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Mathematical creative thinking skills of students: a study on scientific and contextual approaches

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Abstract
Creative thinking in mathematics is recognised as one of the most essential skills for students. It is a high-level cognitive ability encompassing fluency, flexibility, novelty, and elaboration. The scientific and contextual approaches to learning are among the strategies utilised in teaching and learning activities. This research employs a quantitative design with two subjects, selected from classes through random sampling techniques. The study consists of two stages: the administration of mathematical creative thinking tests and interviews. The objectives of this study are: to investigate whether there are significant differences in students' creative mathematical thinking abilities between classes employing the contextual approach and those using the scientific approach; to explore the profile of students' creative thinking abilities in classes employing the contextual approach; and to examine the profile of students' creative thinking abilities in classes using the scientific approach. The data analysis methods include observation, documentation, interviews, and tests. The findings of the study reveal: a significant difference in student learning outcomes in terms of creative mathematical thinking abilities, with a significant average difference of 0.000 and Sig. [2-tailed] < 0.05, indicating superior performance in the contextual approach compared to the scientific approach; the profile of students' creative thinking abilities in the class with the contextual approach encompasses all four aspects of creative thinking: fluency, flexibility, originality, and elaboration; and the profile of students' creative thinking abilities in the class with the scientific approach includes only three aspects: fluency, originality, and elaboration. In conclusion, this research indicates that learning outcomes in classes using the contextual approach are superior to those in classes using the scientific approach.
Keywords: Creative Thinking; Scientific Approach; Contextual Approach

Abstrak
Berpikir kreatif dalam matematika diakui sebagai salah satu keterampilan yang paling penting bagi siswa. Ini adalah kemampuan kognitif tingkat tinggi yang mencakup kefasihan, fleksibilitas, kebaruan, dan elaborasi. Pendekatan saintifik dan kontekstual dalam pembelajaran merupakan salah satu strategi yang digunakan dalam kegiatan belajar mengajar. Penelitian ini menggunakan desain kuantitatif dengan dua subjek yang dipilih dari kelas melalui teknik pengambilan sampel secara acak. Penelitian ini terdiri dari dua tahap: pemberian tes berpikir kreatif matematis dan

wawancara. Tujuan dari penelitian ini adalah: untuk menyelidiki apakah ada perbedaan yang signifikan dalam kemampuan berpikir kreatif matematis siswa antara kelas yang menggunakan pendekatan kontekstual dan kelas yang menggunakan pendekatan saintifik; untuk mengeksplorasi profil kemampuan berpikir kreatif siswa pada kelas yang menggunakan pendekatan kontekstual; dan untuk memeriksa profil kemampuan berpikir kreatif siswa pada kelas yang menggunakan pendekatan saintifik. Metode pengumpulan data yang digunakan adalah observasi, dokumentasi, wawancara, dan tes. Temuan penelitian mengungkapkan: adanya perbedaan yang signifikan pada hasil belajar siswa dalam hal kemampuan berpikir kreatif matematis, dengan perbedaan rata-rata yang signifikan sebesar 0,000 dan Sig. (2-tailed) < 0,05, yang menunjukkan lebih unggulnya hasil belajar siswa pada pendekatan kontekstual dibandingkan dengan pendekatan saintifik; profil kemampuan berpikir kreatif siswa pada kelas yang menggunakan pendekatan kontekstual lebih baik dibandingkan dengan kelas yang menggunakan pendekatan saintifik; profil kemampuan berpikir kreatif siswa pada kelas dengan pendekatan kontekstual mencakup keempat aspek berpikir kreatif yaitu kelancaran, keluwesan, keaslian, dan elaborasi; sedangkan profil kemampuan berpikir kreatif siswa pada kelas dengan pendekatan saintifik hanya mencakup tiga aspek yaitu kelancaran, keaslian, dan elaborasi. Kesimpulannya, penelitian ini menunjukkan bahwa hasil belajar di kelas yang menggunakan pendekatan kontekstual lebih unggul dibandingkan dengan kelas yang menggunakan pendekatan saintifik.
Kata Kunci: Berpikir kreatif; pendekatan saintifik; pendekatan kontekstual

