjects were fourth-grade students, with class IV-D as the experimental class taught using the contextual approach and class IV-B as the control class taught using conventional learning. The research instrument was an essay test designed to measure mathematical creative thinking skills based on fluency, flexibility, and novelty. Data were collected through pretest and posttest, then analyzed using normality, homogeneity, and independent sample t-tests with SPSS 22.0. The results showed that the experimental class score increased from 78 to 83, while the control class increased from 76 to 78. The hypothesis test obtained significance values of 0.000 and $0.001 < 0.05$, so H_0 was rejected and H_1 was accepted. Thus, the contextual approach significantly influences students' mathematical creative thinking skills and can be used as an effective alternative in elementary mathematics learning.

Keywords Contextual approach, Mathematical Creative Thinking, Elementary School Students.

INTRODUCTION

The progress of the education system depends on the curriculum because curriculum development determines the direction of learning objectives, learning content, teaching strategies, and assessment practices used to achieve educational goals (Prahastina et al., 2024; Suci et al., 2025). In the Indonesian context, the Independent Curriculum is designed to provide more flexible, student-centered, and competency-based learning, enabling students to develop greater creativity, independence, and meaningful understanding (Prahastina et al., 2024; Sulistyaningsih et al., 2024). Therefore, the curriculum functions not only as an administrative guideline but also as a learning framework that helps teachers design relevant learning experiences according to students' needs, characteristics, and learning contexts (Fadilla & Fitriyeni, 2024; Suci et al., 2025).

The Independent Curriculum offers greater flexibility in learning. It gives greater attention to students' needs, interests, and learning characteristics, enabling learning to be designed in a more student-centered, contextual manner (Prahastina et al., 2024; Suci et al., 2025). The curriculum also prioritizes students' developmental aspects, including psychological, cognitive, physical, and learning task dimensions, because effective curriculum implementation requires learning experiences that are relevant to students' conditions and school contexts (Sukarno et al., 2024; Sulistyaningsih et al., 2024). In mathematics learning, the Independent Curriculum emphasizes the development of mathematical competence, numeracy literacy, and creative mathematical thinking as essential abilities for solving problems and facing twenty-first-century learning challenges (A'la et al., 2025a; Ibrahim et al., 2023a). Conceptually, mathematical thinking skills are developed through learning competencies that encourage students to reason, solve problems, communicate ideas, and connect mathematical concepts with real-life situations (Ibrahim et al., 2023a; A. R. Sari & Hidayati, 2024).

In the Independent Curriculum, mathematical thinking is embedded in a series of learning competencies that students must master in certain basic education units. In the learning process carried out, mathematical thinking is a basic concept for elementary school students to develop their thinking skills. Sariningsih, (2014) stated that mathematical understanding is important for students because it is necessary to solve mathematical problems, problems in other disciplines, and problems in daily life, namely, the vision of developing mathematics learning to meet current needs. In line with what was formulated by the *National Council of Mathematics Teachers* (NCTM) (Purwasih & Pd, 2015), understanding mathematical problems is a fundamental mathematical thinking skill that

involves reasoning and creative thinking. The level of creative thinking ability, according to Siswono, (Akmalia et al., n.d.), uses the measured aspects of mathematical creative thinking ability, which are fluency, flexibility, and novelty, to identify the level of creative thinking of the subject. Similarly, according to Silver (Aesyiati, 2016), to identify and analyze the creative level of mathematical problem-solving in general, using three aspects: *flexibility*, *fluency*, and *novelty*.

The mathematical creative thinking skills of elementary school students can be developed through an engaging learning process and foster high levels of students' curiosity. One way to explore students' creative thinking skills in the learning process is to use a contextual approach. Rusman (2018) stated that "an approach is the first step in the formation of ideas to see a problem or object to be studied." *Teaching and Contextual Learning* is a learning approach that emphasizes students' full involvement in learning, enabling them to understand and relate the material to real-life situations, thereby encouraging them to apply it in their lives (Sanjaya, 2016). In line with this, Puspita (Indriani, n.d.) states that "a contextual approach is an approach that involves individual experiences to gain new knowledge, share information, and apply knowledge in life."

