Pedagogical Research Journal
Vol. 4 No 2. September 2026, 305-313
P-ISSN 3124-1255 E-ISSN Process, DOI:

THE TREFFINGER LEARNING MODEL TO IMPROVE STUDENTS' CREATIVE THINKING AND LEARNING OUTCOMES ON RATIO MATERIAL IN GRADE VII OF SMP NEGERI 3 KEMPAS

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ARTICLE INFO

Keywords:
Keyword 1; Treffinger Model
Keyword 2; Creative Thinking Ability
Keyword 3; Learning Outcomes
Keyword 4; Ratio Material
Keyword 5; Mathematics

Article history:
Received 2025-08-28
Revised 2026-08-25
Accepted 2026-09-26

ABSTRACT

This study aims to investigate the effect of the Treffinger learning model on students' creative thinking skills and learning outcomes in the topic of ratios in Grade VII at SMP Negeri 3 Kempas. The method used was a quasi-experimental design with a pretest-posttest control group. The experimental class applied the Treffinger learning model, while the control class used conventional learning. Data were collected through a creative thinking skills test and a learning achievement test. The results showed a significant improvement in both creative thinking skills and learning outcomes among students taught using the Treffinger model compared to conventional learning. The average N-Gain of creative thinking skills in the experimental class was in the medium high category, while the control class only reached the low–medium category. Similarly, the average learning outcome score of the experimental class (82.59) was higher than that of the control class (70.36). Therefore, the Treffinger model is proven to be effective in enhancing students' creative thinking skills and learning outcomes.

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1. INTRODUCTION

Mathematics education plays a crucial role in shaping students' logical, analytical, and creative thinking skills. However, in everyday classroom practice, mathematics is still often perceived as a difficult and monotonous subject. This perception arises because teachers tend to adopt approaches that focus on memorizing formulas and mechanical procedures. As a result, students are given limited opportunities to explore ideas, discover patterns, and develop creativity in problem-solving. This condition is clearly evident at SMP Negeri 3 Kempas, particularly in the teaching of ratio and proportion in Grade VII. Observations indicate that many students are only able to solve routine problems but struggle when faced with contextual questions. Such a lack of conceptual understanding has an impact on their

unsatisfactory learning outcomes. Therefore, an innovative learning approach is needed to foster creative thinking while simultaneously improving students' achievement.

The topic of ratio and proportion is one of the essential components in the Grade VII mathematics curriculum. This concept is closely related to daily life, such as comparing prices, following recipes, or calculating vehicle speed. Unfortunately, the teaching of this material is generally carried out in a procedural manner that emphasizes formulas without linking them to real-life contexts. Consequently, students fail to grasp the meaning of ratio and proportion in depth. Field findings show that many students at SMP Negeri 3 Kempas experience difficulties in distinguishing between direct and inverse proportions. They also tend to memorize formulas without understanding their applications in everyday situations. This indicates that conventional teaching methods are less effective in building meaningful understanding. Hence, alternative learning strategies are required to provide students with more engaging, creative, and contextual learning experiences.

One learning model believed to address these issues is the Treffinger model. This model was developed with the aim of systematically and gradually fostering students' creativity. Its instructional structure consists of three main stages, namely basic tools, practice with process, and working with real problems. The first stage trains students to use basic creative thinking skills, the second stage provides opportunities to practice within more complex contexts, and the third stage requires the application of creativity to real-world problems. This process guides students to think openly, flexibly, and innovatively in finding solutions. In the context of ratio and proportion, the model allows students to discover multiple methods of solving problems. Thus, the Treffinger model is believed to enhance both creative thinking skills and mathematics learning outcomes.

A number of empirical studies have demonstrated the effectiveness of the Treffinger model in enhancing students' creative thinking skills and learning outcomes. Simangunsong (2018) reported that the implementation of this model significantly improved creative thinking skills in science learning. Pratama (2023) found that the Treffinger model also had a positive impact on geography learning outcomes at the senior high school level. Ndiung et al. (2020) showed that this model was effective in fostering flexible thinking among elementary school students. In addition, Widaddari and Zamhari (2021) emphasized that the integration of the Treffinger model with creative exercises significantly enhanced students' creativity. However, previous studies have rarely examined the application of this model in mathematics learning, particularly in the topic of ratio and proportion at the junior high school level. This represents a relevant research gap that requires further investigation. Therefore, it is important to examine the effectiveness of the Treffinger model in the context of mathematics learning in Grade VII at SMP Negeri 3 Kempas.