Introduction

Mathematics plays a pivotal role in both daily life and educational settings. As such, it is a subject taught at all levels of formal education, from primary through to secondary school. The teaching of mathematics involves considerable practical application, as the subject extends beyond numerical calculations to encompass logical and creative thinking, along with various other cognitive aspects. According to the Regulation of the Minister of National Education No. 22 of 2006, the objectives of mathematics learning at the primary and secondary levels are as follows: (1) to understand mathematical concepts, explain relationships between concepts, and apply these concepts or algorithms flexibly, accurately, efficiently, and precisely in problem-solving; (2) to utilise reasoning to recognise patterns and properties, perform mathematical manipulations to make generalisations, construct proofs, or explain mathematical ideas; (3) to solve problems that involve understanding, modelling, solving, and interpreting solutions; (4) to communicate ideas using symbols, tables, diagrams, or other media to clarify problems; and (5) to foster an appreciation of the utility of mathematics in life, cultivating curiosity, attention, interest, tenacity, and confidence in solving problems.

Creative thinking is a vital skill that students must develop. It encompasses fluency, flexibility, novelty, and attention to detail, which are necessary for problem-solving (Arnisya & Afriansyah, 2024). This aligns with the view expressed by Suryani (2015), who states that creative thinking in mathematics involves the development of fluency, flexibility, originality, and elaboration of ideas. In order to meet the goals of mathematics education, it is imperative that students engage in creative thinking. This ability is essential not only for problem-solving but also because creativity encourages divergent thinking, which allows for multiple solutions to a given problem. Such thinking expands students' cognitive flexibility, enabling them to approach problems from various perspectives. Through creative approaches in mathematics, students are expected to gain confidence in solving problems and to develop their own methods or ideas for solutions (Dhungana & Thapa, 2023; Jao, 2023; Efwan et al., 2024).

The importance of creativity in education is also underscored by the Indonesian Law No. 20 of 2003 concerning the National Education System, which states that "National education aims to develop the potential of students to become individuals who are faithful, virtuous, healthy, knowledgeable, capable, creative, independent, and responsible citizens" (Winarti, 2016; Halini et al., 2023). In this study, four primary characteristics of creative thinking are measured: (1) fluency, (2) flexibility, (3) elaboration, and (4) originality (Sholikhah, Sofiana, & Hidayah, 2023).

The development of creative thinking abilities is particularly crucial in the information age. Individuals with strong creative thinking skills are better equipped to thrive and tackle challenges (Mariani & Dewi, 2025). To foster these abilities, educators must cultivate classroom environments that stimulate students' creativity. This can be achieved through assignments that prompt critical questions, such as "What if?", "What is wrong?", and "What will you do?" in order to encourage diverse problem-solving approaches (Krulik & Rudnick, 1999; Mukhibin et al., 2024).

However, observations conducted in class XI at MA AL-AHROM Demak reveal that students struggle to apply creative thinking skills in mathematics. They face difficulties in understanding word problems and encounter obstacles in solving mathematical problems. During lessons, students also appear less engaged and lack challenges that might stimulate their curiosity. As a result, their motivation to learn mathematics and develop their creative thinking abilities is diminished. Moreover, students frequently struggle to relate mathematical concepts to real-life situations and to connect prior knowledge with new material (Sitorus, 2023; Monalisa et al., 2024).

Given these challenges, improvements in the teaching process are necessary. One potential solution is the adoption of innovative teaching approaches. Pradana & Noer (2023) suggests that problem-solving, inquiry-based, and discovery-based methods can help foster creative thinking skills. By enhancing teaching methods and selecting appropriate learning models, it is hoped that students' creative thinking abilities can be further developed. Among the approaches that can be applied in mathematics education are contextual and scientific approaches (Ali, et.al 2022; Santoso, et.al, 2023).