Based on observations, interviews with grade IV teachers, and documentation conducted at SD Negeri 2 Surodakan, students' mathematical creative thinking skills remained relatively low. This condition was reflected in students' difficulties when solving open-ended problems that required more than one strategy or solution. Most students tended to imitate the teacher's example procedures and were not yet able to develop their own ideas independently. The initial observation showed that, out of 30 students, 68% could answer questions using only one method. At the same time, indicators of flexibility and novelty in mathematical creative thinking were not optimal. In addition, classroom learning activities remained dominated by teacher-led lectures and textbook-based assignments, leaving students as passive recipients of information. Based on interviews with teachers, this condition was influenced by several factors, including the habit of using conventional learning methods, limited use of innovative learning media, and students' low confidence in expressing mathematical ideas. In response to these problems, the school had implemented several policies, including encouraging teachers to implement student-centered learning through the Independent Curriculum, conducting internal teacher discussions, and providing training on innovative learning approaches. However, the implementation in classroom practice had not yet been consistent, so students' creative thinking skills still needed improvement.

Scientifically, the contextual approach was considered appropriate as an antithesis to these problems because it emphasizes the connection between learning materials and students' real-life experiences. Through Contextual Teaching and Learning (CTL), students are not only directed to memorize mathematical concepts; they are also guided to understand them. Still, they are also encouraged to construct their own understanding through authentic situations encountered in everyday life. This condition is highly relevant to the characteristics of elementary school students who tend to understand concepts more easily when learning is concrete and closely related to their environment. The contextual approach also provides opportunities for students to explore various problem-solving strategies, discuss with peers, and actively communicate ideas, thereby supporting indicators of creative thinking such as fluency, flexibility, and novelty. During preliminary observations at SD Negeri 2 Surodakan, students showed greater enthusiasm when mathematics problems were linked to situations familiar to them, such as buying and selling, measuring classroom objects, and daily counting. Therefore, the contextual approach was believed to be capable of creating meaningful learning experiences, increasing students' active participation, and improving mathematical creative thinking skills more effectively compared to conventional teacher-centered learning.

The results of research conductedby Rahmi (2017), over the last ten years, which reviewed various studies, show that students' mathematical creative thinking skills can be improved through appropriate learning approaches and media. The Contextual Teaching and Learning (CTL) approach has proven to be effective in encng students to develop ideas flexibly and meaningfully(Nurlita & Jailani, 2023). In addition, the use of technology, such as GeoGebra, supports the development of creative thinking indicators, such as *fluency*, *flexibility*, and *novelty* in problem-solving (Wulandari & Siswono, 2024). The use of contextual learning media, including mathematics comics, also contributes to helping students understand concepts more deeply while stimulating creativity through interesting presentations that are close to real life (Putri et al., 2022; Sari et al., n.d.). On the other hand, development research using the ADDIE model shows that systematic learning design can produce products that effectively facilitate the improvement of students' mathematical creative thinking skills (Pratama et al., 2020).

Previous studies have shown that students' mathematical creative thinking skills can be improved through the implementation of innovative learning approaches and media. Research conducted byRahmi (2017) revealed that contextual learning improved students' mathematical

creative thinking skills; however, the study focused on secondary school students and did not examine its implementation among elementary school students within the context of the Independent Curriculum. Likewise, the study Nurlita & Jailani (2023) found that the contextual approach was effective in improving students' creativity and collaboration skills. However, the research emphasized collaborative aspects without specifically discussing indicators of mathematical creative thinking, such as fluency, flexibility, and novelty. Meanwhile, (Wulandari & Siswono, 2024) emphasized the use of GeoGebra technology to support mathematical creative thinking. Still, their study focused more on digital media support and did not specifically examine the direct implementation of contextual learning approaches in elementary school classrooms. Furthermore, the study conducted Putri et al. (2022) on contextual learning media in the form of mathematics comics was more focused on media development than on the effectiveness of the learning approach in improving students' creative thinking skills. In addition, (Pratama et al., 2020), through the ADDIE development model, mainly focused on developing learning products and did not experimentally test the influence of contextual approaches on students' mathematical creative thinking skills.