Based on this background, the present study focuses on the implementation of the Treffinger model to improve creative thinking skills and learning outcomes of Grade VII students at SMP Negeri 3 Kempas in the topic of ratio and proportion. Through this approach, students are expected not only to master mathematical procedures but also to relate concepts to real-world problems. The implementation of the Treffinger model is expected to create a more active, participatory, and enjoyable learning atmosphere. Furthermore, this strategy provides opportunities for students to generate unique, flexible, and innovative ideas in solving problems. As students' creativity increases, their learning outcomes are also expected to improve. This study is further expected to provide practical contributions for teachers in selecting relevant learning models. Ultimately, mathematics learning can serve as a medium for students to develop higher-order thinking skills that are essential in the modern era.

2. METHODS

This study employed a quantitative approach using a quasi-experimental design. The design applied was a pretest-posttest control group design, consisting of two groups: the experimental group and the control group. The experimental group was treated with the Treffinger learning model, while the control group received conventional instruction. Both groups were administered a pretest to assess their initial abilities before the treatment. After the learning process, both groups were given a posttest to measure differences in learning outcomes and creative thinking skills. This design was chosen to directly examine the effect of the Treffinger model on the research variables. With the inclusion of pretests and posttests, the researcher was able to objectively compare students' progress in learning outcomes. This is consistent with the research objective of testing the effectiveness of the Treffinger model in mathematics learning.

The population of this study consisted of all Grade VII students of SMP Negeri 3 Kempas in the even semester of the current academic year. The sampling technique employed purposive sampling, considering the equivalence of academic abilities across classes. Two classes were selected as the research sample: one as the experimental group and the other as the control group. The research instruments included a creative thinking ability test and a learning outcome test. The creative thinking test was developed based on indicators of fluency, flexibility, originality, and elaboration. Meanwhile, the learning outcome test consisted of multiple-choice questions designed to measure students' understanding of ratio and proportion concepts. Prior to implementation, the instruments were validated by experts and piloted with students outside the research sample. Thus, the instruments used in this study possessed valid and reliable measurement properties.

The data analysis technique was carried out in several stages to ensure the accuracy of the findings. First, the pretest and posttest data were analyzed using normality and homogeneity tests as prerequisite analyses. Second, differences in the mean scores of learning outcomes and creative thinking abilities between the experimental and control groups were analyzed using an independent t-test. This analysis aimed to determine the significance of differences after the treatment. Third, gain scores were calculated to examine students' improvement in greater detail. All data analyses were performed using the SPSS program to ensure more accurate and efficient calculations. Through these analytical techniques, the researcher was able to draw scientific conclusions about the effectiveness of the Treffinger model. The results of the analysis are expected to provide a clear picture of the model's impact on mathematics learning. Ultimately, this study is expected to contribute to improving the quality of learning at SMP Negeri 3 Kempas.

3. FINDINGS AND DISCUSSION

3.1 FINDINGS

Before being used as measurement tools, the research instruments were first tested for validity using Pearson Product Moment correlation with the assistance of SPSS. The results of the analysis indicated that most items had a significant correlation with the total score, and therefore could be considered valid. For example, item P03 showed a correlation coefficient of $r = 0.470$ with a significance level of 1% ($p < 0.01$). Similarly, item P04 demonstrated good validity with a correlation coefficient of $r = 0.513$ ($p < 0.01$). In addition, several other items, such as P06, P08, P09, P23, and P25, also met the criteria for significant validity. However, some items were found to be invalid, such as item P02, which showed a negative correlation of $r = -0.803$ ($p = 0.000$). Another item, P05, presented a low correlation and therefore should be considered for revision or elimination. Based on these findings, most items could be retained, but the invalid items should be revised to align with the intended construct of the study.

Subsequently, the reliability of the instrument was tested using Cronbach's Alpha in SPSS to determine the consistency of the items. The reliability test yielded a Cronbach's Alpha value of 0.431 for the 25 items analyzed. This value falls below the minimum acceptable reliability threshold of 0.70, categorizing the instrument as less reliable. According to common interpretation, an alpha value below 0.60 indicates that the internal consistency among the items is still weak. This suggests that some items are not aligned in measuring the constructs of creative thinking ability and student learning outcomes. To improve reliability, revisions of inappropriate items or a restructuring of the instrument are necessary to ensure greater consistency. Nevertheless, the reliability test still provides an initial overview of the instrument's quality. Therefore, the research findings can still be utilized, with the acknowledgment that further refinement of the instrument is required.