The Contextual Teaching and Learning (CTL) approach is a concept that helps educators connect instructional content to real-world situations, encouraging students to apply their knowledge in their daily lives as members of both family and community. The approach is based on seven key elements: constructivism, questioning, discovery, learning communities, modelling, and authentic assessment (Santoso, et.al, 2023). Meanwhile, the scientific approach, as outlined by Ali, et.al (2022), is designed to actively engage students in constructing concepts and principles through stages such as observing, formulating problems, hypothesising, collecting data, analysing data, drawing conclusions, and communicating findings. This method encourages the development of process skills such as observing, clarifying, measuring, predicting, explaining, and concluding. According to Pebriyanti, et all (2021), teaching with a scientific approach allows students to realise that information can be biased and that it is not always aligned with the teacher's perspective.

In conclusion, improvements in mathematics teaching methods are essential for enhancing students' creative thinking skills. This study aims to investigate the influence of contextual and scientific approaches on students' creative thinking abilities within mathematics education (Suherman & Vidákovich, 2024).

Method

This research is a type of quantitative research, conducted at MA AL-AHROM, Demak Regency, Central Java, Indonesia. The study was carried out in the second semester of the 2023/2024 academic year with class XI as the sample group. The sampling technique used was cluster random sampling, ensuring that the selected students were grouped into designated classes. The study involved two experimental groups: the first experimental group, XI MIA 1, was assigned the scientific learning approach, with a sample of 20 students. The second experimental group, XI MIA 2, received the contextual learning approach, also with a sample of 20 students.

The data collection methods employed were testing, interviews, and documentation. The documentation method was used to gather initial data on students' abilities through their test scores from previous materials. This data was then analysed using normality and homogeneity tests to ensure that the selected subjects had comparable initial abilities, thus facilitating more straightforward analysis after the implementation of the different learning approaches. The test method was used to collect data on students' mathematics learning outcomes following the application of the respective treatments. The test used to measure mathematics learning outcomes consisted of descriptive questions.

The interview method was used to complement and clarify students' responses during the test, serving as a tool to assess the level of creativity demonstrated by students in completing the test. Data analysis techniques included normality tests (Kolmogorov-Smirnov Test), homogeneity tests, hypothesis tests (independent sample t-test), and proportion tests. After analysing the post-test scores, one subject from each class was selected for further study, in order to gain deeper insight into the level of creative thinking ability in each class. The selection of subjects for interviews was carried out randomly in both classes.

Result

Before commencing the research, the initial abilities of the two subject classes were determined. Experimental class 1, which was assigned a scientific approach, and experimental class 2, which received a contextual approach, were assessed for their baseline performance. As such, prior to any treatment, normality and homogeneity tests were conducted. The results from the Kolmogorov-Smirnov Z test indicated a significance value of 0.926 for experimental class 1, with a Sig. value greater than 0.05. Thus, it was concluded that the data for both experimental class 1 and experimental class 2 followed a normal distribution. Furthermore, the homogeneity test yielded a significance value of 0.140, also greater than 0.05, confirming that the data were homogeneous. This analysis indicates that both samples originated from the same population.

The subsequent data analysis for normality employed the Kolmogorov-Smirnov Test, which follows the decision rule: if the significance value (Sig.) exceeds 0.05, the residuals are considered normally distributed. If the Sig. value is less than 0.05, the residuals are considered non-normally distributed. The One-Sample Kolmogorov-Smirnov Test for posttest results from both experimental classes yielded a value of 0.647, with a Sig. value greater than 0.05, confirming that the posttest results for both experimental class 1 and experimental class 2 were normally distributed. Similarly, the homogeneity test for the posttest values yielded a Sig. value of 0.286, which was also greater than 0.05, thus confirming homogeneity in the final data.

Next, a hypothesis test was conducted to examine whether there was a significant difference between the learning outcomes of the two experimental classes. According to the two-tailed significance test, if the Sig. value is less than 0.05, the differences are deemed statistically significant. The results indicated a Sig. value of 0.000 (Sig. [2-tailed] < 0.05), confirming a significant difference between the learning outcomes of the two experimental classes.