Based on these previous studies, there remains a research gap: the limited number of studies that specifically examine the influence of contextual approaches on elementary school students' mathematical creative thinking skills during the implementation of the Independent Curriculum, particularly among fourth-grade students at SD Negeri 2 Surodakan. The novelty of this study lies in the use of a quasi-experimental design to directly measure improvements in elementary school students' mathematical creative thinking skills, as indicated by fluency, flexibility, and novelty in mathematics learning, aligned with students' real-life situations. This study also presents empirical conditions in elementary school classrooms where learning remains predominantly teacher-centered, thereby making a new contribution to the effectiveness of contextual approaches as an alternative learning strategy relevant to the characteristics of elementary school students within the Independent Curriculum. Therefore, the purpose of this study is to examine the influence of the contextual approach on elementary school students' mathematical creative thinking skills.

METHOD

This research is quantitative. Quantitative research uses numerical data from data collection, data interpretation, and the presentation of research results. The research design used in this study

is experimental. (Sujarweni, 2015) stated that experimental methods aim to explain the cause-and-effect relationship between one variable and another variable (variable X and variable Y). The method applied in this study is a quasi-experimental design. According to (Sugiyono, 2016), quasi-experimental research is a type of research that involves a control group but cannot fully control external variables that may influence the experiment. This research was conducted at SD Negeri 2 Surodakan, located in Surodakan Village, Trenggalek District, Trenggalek Regency, East Java, Indonesia, involving fourth-grade students in the 2024/2025 academic year. The selection of this research location was based on preliminary observations and interviews with teachers, which indicated that students' mathematical creative thinking skills remained relatively low and that classroom learning activities remained predominantly teacher-centered. Therefore, SD Negeri 2 Surodakan was deemed an appropriate research site to examine the influence of the contextual approach on students' mathematical creative thinking skills.

Table 1. Research Design

Classes	Prates	Treatment	Post-tests
Experiments	O1	X	O2
Controls	O3		O4

Source: Sugiyono (2016: 76)

Furthermore, the population and sample were determined by selecting a research location. The population in this study is grade IV students at SD Negeri 2 Surodakan, Trenggalek District, Trenggalek Regency, totaling 122 students divided into four classes. Details of the population are shown in the following table.

Table 2. Number of State Elementary School Population 2 Academic Year 2019/2020

Classes	Male (%)	Female (%)
IV A	48	52
IV B	59	41
IV C	50	50
IV D	47	53

The sampling technique used in this study is non-*probability sampling. Nonprobability Sampling* is a sampling technique that does not provide the same opportunity for each element or member of the population to be selected into the sample. The sampling method used in this study is *purposive sampling.* This means that students in grades IV-B and IV-D have not applied a contextual approach and are still using methods aligned with the book material.

Table 3. Sampling Techniques

Population			Sample	Sampling techniques
IV-B	IV-D	Quantity	(Class IV-D as experimental class and class IV-B as control class)	*Sampling Purpose*

The independent variable in this study is Contextual Approach (X). The variable related to this study is Mathematical Creative Thinking Ability (Y).

Table 4. Research Variables

Yes	Variable	Sub Variables	Indicator	Instrument Type
1	Bound (Y)	**-**	Pretest *and* posttest *scores*	Essay
2	Free (X)	**-**	Learn according to the material in the book Learning using a contextual approach	

