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Students' Geometric Creative Thinking Skills: An Analytical Study

Abstract

20 This research is important to find out how students' creative thinking skills are in understanding the basic
teaching materials of geometry. We can use this knowledge to design or develop more innovative and effec-
tive learning methods. If a student learns more about his ability to understand and apply the basic concepts of
3 geometry, it will enable him to develop his ability further. The study aims to identify and analyze the level of
students' creative geometric thinking skills on the geometrical material. The research uses qualitative descrip-
tive methods, with data collection through tests, evaluation sections, and interviews. The research sample
was taken from students in a mathematics study program at a private university in Riau Province. The tests
18 are given to measure students' mathematical creative thinking skills in the geometry material, while the as-
sessment and interview sections are used to gain a deeper understanding of how students use their creativity
in understanding and applying the concepts of geometry so that the level of creativity can be identified. We
1 also use interviews to validate the results of student tests. The results show that students' creative thinking
skills are at the stage of identifying, describing, and understanding the basics of geometry, such as point mat-
ter, lines, and angles. Students have varying levels of understanding of visualization, analysis, and informal.
Nevertheless, students have demonstrated creative thinking skills in analyzing the images given, especially on
24 the subject where students refer to indicators of fluency, flexibility, originality, and elaboration. Although not
entirely original, they are able to combine existing concepts in an informative and detailed manner. The ex-
planations provided in the question's answer offer significant and pertinent details about the concepts of
points, lines, and angles, highlighting their interrelatedness. Students can also elucidate the fundamental def-
initions of each concept, applying them to both visual aids and supporting evidence. Implications of this re-
search are the development of learning methods and strategies, increased student understanding and crea-
tivity in applying concepts of geometry and providing insight into how best to evaluate and evaluate creative
thinking skills in a geometric context.

Keywords: Geometry; Mathematical Creative Thinking Ability; Students; Mathematics Education.

Abstrak

19 *Penelitian ini penting untuk mengetahui bagaimana keterampilan berpikir kreatif mahasiswa dalam memahami
materi dasar geometri. Pengetahuan ini dapat dimanfaatkan untuk merancang atau mengembangkan metode
pembelajaran yang lebih inovatif dan efektif. Jika mahasiswa mengetahui lebih banyak tentang kemampuannya
dalam memahami dan menerapkan konsep materi dasar geometri, maka memungkinkan mahasiswa untuk dapat*
22 *mengembangkan kamampuannya lebih jauh lagi. Penelitian ini bertujuan untuk mengidentifikasi dan*
11 *menganalisis tingkat keterampilan berpikir kreatif geometris mahasiswa pada materi geometri. Penelitian ini
menggunakan metode deskriftif kualitatif, dengan pengumpulan data melalui tes, rubrik penilaian dan wa-
wancara. Sampel penelitian diambil dari mahasiswa program studi matematika di sebuah universitas swasta di
Provinsi Riau. Tes diberikan untuk mengukur kemampuan berpikir kreatif matematis mahasiswa dalam materi*
23 *geometri, sementara rubrik penilaian dan wawancara digunakan untuk mendapatkan pemahaman yang lebih
mendalam tentang bagaimana mahasiswa menggunakan kreativitas mereka dalam memahami dan menerapkan
konsep geometri, sehingga tingkat kreatifitas dapat diidentifikasi. Wawancara juga digunakan untuk menguat-
kan hasil tes mahasiswa. Hasil penelitian menunjukkan bahwa keterampilan berpikir kreatif mahasiswa berada
pada tahap mengidentifikasi, menggambarkan, dan memahami dasar-dasar geometri seperti: materi titik, garis,
dan sudut. Mahasiswa mampu mencapai tingkat pemahaman visualisasi, analisis, dan informal. Meskipun
demikian, mahasiswa telah menunjukkan kemampuan berpikir kreatif dalam menganalisis gambar-gambar yang
diberikan, terutama pada soal yang mendosong mahasiswa menujukkan indikator fluency, flexibility, originality,
dan elaboration. Walaupun tidak sepenuhnya orisinal, mereka mampu menggabungkan konsep-konsep yang ada
dengan cara yang informatif dan rinci. Penjelasan yang dituliskan dalam menjawab soal memberikan informasi*
21 *yang berarti dan relevan tentang konsep titik, garis, dan sudut, sehingga dapat dimaknai ketiga konsep ini saling
terkait satu sama lain. Mahasiswa juga dapat menjelaskan ketiga konsep tersebut secara detail sehingga definisi
dasar masing-masing konsep dapat dijelaskan dan dapat diaplikasikan baik dalam gambar maupun pembuktian.
Implikasi dari hasil penelitian ini adalah pengembangan metode dan strategi pembelajaran, peningkatan pema-
haman dan kreatifitas mahasiswa dalam menerapkan konsep-konsep geometri, dan memberikan wawasan ten-
tang cara terbaik untuk menilai dan mengevaluasi keterampilan berpikir kreatif dalam konteks geometri.*