Table 1. Independent t test

Independent Samples Test				
		t-Test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Learning Outcomes	Equal variance assumed	.000	-8.30000	1.52712
	Equal variance not assumed	.000	-8.30000	1.52712

Based on the Table 1, it is evident that for equal variances assumed, the significance (Sig. [2-tailed]) is 0.000, which is less than 0.05, indicating a significant difference between the learning outcomes of experimental class 1 and experimental class 2. To further assess classical completeness, a proportion test was conducted for both experimental classes. The one-way hypothesis test yielded a $Z_{\text{-value}}$ of 0.000 for experimental class 1, and for experimental class 2, the $Z_{\text{-value}}$ was 0.3921. Both results support the hypothesis H_0, indicating that the classical completeness for both experimental classes is greater than or equal to 85%.

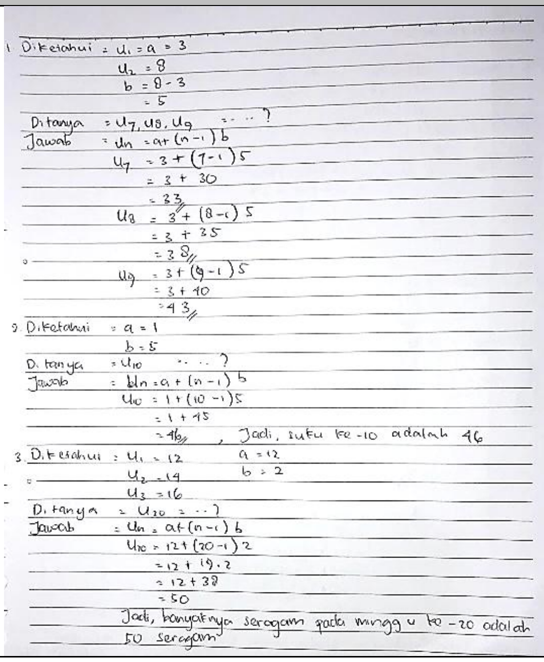
Additionally, a sampling of two students from each experimental class was randomly selected for interview-based testing. The selected subjects are as follows in Table 2.

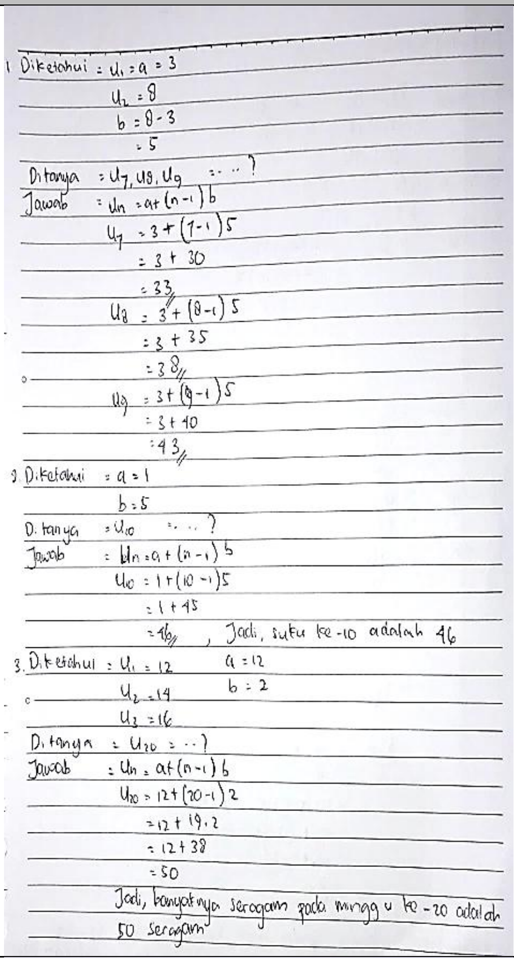
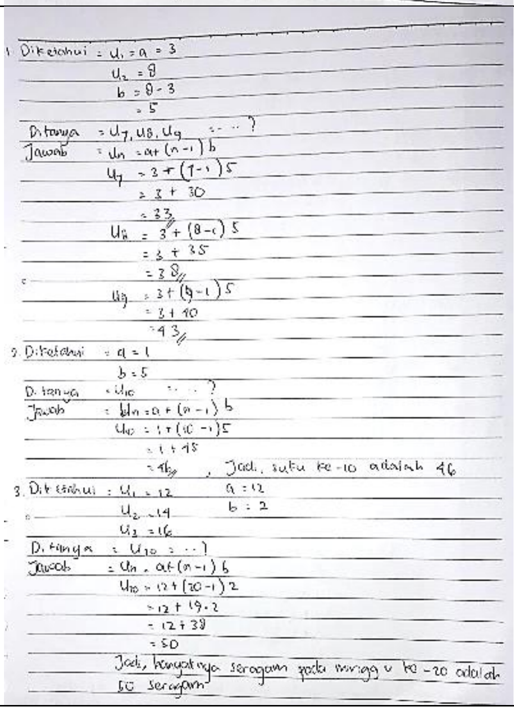
Table 2. Selected subjects