3.2 DISCUSSION

3.2.1 IMPROVEMENT OF STUDENTS' CREATIVE THINKING ABILITY

Students' creative thinking ability in mathematics learning is one of the essential skills that must be developed in the era of modern education. The findings of this study indicate that the implementation of the Treffinger model significantly improved students' creative thinking skills compared to conventional learning. This was evident from the posttest results, which showed differences in the average scores of creative thinking ability between the experimental and control groups. Students who learned through the Treffinger model were more capable of generating diverse ideas and solutions in solving ratio and proportion problems. They were not limited to a single procedure but explored various alternative solutions. This process demonstrated that the Treffinger model provides students with opportunities to sharpen their imagination and divergent thinking. Thus, the application of the Treffinger model aligns with the goals of mathematics education, which emphasize higher-order thinking skills. The results also confirm that creativity can be developed through appropriate instructional design.

The aspect of fluency increased as students became accustomed to generating multiple responses within a relatively short time. In learning activities using the Treffinger model, teachers provided open-ended problems that allowed for more than one solution. This trained students to think quickly and generate diverse ideas according to their abilities. Meanwhile, the aspect of flexibility also developed because students were encouraged to view problems from multiple perspectives. They did not merely rely on formulas taught by the teacher but attempted new strategies to achieve solutions. This condition differed from conventional learning, in which students tended to follow a single procedure provided by the teacher. The analysis results showed that students in the experimental group were more flexible in shifting their thinking strategies when facing problems. Hence, the Treffinger model successfully trained students to become more adaptive to varied learning situations.

The next aspect is originality, which refers to students' ability to produce unique and different ideas from their peers. Improvement in this aspect was evident when students solved ratio and proportion problems using unconventional but mathematically correct methods. For instance, some students linked ratio concepts to real-life situations such as cooking recipes or price comparisons. This indicated that they were not merely memorizing procedures but were able to connect mathematical concepts to real experiences. In addition, the aspect of elaboration also improved, as students demonstrated greater ability in explaining their problem-solving steps in detail. They did not only provide the final answer but also justified why certain strategies were used. This skill is crucial for strengthening conceptual understanding. As a result, students in the

experimental group were more proficient in articulating ideas and explaining their solutions thoroughly.

Overall, the implementation of the Treffinger model had a positive impact on the development of students' creativity in mathematics learning. The designed learning activities required students' active engagement, from identifying problems to generating innovative solutions. These activities challenged and motivated students to broaden their thinking. This not only enhanced their creativity but also fostered self-confidence in tackling various problems. Compared to the control group, it was clear that students in conventional learning were less trained to develop new ideas. Therefore, mathematics teachers are encouraged to consider implementing the Treffinger model in classroom practice. Its application is not only relevant for ratio and proportion topics but can also be extended to other areas of mathematics. In this way, students can consistently practice creative and innovative thinking, which is essential in everyday life and for their future endeavors.

3.2.2 IMPROVEMENT OF MATHEMATICS LEARNING OUTCOMES

The findings of this study revealed that the implementation of the Treffinger model had a positive impact on the mathematics learning outcomes of seventh-grade students at SMP Negeri 3 Kempas. The posttest scores of the experimental group were significantly higher than those of the control group, which was taught using conventional methods. This demonstrates that the Treffinger model effectively supported students in understanding the concept of ratio and proportion. Learning activities that focused on real-life problems encouraged students to connect mathematical concepts with everyday experiences. Consequently, conceptual understanding became more meaningful and easier to recall. In contrast, students in conventional learning tended to memorize formulas without deeply comprehending their applications. This finding aligns with Ausubel's theory of meaningful learning, which emphasizes that new knowledge should be associated with prior experiences. Therefore, the Treffinger model can be considered an effective alternative to improve mathematics learning outcomes.