INTRODUCTION

The ability of mathematical creative thinking is one of the essential aspects in mathematics education. This ability of students is related to generating new ideas, creative solutions, seeing things from new perspectives, and using unconventional approaches to solve mathematical problems so that they can address global issues (Newman, 1989; Siswono, 2016). Additionally, creative thinking is the ability to think beyond conventional patterns; creative thinkers can free themselves from dominant patterns stored in their brains. Therefore, enhancing creative thinking means increasing scores in understanding, fluency, flexibility, and novelty in problem-solving and using new approaches, perspectives, methods, and insights in understanding something (Fakhriyani, 2016; Langrehr, 2020; Umar & Abdullah, 2020). Students' creative thinking abilities can be measured using four aspects of creative thinking: fluency, flexibility, originality, and elaboration (Mutia et al., 2022).

The ability to think systematically, scientifically, logically, and critically can enhance creativity and help students express opinions or answers to problems with various solutions. Furthermore, the importance of creative thinking that generates new ideas is to solve the problems faced in an ever-changing world (Istianah, 2013; Maulanaizza & Kusumandari, 2023). Moreover, it drives human progress in exploration, development, and new discoveries in the fields of science and technology, as well as in all human endeavors (Ghufron & Suminta, 2010). Additionally, it produces new and varied solutions to problems (Yunianta, 2014). The obstacles in developing mathematical creative thinking skills include habits (Snášel et al., 2017). These habits include: 1) the tradition passed down by teachers that once you can do something, there's no need to seek alternatives; 2) students prefer to solve problems according to examples; 3) more focus on formulas than considering other alternatives.

Thinking is a mental activity that involves formulating understanding, synthesizing, and drawing conclusions to solve problems, resulting in higher or highest levels of cognitive behavior (Gagné, 1980; Yuwono, 2016). In line with this, (Houwer & Hughes, 2020) suggests that high-level thinking includes both creative and critical thinking. Thinking involves the careful and precise development of ideas, often beginning with a problem (Suryosubroto, 2009). Furthermore, (Iin, 2023) explains that the thinking process is an experience of encountering a problem to generate and determine new ideas as solutions to the problem at hand. Meanwhile, creative thinking is characterized by four components: fluency (generating many ideas), flexibility (shifting perspectives easily), originality (creating something new), and elaboration (developing additional ideas from one idea) (Ahmadi, 2013; Siswono, 2016). Additionally, (Wijngaarden et al., 2021) identified characteristics of creative individuals such as: 1) openness to new experiences, flexible in thinking and responding; 2) tolerance for differing opinions, uncertain situations; 3) freedom in expressing opinions and feelings, enjoys asking questions; 4) appreciation for fantasy, rich in initiative, has original ideas; 5) having their own opinions and not easily influenced by others; 6) having a positive self-image and emotional stability, confident and independent; 7) having a great curiosity, interested in abstract, complex, holistic and puzzling matters, has broad interests; 8) willing to take calculated risks, responsible and committed to tasks; 9) persevering and not easily bored, resourceful in problem-solving; 10) sensitive to environmental situations; 11) more focused on the present and future than the past. Meanwhile, creative thinking according to other experts is the thinking activity to produce something creative, original, and divergent (Baer, 1991; Kadir et al., 2022; Pehkonen, 1997; Runco & Jaeger, 2012; Sekar et al., 2015; Sunaryo, 2014). So, it can be concluded that the indicators of creative thinking consist of: (fluency), flexibility, originality, and elaboration (Kahfi, 2016; Sitepu, 2019). Based on these descriptions, it can be concluded that thinking is a mental or brain activity that involves formulating, problem-solving, decision-making, efforts to understand something, seeking answers to problems, and seeking meaning in things, which lead to directed discoveries towards a goal. Meanwhile, creative thinking is a process to develop and solve problems to create new ideas or concepts.