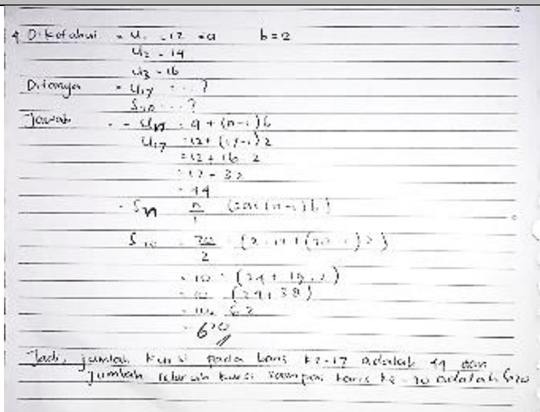
No.	Subject Code	Class
1.	S1	Experiment 1 (Scientific)
2.	S2	Experiment 2 (Contextual)

The answers provided by the selected subjects were analysed during the subsequent interview tests. The results, as shown in Table 3, highlight the fluency, flexibility, originality, and elaboration in the responses of both subjects.

Table 3. Mathematical creative thinking test answers subject S1

No.	Indicator	Test Answer	Analysis
1.	Fluency	 1 Diketahui : $U_1 = a = 3$ $U_2 = 8$ $b = 8 - 3$ $= 5$ Ditanya : U_7, U_8, U_9 = ... ? Jawab : $U_n = a + (n-1)b$ $U_7 = 3 + (7-1)5$ $= 3 + 30$ $= 33$ $U_8 = 3 + (8-1)5$ $= 3 + 35$ $= 38$ $U_9 = 3 + (9-1)5$ $= 3 + 40$ $= 43$ 2 Diketahui : $a = 1$ $b = 5$ Ditanya : U_{10} = ... ? Jawab : $U_n = a + (n-1)b$ $U_{10} = 1 + (10-1)5$ $= 1 + 45$ $= 46$, Jadi, suku ke-10 adalah 46 3 Diketahui : $U_1 = 12$ $a = 12$ $U_2 = 14$ $b = 2$ $U_3 = 16$ Ditanya : U_{20} = ... ? Jawab : $U_n = a + (n-1)b$ $U_{20} = 12 + (20-1)2$ $= 12 + 19 \cdot 2$ $= 12 + 38$ $= 50$ Jadi, banyaknya seragam pada minggu ke-20 adalah 50 seragam	Subject 1 is able to provide relevant answers and his line of thinking is smooth, namely being able to do each step correctly and being able to calculate U 7, 8 and 9 and being able to find differences from these patterns. Subject 1 writes the answer in sequence, it's just that it doesn't complete the conclusion at the end of the answer. Based on the results of the written test, subject 1 meets the indicator of creative thinking in the aspect of fluency