The flow of the research is described below

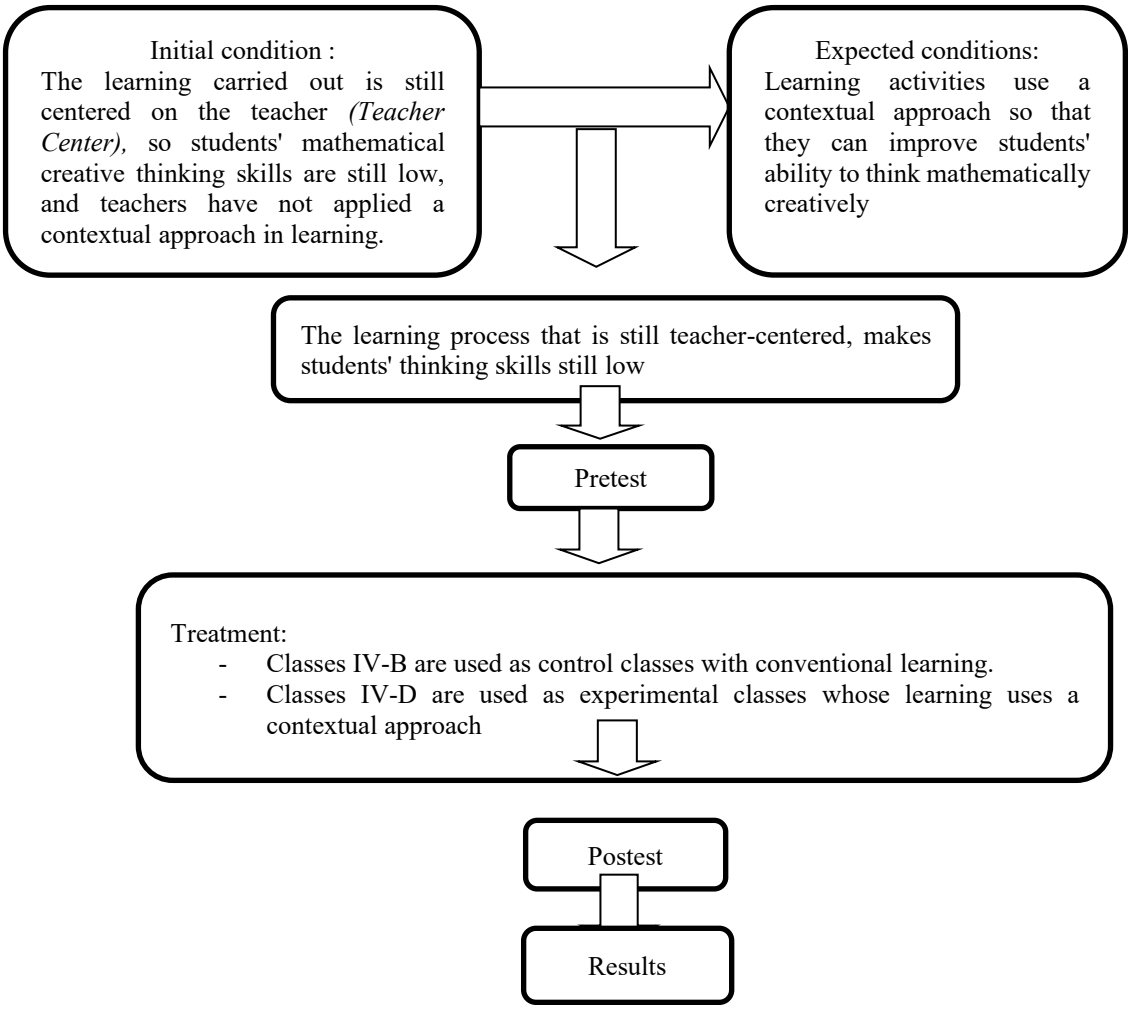

Figure 1. Research Flow Diagram

The data collection instrument was a test assessing students' mathematical creative thinking skills to examine the influence of contextual learning. The data in this study are quantitative, obtained from students' mathematical creative thinking ability tests. This research was conducted at SD Negeri 2 Surodakan, located in Surodakan Village, Trenggalek District, Trenggalek Regency, East Java, Indonesia, involving fourth-grade students in the 2024/2025 academic year. The data source for this study came from students in classes IV-B and IV-D, who served as the research subjects.

The data collection technique used is the test method, namely pretest and posttest, in the form of essay questions designed to measure indicators of mathematical creative thinking ability, including *fluency*, *flexibility*, and *novelty*. The research instrument is in the form of test questions that have undergone validity and reliability testing before use. The validity of the instrument aims to ensure the suitability of the item to the measured indicator, while reliability determines the consistency of measurement results.

The data analysis technique is carried out through several stages, namely: (1) analysis prerequisite test which includes a normality test and a homogeneity test to find out whether the data is normally distributed and has a homogeneous variance; (2) a hypothesis test using *a t-test* to determine the difference in the average posttest results between the experimental class and the control class; and (3) an analysis of improving students' mathematical creative thinking skills through a comparison of pretest and posttest scores.