The geometry material was chosen because geometry is a branch of mathematics that requires understanding and visualization of space, patterns, properties, and relationships between geometric objects, making it a suitable research topic. Having strong mathematical creativity in geometry will enable students to solve complex geometric problems, gain a deeper understanding of geometric concepts, and improve their mathematical modeling skills (Jones & Tzekaki, 2016; Pujawan et al., 2020; Yahaya, 2005). This research is also important because creative mathematical thinking skills have a strong correlation with the development of problem-solving skills, logic, abstract thinking, and creativity in general. Therefore, understanding students' creative mathematical thinking skills in geometry content can provide insights into the effectiveness of teaching methods and strategies used in this context. By analyzing students' mathematical creative thinking skills in geometry content, this research is expected to provide valuable information for mathematics educators, curriculum developers, and education practitioners to develop more effective teaching strategies and empower students to develop their mathematical creative thinking skills.

In geometry, the properties of lines, angles, planes, and space are studied. Geometry is a fundamental subject that requires imagination and is an essential part of the curriculum. The concepts of geometry are often encountered in everyday life and play a crucial role in understanding characteristics and relationships, as well as developing critical thinking skills (Istikomah et al., 2022). Concepts are formed through students' direct participation in geometry instruction. Geometry also requires high-level reasoning and problem-solving skills. Students must understand geometric concepts and be able to implement them when recognizing various shapes and spaces, describing, and distinguishing geometric shapes (Istikomah, 2019).

The creative thinking skills of students in geometry need to be analyzed because it can help in understanding the extent to which students are able to develop their creativity in solving geometric problems. The geometric problems referred to include evaluating the understanding of concepts, developing problem-solving skills, identifying student needs, curriculum development, and others. Thus, the urgency of analyzing students' geometric creative thinking skills is not only related to evaluating learning achievements but also to developing students' creative skills and improving the overall effectiveness of mathematics education. Therefore, this study aims to identify and analyze the level of students' mathematical creative thinking skills in the subject of geometry.

METHOD

This research is a qualitative descriptive study. The qualitative approach is an approach to building statement of knowledge based on a constructive perspective (Creswell & Poth, 2016). The method used to achieve the research objectives involves the following stages (See Figure 1).

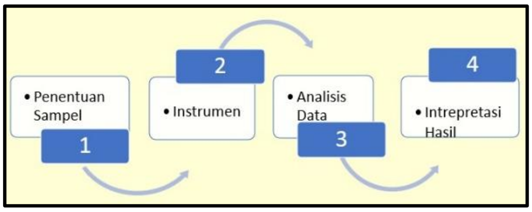

Figure 1. The stages of the research

Sampling Determination

The sample was students from the first semester mathematics education study program. They took geometry courses. The sample selection method is purposive sampling. Purposive sampling is a sampling technique in which the selection of informants is carried out with a specific aim in order to fulfill the main criteria in a study (Creswell, 2014). Purposive sampling was selected by involving students from various backgrounds, talent levels, and levels of experience learning geometry. This aims to be appropriate to the research topic.