No.	Indicator	Test Answer	Analysis
2.	Flexibility	 1 Diketahui : $U_1 = a = 3$ $U_2 = 8$ $b = 8 - 3$ $= 5$ Ditanya : $U_7, U_8, U_9 = \dots ?$ Jawab : $U_n = a + (n-1)b$ $U_7 = 3 + (7-1)5$ $= 3 + 30$ $= 33$ $U_8 = 3 + (8-1)5$ $= 3 + 35$ $= 38$ $U_9 = 3 + (9-1)5$ $= 3 + 40$ $= 43$ 2 Diketahui : $a = 1$ $b = 5$ Ditanya : $U_{10} = \dots ?$ Jawab : $U_n = a + (n-1)b$ $U_{10} = 1 + (10-1)5$ $= 1 + 45$ $= 46$, Jadi, suku ke-10 adalah 46 3 Diketahui : $U_1 = 12$ $a = 12$ $U_2 = 14$ $b = 2$ $U_3 = 16$ Ditanya : $U_{20} = \dots ?$ Jawab : $U_n = a + (n-1)b$ $U_{20} = 12 + (20-1)2$ $= 12 + 19 \cdot 2$ $= 12 + 38$ $= 50$ Jadi, banyaknya seragam pada minggu ke-20 adalah 50 seragam	In this case subject 1 has not met the flexibility indicator because subject 1 can only provide one solution, and in the way of solving the problem subject 1 has not varied. The solution is correct but does not meet the flexibility indicator
3.	Originality	 1 Diketahui : $U_1 = a = 3$ $U_2 = 8$ $b = 8 - 3$ $= 5$ Ditanya : $U_7, U_8, U_9 = \dots ?$ Jawab : $U_n = a + (n-1)b$ $U_7 = 3 + (7-1)5$ $= 3 + 30$ $= 33$ $U_8 = 3 + (8-1)5$ $= 3 + 35$ $= 38$ $U_9 = 3 + (9-1)5$ $= 3 + 40$ $= 43$ 2 Diketahui : $a = 1$ $b = 5$ Ditanya : $U_{10} = \dots ?$ Jawab : $U_n = a + (n-1)b$ $U_{10} = 1 + (10-1)5$ $= 1 + 45$ $= 46$, Jadi, suku ke-10 adalah 46 3 Diketahui : $U_1 = 12$ $a = 12$ $U_2 = 14$ $b = 2$ $U_3 = 16$ Ditanya : $U_{20} = \dots ?$ Jawab : $U_n = a + (n-1)b$ $U_{20} = 12 + (20-1)2$ $= 12 + 19 \cdot 2$ $= 12 + 38$ $= 50$ Jadi, banyaknya seragam pada minggu ke-20 adalah 50 seragam	Based on the test answers subject 1 was able to give a clear answer where he mentioned what was known U 1 = 12, U2 = 14, U3 = 16; a = 12; b = -2 and can determine what is asked on the question which is U20. Then subject 1 solved the problem using the arithmetic sequence formula and there was no error in writing the answer.

No.	Indicator	Test Answer	Analysis
4.	Elaboration		Based on the test answers, Subject 1 was able to include additional details on how the solution could be further applied to find the solution to the problem by first calculating U17 before proceeding to Sn.

In the fluency indicator, both subjects exhibited the ability to provide relevant answers in a coherent and smooth manner, aligning with the definition of creative thinking, which involves a smooth flow of thought and the ability to present relevant solutions (Amidi & Zahid, 2016; Maulida, 2019). However, only Subject 2 demonstrated flexibility by offering multiple solutions, while Subject 1 was limited to a single solution, which did not meet the flexibility criteria. Regarding originality, both subjects successfully detailed their solutions using the appropriate formulae, showcasing a strong understanding of the problem and its solution. In terms of elaboration, Subject 2 provided more varied and detailed solutions than Subject 1, who, despite offering only one method, still presented a comprehensive and correct solution.

Table 4. Percentage of achievement of each indicator

Class	Indicator				Average	Marginal Mean
	Fluency	Flexibility	Originality	Elaboration		
Experiment 1	86%	71%	89%	80%	81%	73,200
Eperiment 2	94%	84%	93%	86%	88%	81,500

As indicated in Table 4, the marginal mean for experimental class 2 (88%) was higher than that for experimental class 1 (81%), suggesting that the contextual approach yielded better learning outcomes than the scientific approach. This finding aligns with Lestari (2015), who asserts that learning outcomes using a contextual approach lead to higher completion rates, as students engage with real-world problems that enhance their problem-solving skills.

Discussion

The findings of this study indicate that students' creative thinking abilities are more effectively developed through the Contextual Teaching and Learning (CTL) approach compared to the Scientific approach. This conclusion is supported by both quantitative data and qualitative insights gathered from interviews with selected student subjects.