The hypothesis in this study is as follows: H_0: There is no influence of the contextual approach on students' mathematical creative thinking ability. H_1: There is an influence of the contextual approach on students' mathematical creative thinking skills. Thus, this research method was systematically developed to test the influence of applying contextual approaches on the mathematical creative thinking ability of elementary school students.

FINDINGS AND DISCUSSION

Findings

The research uses the validity of the test instrument to determine the extent of the instrument's accuracy in carrying out its measurement function, namely that the data obtained are relevant to or in accordance with the purpose of the measurement. The validity test is carried out for each item, and the results are seen in the calculation of r, which is compared to the table r = 0.279.

If r is calculated ≥ the table r, it is valid; on the other hand, if r is calculated < the table r, it is invalid. The number of students tested in one class is 30. The following table shows the validity of the pretest and posttest questions.

Table 5. Question Validity Test Results

Yes	Criteria	Question Items	Quantity
1	Applicable	1, 6, 7, 8, 9, 10,11, 12, 13, 14, 15	11
2	Invalid	2, 3, 4, 5	4

It can be concluded that of the 15 questions tested, 11 were valid and 4 were invalid. Valid questions can be used as pretests and posttests, while invalid ones cannot. The reliability coefficient was calculated using the Alpha Cronbach formula with the help *of SPSS 22.0 software for Windows.* Reliability testing was performed on 10 valid items.

Table 6. Reliability Test Results

Reliability Statistics	
Alpha Cronbach	**N item**
.854	10 item

From the reliability test with the Alpha Cronbach formula, a reliability value of 0.854 was obtained. The study's results showed that the research instrument used had high reliability.
The calculation uses the Difficulty Index formula. The data can be seen below.

Table 7. Difficulty Test Data

Nope.	Criteria	Question Items	Quantity
1.	Difficult	5, 7, 10, 11, 14	5
2.	Medium	2, 4, 6, 8, 9, 12, 13, 15	8
3.	Easy	1, 3	2

The number that indicates the difficulty and ease of the question is called *the difficulty index*. The difficulty index ranges from 0.00 to 1.0. The index of 0.00-0.30 indicates that the question is difficult (5), 0.31-0.70 indicates that the question is medium (8), and 0.71-1.00 indicates that the question is easy (2). The results of the question power difference test are shown in the table below.

Table 8. Different Types of Testing

Yes	Criteria	Question Items	Quantity
1	Very good	6,11,12,13,14,15	6
2	Good	7,8,9,10	4
3	Enough	1,3,4,5	4
4	Ugly	2	1

Based on the power difference index, 0.00 to 0.30 is considered bad by 1 question, 0.31 to 0.40 is considered enough for 4 questions, 0.41 to 0.70 is considered good for 4 questions, and 0.71 to 1.00 is considered very good for 6 questions. Results from the study on the influence of contextual proximity on the ability to think creatively mathematically in elementary school students are shown descriptively in the figure below.

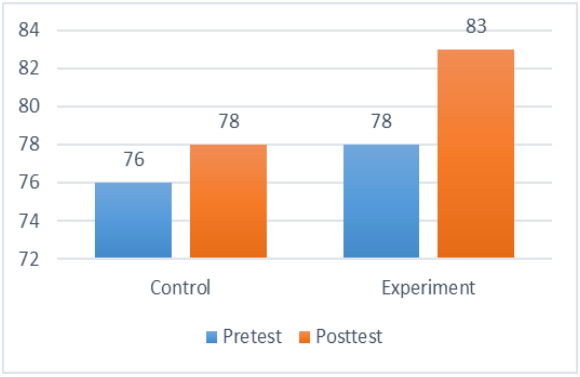

Figure 2. Pretest and poster data on mathematical creative thinking skills for students in grades IV-B and IV-D SD Negeri 2 Surodakan

It can be seen that the pretest score of the control class averages 76, and the posttest score averages 78. While the pretest score of the experimental class averages 78, the posttest score averages 83.

Next, data analysis was carried out, followed by using prerequisite tests, namely normality and homogeneity tests, and then by the final stage of hypothesis testing. The normality test was carried out to determine whether the data from the two classes were normally distributed. The researcher used *the Kolmogorov-Smirnov test as the normality test.* The following are the results of the normality test.