Instruments

Mathematical creative thinking assessment and assessment rubric are used as instruments. Test questions are designed based on key concepts of mathematical creative thinking abilities and the geometry curriculum. Interviews are used to gain deeper insights into their mathematical creative thinking abilities. The test instrument is given during the final semester exam. Answer sheets are collected, then student answers are checked and analyzed one by one. This is to find out whether the questions given can be answered according to the indicators of creative thinking skills, namely: fluency, flexibility, originality and elaboration. Then, student answers are selected that represent these criteria to be discussed.

Data Analysis

After data collection, the analysis assesses students' mathematical creative thinking abilities in geometry. Descriptive statistical techniques such as calculating averages, percentages, or frequency distributions can characterize overall levels of creative mathematical reasoning.

Qualitative analysis can provide a deeper understanding of the mathematical creative thinking strategies used by students.

Interpretation and Presentation of Results

The final stage involves interpreting the results of the data analysis and presenting the research findings. Results can be presented in tables, diagrams, and narratives to provide a clear picture of students' creative mathematical thinking abilities in geometry. The research findings will also be compared with previous studies for a more comprehensive understanding.

This research will begin this year and continue for the next two years. In summary, the research flow is depicted in the flowchart below (See Figure 2).

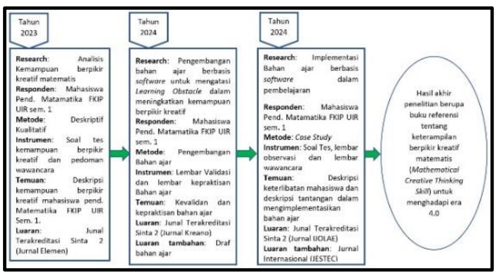

Figure 2. Research Flow Diagram

RESULT AND DISCUSSION

Result

The research results indicate that students' creative thinking skills in point, line, and angle topics show that they can identify, describe, and understand the basics of the subject. This can be seen from question number 1, which is: "*a) Explain the Figure 3, b) What should you do first with the images to make it easier for you to analyze or provide comments on the images?, c) Provide lots of correct analysis or comments about the things that apply to each picture accompanied by correct reasons in the form of definitions, postulates/axioms, properties of numbers, etc*".

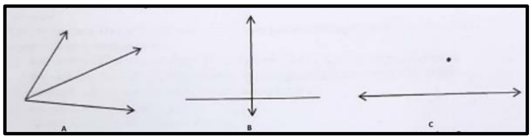

Figure 3. Image for question number 1

Student answers are as shown in Figure 4.

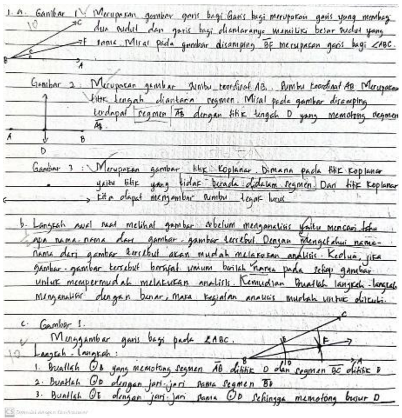

Figure 4. Student answers to number 1

Based on Van Hiele's theory, the analysis of these responses can be seen in terms of the levels of geometric understanding achieved by the participants, in this case, the students. At level 0 (Visualization), the students can identify the images presented in the question by drawing lines in the images and understanding the concept of dividing lines as angle dividers. At level 1 (Analysis), the students can analyze, draw, and name angles, lines, and segments. Additionally, there is an understanding of the coordinate axis AB as the midpoint between segments. They also mention that coplanar points are points that are not within a segment. This demonstrates an understanding of the relationships between points in a coordinate system. At stage 2 (Informal), the students are not yet able to draw conclusions, do not explain the properties of the angles formed, and do not explain the relationships between points and angles. In stages 3 and 4, namely deduction and rigor, they are not yet evident because the students do not provide proof of their findings and have not written their answers in a sequential and precise manner.