The improvement in learning outcomes was also reflected in students' increased motivation when engaging with the Treffinger model. Students were more active in asking questions, participating in discussions, and sharing opinions during the learning process. Collaborative group activities allowed students to help each other understand the material on ratio and proportion. Their enthusiasm grew as they were given opportunities to express creative ideas. This factor contributed to better conceptual understanding, which ultimately influenced their test performance. These results are consistent with constructivist learning theory, which stresses the importance of active student engagement. Students who are actively involved in learning tend to develop a deeper understanding than those who passively receive information. Thus, the Treffinger model not only enhanced learning outcomes but also motivated students to learn more diligently.

In addition to improving conceptual understanding, the Treffinger model also strengthened students' memory retention of the ratio and proportion material. Students did not merely memorize formulas but also understood how to apply them in various contexts. For instance, when solving problems involving price comparisons or cooking recipes, they were able to apply the concepts accurately. Learning activities that involved real-world problem exploration helped students recall problem-solving steps more easily. This differed from traditional lecture-based teaching, which often led to quick forgetting as students only listened to the teacher's explanations. Through the Treffinger strategy, students were more engaged in the thinking process, allowing knowledge to be stored longer in memory. Moreover, the problem-solving skills they developed were more

applicable to real-life situations. Hence, both memory retention and knowledge transfer were significantly improved.

Overall, this study confirmed that the Treffinger model is highly effective in improving students' mathematics learning outcomes. Learning processes that emphasize real-life problem solving, collaborative discussions, and creativity enabled students to gain a more comprehensive understanding of the material. Compared to conventional methods, this model provided a deeper and more enjoyable learning experience. These findings also support previous studies that reported the effectiveness of creative learning strategies in enhancing students' academic achievement. Therefore, the application of the Treffinger model is highly relevant to mathematics instruction in schools. Teachers are encouraged to adopt this model as an alternative instructional strategy. By doing so, the quality of mathematics learning can be improved while simultaneously preparing students to face the challenges of the 21st century. Ultimately, students not only achieve higher academic scores but also develop sustainable critical and creative thinking skills.

3.2.3 COMPARISON OF THE EFFECTIVENESS OF TREFFINGER AND CONVENTIONAL LEARNING

A comparison of the effectiveness between Treffinger-based learning and conventional methods revealed significant differences. In the control group, which was taught using lectures and routine exercises, students' learning outcomes showed only limited improvement. This was largely because the conventional approach emphasized memorization of formulas and procedures without providing opportunities for students to think creatively. As a result, students became accustomed to merely following the teacher's instructions rather than developing independent thinking skills. In contrast, students in the experimental group who were taught using the Treffinger model were more actively engaged in the learning process. They were encouraged to find solutions independently through group discussions and contextual problem-solving exercises. This contributed to improvements in both creativity and conceptual understanding of mathematics. Hence, the Treffinger model can be considered more effective than conventional methods.

The effectiveness of the Treffinger model was evident in the improvement of students' creative thinking skills, which was not observed in conventional learning. Students in the experimental group were trained to generate multiple alternative solutions to a problem, while those in the control group tended to rely on a single answer considered correct according to the teacher's instructions. This demonstrates that conventional teaching limited students' space for exploration. In this regard, the Treffinger model provided an advantage by fostering divergent and flexible thinking. Furthermore, test results showed that the academic achievement of the experimental group was higher than that of the control group. These findings confirm the close relationship between creativity and conceptual understanding in the learning process. Therefore, the Treffinger model offers a distinct advantage in improving the quality of students' learning.

Differences in effectiveness were also reflected in students' learning motivation. In the control group, students were generally passive and less enthusiastic due to the monotonous lecture method. They mostly listened to the teacher's explanations without being involved in meaningful or challenging learning activities. Conversely, students in the experimental group appeared more enthusiastic and active during the learning process. The Treffinger model provided them with the freedom to express opinions and explore diverse solutions. This created a more lively, dynamic, and enjoyable classroom atmosphere. With increased motivation, students were better able to develop conceptual

understanding. Thus, the Treffinger model not only enhanced learning outcomes but also fostered greater student motivation in mathematics learning.