Table 9. Normality Test Results

Classes		**Kolmogorov-Smirnova**		
		Statistics	df	Sig.
Mathematical creative thinking skills	Class B	,161	27	.070
	Class D	,137	30	,160

From the table above, the test uses *Kolmogorov Smirnov*. The normality test uses *the Kolmogorov-Smirnov* test on the results of the control class for mathematical creative thinking ability, and the p-value is p > 0.05, indicating that the data are normally distributed. The significance value in Table 4.6 supports this, i.e., it shows that the significance value for the control class using the Kolmogorov-Smirnov test was 0.070, which is> 0.05. In contrast, the Kolmogorov-Smirnov test for

the experimental class yielded a p-value of 0.160 > 0.05.

Homogeneity Test

The homogeneity test aims to determine whether the distribution of a variant or the data from two or more groups is homogeneous. The homogeneity test can be carried out after the data meet the requirements for normality, i.e., the data are declared to be normally distributed. The homogeneity test is carried out using *One-Way* ANOVA, which is calculated using SPSS 22.0 with a significance level of 0.05. If the significance value > 0.05, then the data distribution is homogeneous. The results of the homogeneity test are shown below.

Table 10. Homogeneity Test Results

Live Statistics	df1	DF2	Sig.
2,169	1	55	,147

Based on the table above, the results of mathematical creative thinking ability show homogeneous distributions with control and experimental classes having a significance value of 0.147 > 0.05, indicating a homogeneous variant of mathematical creative thinking ability.

Hypothesis Testing

After the normality and homogeneity test, the hypothesis test stage used in this study is *the Independent Samples T-Test*, with *SPSS* 22.0 used to determine whether the contextual approach influences the mathematical creative thinking ability of students at SD Negeri 2 Surodakan. The results of the hypothesis test are shown in the table below.

Table 11. Independent Sample *of Hypothesis Test Results T*

Mathematical creative thinking skills	t-test for Facility Equity		T	Sig.
	Red	Std. Error Difference		(Tail 2)
The same variance is assumed	-7,093	1,889	-3,754	,000
Equal variance is not assumed	-7,093	1,934	-3,668	,001

The results of the hypothesis test above obtained a sig value. The control class (2 heads) and the experimental class had 0.000 and 0.001, respectively. In accordance with the *independent-samples t-test*, the significance. (2 heads) value < 0.05 indicates a significant difference between the control and experimental classes. Hypothesis 0 is rejected, indicating a significant effect of the contextual approach on the mathematical creative thinking ability of elementary school students.

Discussion

The results of this study indicate that the contextual approach has a significant influence on students' mathematical creative thinking skills at SD Negeri 2 Surodakan, Trenggalek, East Java. This finding is shown by the increase in the experimental class's average score from 78 in the pretest to 83 in the posttest, while the control class increased only from 76 to 78. The independent-samples t-test also showed significance at 0.000 and 0.001 (< 0.05), indicating a significant difference between students who learned through the contextual approach and those who learned through conventional instruction. This finding supports previous studies that have shown that contextual learning can improve students' mathematical understanding and creative thinking by connecting mathematical concepts to real-life situations (Hayati et al., 2022; Purwasih, 2015; Rahmi, 2017; Sariningsih, 2014; Tamur et al., 2021).

Theoretically, the contextual approach is relevant to the development of mathematical creative thinking because it emphasizes meaningful learning through the relationship between subject matter and students' daily experiences. Contextual Teaching and Learning encourages students to be actively involved in finding concepts, connecting them with real-life situations, and applying them in daily life (Indriani & others, 2019; Rusman, 2018; Sanjaya, 2006; A. R. Sari & Hidayati, 2024). In mathematics learning, this approach is important because mathematical creative thinking requires students to generate various ideas, use different strategies, and produce original solutions. These aspects are in line with the indicators of creative thinking, namely fluency, flexibility, and novelty (Aesyiati, 2016; Ibrahim et al., 2024).

The improvement of students' mathematical creative thinking skills in the experimental class indicates that contextual learning provides more opportunities for students to explore various solution strategies. In conventional learning, students tend to follow the teacher's examples and procedures, limiting their flexibility and novelty. In contrast, contextual learning encourages students to connect mathematical concepts with familiar situations, such as measurement, counting activities, buying and selling, and other daily-life contexts. This finding is consistent with previous studies showing that contextual learning can improve students' mathematical creative thinking, problem-solving ability, and collaboration (Agustyaningrum, 2014; Hayati et al., 2022; Nurlita & Jailani, 2023; Rahmi, 2017; Yanti & Basir, 2023).