Question number 2 provides a theorem: "A triangle is isosceles if two of its angles are congruent. What should you do with the theorem?". The student's answer is as follows in Figure 5.

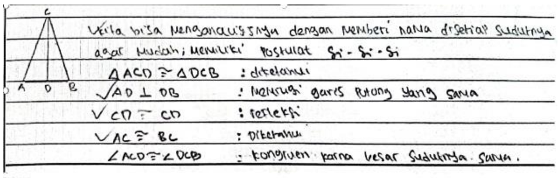

Figure 5. Student answers to question number 2.

Based on Van Hiele's theory, the analysis of the answer can be seen in terms of the level of geometric understanding achieved by the participant, in this case, the student. At level 0 (Visualization), the student can recognize the given theorem and demonstrate an understanding of the concept of an isosceles triangle and congruent angles. At level 1 (Analysis), the student can analyze the triangle and its angles by naming each angle and using the side-side-side postulate to identify triangle congruence. At level 2 (Informal), the student uses informal deductive reasoning by linking the given information (congruent angles) with the concepts they know (triangle congruence). However, at levels 3 (Deduction) and 4 (Abstraction), there is no evidence that the analysis reaches the level of formal deduction, where individuals can formulate formal proofs to support geometric statements. Additionally, there is no indication that the analysis reaches the level of abstraction, where individuals can understand more complex mathematical concepts in the context of geometry.

Question number 3, Formulation: "If a quadrilateral has a pair of parallel sides, then it has a pair of congruent sides. What should you do with the formulation?". The student's answer is as shown in Figure 6.

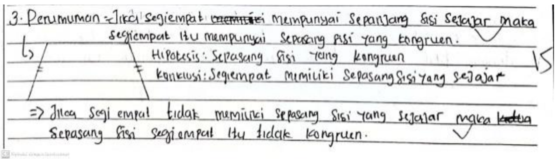

Figure 6. Student answers to question number 3

Based on Van Hiele's theory, the analysis of the answer can be seen in terms of the levels of geometric understanding, namely: At level 0 (Visualization), the student is able to recognize the statement about a quadrilateral having a pair of parallel sides and understand the consequences of that statement. At level 1 (Analysis), the student can analyze the statement by separating the hypothesis (a pair of congruent sides) and the conclusion (the quadrilateral has a pair of parallel sides). The student is also able to use logical reasoning to connect the hypothesis with the conclusion. At level 2 (Informal), the student uses informal deductive reasoning by linking the given information (quadrilateral with a pair of parallel sides) with the concepts they know (congruence of sides). At level 3 (Deduction), the student has not yet shown the ability to construct formal proofs to support geometric statements. Similarly, at level 4 (Abstraction), the student has not yet demonstrated an understanding of more complex mathematical concepts in the context of geometry. Therefore, the analysis of question number 3 can be said to have reached the levels of visualization, analysis, and informal understanding in Van Hiele's theory, but has not yet reached the levels of formal deduction and abstraction.

Question number 4: Explain the figure 7 below, then provide reasons for your explanation!

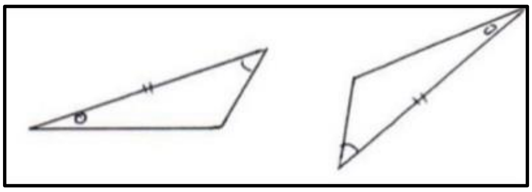

Figure 7. Image for question number 4

Students answered as shown in Figure 8 below:

Based on Van Hiele's theory, the analysis of the answer can be seen in terms of the levels of geometric understanding achieved by the participant, in this case, the student. At level 0 (Visualization), the student can recognize two acute triangles and understand the concept of angles in triangles. At level 1 (Analysis), they can analyze the two triangles by naming their angles (ABC and PQR) and using the side-angle-side postulate to prove triangle congruence. At level 2 (Informal), the student uses informal deductive reasoning by linking the given information (congruence of sides and angles) with the concepts they know (triangle congruence). However, at levels 3 (Deduction) and 4 (Abstraction), the student has not yet been able to present formal proofs to support geometric statements or understand more complex mathematical concepts in the context of geometry. Based on this analysis, it can be concluded that the student has achieved a level of understanding in visualization, informal, and analysis, but has not yet reached the levels of formal deduction and abstraction.