Subject 1, taught using the Scientific approach in class XI MIA 1, demonstrated proficiency in solving problems accurately and in detail. However, challenges arose when attempting to explore alternative solutions or develop novel ideas. During the interview, Subject 1 expressed difficulty in finding solutions beyond the formulaic methods previously learned. Despite this, Subject 1 met the criteria for other indicators of creative thinking.

Conversely, Subject 2, instructed using the CTL approach in class XI MIA 2, exhibited the ability to solve problems effectively and provided solutions employing diverse methods and ideas. Subject 2 reported that relating problems to real-life contexts facilitated understanding and problem-solving, thereby enhancing creative thinking skills.

These observations align with recent research by Kurniawan (2023), which found that the CTL approach significantly improved students' creative thinking abilities in mathematics. The study highlighted that students exposed to real-life problems were more engaged and demonstrated higher levels of creativity in problem-solving. This suggests that the contextual approach not only engages students more effectively but also fosters deeper cognitive processing, leading to the development of more diverse problem-solving strategies.

Additionally, a study by Puji, et.all (2024) supports the notion that contextual learning environments encourage students to think creatively by presenting them with problems that require innovative solutions. The research emphasized the importance of connecting learning materials to students' everyday experiences to foster creativity. By embedding mathematical concepts within real-world contexts, students are able to approach problems from multiple perspectives, thereby enhancing their ability to think flexibly and creatively.

Furthermore, research by Mulbar and Hasanah (2021) suggests that while the Scientific approach enhances students' understanding through structured observation and inquiry, it may not equally promote creative thinking. The study advocates for integrating contextual elements into scientific learning to stimulate creativity. This highlights the potential of combining scientific methods with contextual learning to create a more balanced and effective approach to fostering creative thinking.

In summary, the Contextual Teaching and Learning approach proves to be more effective in fostering students' creative thinking abilities in mathematics. By integrating real-life contexts into learning, students are better equipped to develop innovative solutions, thereby enhancing their overall mathematical proficiency. These findings suggest that future instructional strategies should prioritize context-rich learning environments to better support students in their problem-solving endeavors and encourage the development of creative thinking.

Conclusion

Based on the analysis and discussion of the study results, it can be concluded that: There are significant differences in the creative thinking abilities of students who are taught using the Contextual Teaching and Learning (CTL) approach compared to those taught using the Scientific approach; The mathematics learning outcomes of students exposed to the CTL approach are superior to those of students who received the Scientific approach; The CTL approach is more effective than the Scientific approach in fostering students' creative thinking abilities. This conclusion is supported by the higher average scores in creative thinking indicators observed in the students taught using the CTL approach.

The findings of this research emphasize the importance of selecting the appropriate teaching approach, as it significantly impacts students' mathematics learning outcomes. Therefore, it is recommended that educators implement the Contextual Teaching and Learning approach for specific mathematical content to enhance student engagement and improve overall academic performance. Additionally, the results suggest that students' creative thinking abilities play a critical role in determining their success in mathematics. Hence, fostering creativity through the use of contextual learning strategies should be prioritized in mathematics education to achieve optimal learning outcome.

Conflict of Interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

Reference

Ali, N., Ullah, S., & Khan, D. (2022). Interactive laboratories for science education: A subjective study and systematic literature review. *Multimodal technologies and interaction,* 6(10), 85.

Arnisya, M. F., & Afriansyah, E. A. (2024). Unlocking Students' Creative Thinking in Mathematics: A Study on Three-Dimensional Shapes. *Plusminus: Jurnal Pendidikan Matematika*, *4*(3), 487-502. https://doi.org/10.31980/plusminus.v4i3.2204

Dhungana, S., & Thapa, R. (2023, December). Ways of Developing Creative Thinking and Reasoning of Students in Mathematics Learning. In *Mathematics Education Forum Chitwan* (Vol. 8, No. 1, pp. 57-75).

Efwan, N. S., Afriansyah, E. A., Luritawaty, I. P., Arwadi, F., & Yadav, D. K. (2024). The Level of students' mathematical creative thinking skills as measured by their self-confidence. *International Journal of Didactic Mathematics in Distance Education*, *1*(2), 125-136.