Furthermore, this study strengthens previous research showing that contextual approaches and contextual-based learning media can support higher-order thinking skills in mathematics. Putri

found that mathematics comics based on Contextual Teaching and Learning helped students understand mathematical concepts and develop creative thinking. Sari, Anita, and Maesyaroh also found that the contextual approach improved students' critical thinking skills in mathematics. Similar findings were reported by Zen, Aisyah, and Kurniawan, who stated that contextual learning assisted by video media improved students' creative thinking skills (Gerosa et al., 2025; Hestisuci & Jailani, 2025; Putri, 2024; N. H. Sari et al., 2023). Therefore, the present study affirms that contextual learning is not only useful for improving mathematical understanding but also for developing students' mathematical creativity.

The findings of this study also align with recent studies on mathematical creative thinking in elementary and mathematics education. Mathematical creative thinking is an important ability because it helps students solve problems, construct ideas, and develop alternative strategies in learning mathematics (A'la et al., 2025b; Purwasih, 2015; Sariningsih, 2014). Recent studies also emphasize that creativity in mathematics learning can be developed through contextual problems, open-ended tasks, problem-solving, and problem-posing (Ibrahim et al., 2023b; Leikin & Sriraman, 2022; A. R. Sari & Hidayati, 2024). Thus, the contextual approach used in this study is relevant to the need to develop students' mathematical creative thinking skills from elementary school.

Based on the dialogue with previous studies, this research provides an affirmation that the contextual approach is effective in improving elementary school students' mathematical creative thinking skills. The results of this study are consistent with earlier studies, which found that contextual learning can improve mathematical understanding, reasoning, problem solving, collaboration, and creative thinking (Sariningsih, 2014; Agustyaningrum, 2014; Rahmi, 2017; Nurlita & Jailani, 2023; Tamur et al., 2021; Hayati et al., 2022). However, this study also provides an antithesis to conventional teacher-centered learning. The control class showed only a small increase from 76 to 78, indicating that conventional learning is less effective at facilitating students' fluency, flexibility, and novelty in mathematical thinking (Gerosa et al., 2025; Rusman, 2018; Sanjaya, 2006; N. H. Sari et al., 2023).

Nevertheless, implementing contextual learning requires careful learning design. Teachers must be able to choose contexts that are close to students' lives, guide students in discussion, and provide opportunities for students to present different solution strategies. If the contextual approach is used only as a surface-level example without active student involvement, the learning process may remain monotonous and fail to foster optimal creative thinking (Indriani & others, 2019;

Nurlita & Jailani, 2023; Sanjaya, 2006; Tamur et al., 2021). Therefore, the success of contextual learning depends not only on the approach itself, but also on the teacher's ability to facilitate meaningful mathematical activities.

Therefore, the contextual approach can be recommended as an effective alternative in elementary mathematics learning, especially within the implementation of the Independent Curriculum. The results of this study at SD Negeri 2 Surodakan, Trenggalek, show that connecting mathematics to real-life situations can make learning more meaningful and encourage students to develop creative mathematical thinking. This study contributes to strengthening the use of contextual learning in elementary school mathematics by supporting active participation, problem-solving, and creative mathematical ideas (Ibrahim et al., 2023b; A. R. Sari & Hidayati, 2024).

CONCLUSION

Based on the results and discussion of the study conducted at SD Negeri 2 Surodakan, Trenggalek, East Java, it can be concluded that the contextual approach significantly influences elementary school students' mathematical creative thinking skills. This is evidenced by the results of the independent-samples t-test, which showed a p-value < 0.05, indicating that H_0 was rejected and H_1 accepted. Thus, the contextual approach can be an effective alternative in mathematics learning because it helps students connect mathematical concepts to real-life situations and develop creative thinking skills such as fluency, flexibility, and novelty. Future researchers are advised to examine other aspects that were not measured in this study and to apply the contextual approach to different materials, grade levels, or school contexts.

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