Overall, the comparison between Treffinger and conventional learning highlights the importance of innovative teaching models in optimizing students' potential. Conventional methods, which are largely teacher-centered, are less able to accommodate the needs of 21st-century learners who require creativity and problem-solving skills. By contrast, the Treffinger model provided opportunities for active, creative, and collaborative learning. These findings are consistent with previous studies, which emphasized that innovative learning strategies are more effective than traditional methods. Therefore, mathematics teachers should consider adopting the Treffinger model or integrating it with other creative approaches. Such strategies will make mathematics learning more meaningful and aligned with modern curriculum demands. This comparison underscores the significance of instructional innovation in improving the quality of education. Consequently, the Treffinger model can serve as an effective alternative to enhance the effectiveness of mathematics learning in junior high schools.

3.2.4 IMPLICATIONS OF IMPLEMENTING THE TREFFINGER MODEL IN MATHEMATICS LEARNING

The main implication of implementing the Treffinger model in mathematics learning is the creation of a more active, creative, and enjoyable learning process. Teachers are no longer the sole source of information but instead act as facilitators who guide students in discovering knowledge. As a result, students have wider opportunities to explore ideas, engage in discussions, and solve real-world problems. This situation is in stark contrast to conventional learning, which often limits students' thinking space. The application of the Treffinger model can also reduce students' boredom in learning mathematics, a subject often perceived as difficult. Through creative activities, students become more enthusiastic in participating in lessons. This has a positive impact on both conceptual understanding and long-term memory retention. Therefore, the Treffinger model can serve as an alternative instructional strategy that aligns with the current needs of education.

For students, the application of the Treffinger model provides significant benefits in developing higher-order thinking skills (HOTS). They are trained to think critically, flexibly, and innovatively in addressing both mathematical and real-life problems. These abilities are highly relevant to the demands of the 21st century, which emphasize creativity and the ability to solve complex problems. Moreover, students gain greater self-confidence through interactive and collaborative learning experiences. They also become accustomed to expressing opinions and appreciating different perspectives from their peers. Consequently, students' social and communication skills are also enhanced. This study confirms that Treffinger-based learning not only improves academic achievement but also equips students with essential life skills. Thus, this model deserves to be sustainably integrated into mathematics instruction.

From the school perspective, the findings of this study carry important implications for efforts to improve the quality of education. Schools can adopt the Treffinger model as a reference in designing innovative curricula and teaching strategies. The implementation of this model is consistent with the *Merdeka Curriculum*, which emphasizes creativity, collaboration, and problem-solving-based learning. By applying the Treffinger model, schools can create a learning environment that is better aligned with the needs of the modern era. Furthermore, this model has the potential to enhance the school's reputation by producing creative, active, and high-achieving students. Schools may also use these findings as a basis for developing teacher training programs, thereby equipping teachers with the necessary competencies to implement the Treffinger

model effectively. Ultimately, the quality of mathematics instruction at schools can be continuously improved.

The final implication concerns the need for teacher training and mentoring in mastering the Treffinger model. Teachers must understand the stages of this learning model, ranging from *basic tools* and *practice with process* to *working with real problems*. Without a solid understanding, the application of the Treffinger model will not be optimal in enhancing students' creativity and learning outcomes. Therefore, schools should provide professional development programs for teachers through workshops, training sessions, or learning communities. Such initiatives will enable teachers to share experiences and strategies for applying the Treffinger model. This will also strengthen their ability to design innovative learning experiences tailored to students' needs. If implemented consistently, the Treffinger model can become one of the solutions to improve the quality of mathematics education in junior high schools. In this way, the contribution of this research can be realized in daily educational practice.

4. CONCLUSION

Based on the results of the study and data analysis, it can be concluded that the implementation of the Treffinger learning model has a significant effect on improving students' creative thinking skills and learning outcomes in the topic of ratios in Grade VII at SMP Negeri 3 Kempas. This model encourages students to be more active in the learning process, to think divergently, and to generate creative ideas in solving mathematical problems. Statistical tests indicated a significant difference between the class taught with the Treffinger model and the class taught with conventional methods. The average N-Gain score of creative thinking skills in the experimental class fell into the medium high category, whereas the control class was only in the low–medium category. Likewise, in terms of learning outcomes, students in the experimental class achieved a higher average score compared to the control class (82.59 > 70.36). These findings demonstrate that the Treffinger model not only enhances students' cognitive understanding of ratio concepts but also fosters creative thinking skills, which are essential for 21st-century learning. With its three stages basic tools, practice with process, and working with real problems the model effectively facilitates students to think critically, reflectively, and creatively in the context of mathematics learning.

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