Halini, Zubaidah, R., Pasaribu, R. L., Mirza, A., & Afriansyah, E. A. (2023). Students' Scientific Attitudes and Creative Thinking Skills. *Mosharafa: Jurnal Pendidikan Matematika*, *12*(2), 315-326. https://doi.org/10.31980/mosharafa.v12i2.786

Krulik, S., & Rudnick, J. (1999). *Problem solving in school mathematics*. Prentice Hall.

Kurniawan, H., Kurniasih, N., & Yuzianah, D. (2023). Enhancing Problem-Solving Skills in Mathematics: Applying LDMAT and SRL for Students with Learning Difficulties. *Jurnal Gantang, 8*(1), 21-35.

Mariani, D., & Dewi, U. (2025). Literature study: The effect of the problem-based learning model assisted by the flipped classroom on mathematical creative thinking ability. *Jurnal Pendidikan Indonesia, 6*(1), 75-90.

Monalisa, L. A., Kristiana, A. I., Wihardjo, E., Hussen, S., & Putri, F. A. (2024). The Correlation of Junior High School Students' Self-Confidence and Mathematical Problem-Solving Ability. *Mosharafa: Jurnal Pendidikan Matematika*, *13*(4), 1097-1108. https://doi.org/10.31980/mosharafa.v13i4.1692

Mukhibin, A., Herman, T., Aulia, L. S., & Firdaus, H. (2024). Integrating Computational Thinking in STEM Learning: An Effort to Improve Students' Problem-Solving Skills. *Mosharafa: Jurnal Pendidikan Matematika*, *13*(1), 49-62. https://doi.org/10.31980/mosharafa.v13i1.1975

Mulbar, U., & Hasanah, R. (2021, May). The influence of discovery learning with scientific approach on students' creative thinking ability. In *Journal of Physics: Conference Series* (Vol. 1899, No. 1, p. 012134). IOP Publishing.

Pebriyanti, E. D., Afrilianto, M., & Rosyana, T. (2021). Implementasi Pendekatan Saintifik dalam Pembelajaran Online Materi Persamaan Dan Fungsi Kuadrat Di Kelas Ix-A Mts. Al-Bidayah. *JPMI (Jurnal Pembelajaran Matematika Inovatif), 4*(5), 1205-1212.

Pradana, K. C., & Noer, S. H. (2023). Critical thinking and mathematical problem solving skills of students through schoology-assisted blended learning models. *Mathline: Jurnal Matematika Dan Pendidikan Matematika, 8*(3), 827-844.

Puji, E. S., Sukarso, A. A., & Merta, I. W. (2024). Application of contextual teaching and learning model to improve disposition and creative thinking skills of high school students. *Jurnal Pijar Mipa, 19*(3), 401-409.

Santoso, H., Sunardi, S., & Prastiti, T. D. (2023). The Effect of The CTL Approach on Student's Creative Thinking Skills and Mathematics Learning Outcomes. *Madrasah: Jurnal Pendidikan Dan Pembelajaran Dasar, 15*(2), 102-114.

Sholikhah, S., Sofiana, W. A., & Hidayah, N. D. (2023). Student teachers' perception of the effect of contextual teaching and learning approach on critical thinking skills. *Issues in Mathematical Thinking (IM Thinking), 1*(1).

Sitorus, J. (2016). Students' creative thinking process stages: Implementation of realistic mathematics education. *Thinking Skills and Creativity, 22*, 111-120.

Suherman, S., & Vidákovich, T. (2024). Relationship between ethnic identity, attitude, and mathematical creative thinking among secondary school students. *Thinking Skills and Creativity, 51*, 101448.

Suriyani, S., Hasratuddin, H., & Asmin, A. (2015). Peningkatan kemampuan berpikir kreatif dan kemandirian belajar siswa mts negeri 2 medan melalui pembelajaran matematika dengan pendekatan open-ended. *Jurnal Tabularasa PPS Unimed, 12*(33), 224-234.

Winarti, W. (2016). Contextual teaching and learning (CTL) untuk meningkatkan kemampuan berpikir kreatif siswa. *Jurnal Pendidikan Fisika Dan Keilmuan (JPFK), 1*(1), 1.