The creative thinking skills of the students, based on Van Hiele's theory, are at the levels of visualization, analysis, and informal understanding, but have not yet reached the levels of formal deduction and abstraction. If we look at this analysis based on indicators of creative thinking, the student's answer to question number one shows creative thinking skills in analyzing the given images, especially in terms of fluency, flexibility, originality, and elaboration. Although not entirely original in their ideas, they are able to combine existing concepts in an informative and detailed manner.

Discussion

Based on the research findings, the results of this study are important in enhancing the quality of geometry education in schools. By understanding students' level of understanding in geometry, teachers can adapt appropriate teaching methods to enhance students' understanding and creative thinking skills. By understanding the level of students' understanding in geometry, teachers can tailor appropriate teaching methods to enhance students' understanding and creative thinking skills. This means that teachers can adjust their teaching strategies to match the students' current grasp of geometric concepts, ensuring that they receive instruction that is both effective and suitable for their learning needs. Furthermore, the results of this research can serve as a reference for curriculum development and further research in the field of geometry. Therefore, this research can make a significant contribution to improving the quality of education in Indonesia.

The research findings mentioned indicate that students can identify, describe, and understand the basics of geometry, which is the first step in building creative thinking skills. Drawing from the theory of creative thinking skills, this discussion will elucidate how the stages and aspects of these skills contribute to these findings, namely:

Basic Identification and Understanding Stage.

The initial stage of developing creative thinking skills involves basic identification and understanding processes. In the context of research, students have demonstrated this ability through their understanding of points, lines, and angles. According to (Taylor, 2017), fluency, or the ability to generate many ideas, is part of the creative process. In this case, students understand and identify basic geometric concepts, which are the foundation for building further ideas.

Visualization and Analysis.

The ability to visualize and analyze information is the next step in creative thinking. Students demonstrate this ability through their analysis of the provided images. Students' ability to analyze images from various perspectives demonstrates (Rudowicz et al., 1995) emphasis on the importance of flexibility in creative thinking.

Fluency, Flexibility, Originality, and Elaboration.

Research findings show that students show indicators of creative thinking skills through fluency, flexibility, originality, and elaboration. Although not completely original, their ability to combine existing concepts in an informative and detailed way indicates elaboration or the development of ideas. (Sawyer, 2003) states that creativity involves using existing knowledge to produce something new and useful.

Application and Proof.

In the end, students were able to explain and apply the concepts of points, lines, and angles in detail, which demonstrated their ability to explain and prove these concepts. According to (Kaufman & Sternberg, 2010), these skills reflect an important aspect of creative thinking, namely the application of knowledge in new and different ways.

Creative thinking skills in the context of geometry, as shown in research findings, include a complex process from basic identification and understanding to application and proof. Students demonstrate key aspects of creative thinking such as fluency, flexibility, originality, and elaboration in the analysis and application of geometric concepts. This shows that building a strong foundation in conceptual understanding and encouraging creative exploration of these concepts can improve creative thinking skills in the fields of mathematics and geometry.

The novelty of this research lies in the approach used to analyze students' creative thinking skills in the context of geometry. By utilizing the Van Hiele theory, this study provides a deeper understanding of students' levels of visualization, analysis, informal understanding, formal deduction, and abstraction in comprehending geometry. By employing the Van Hiele theory, this research offers a deeper understanding of students' levels of comprehension in visualization, analysis, informal reasoning, formal deduction, and abstraction concerning geometry. This means that the study delves into how students grasp and process geometric concepts at various cognitive levels, shedding light on their ability to visualize shapes, analyze their properties, reason informally, deduce formally, and grasp abstract geometric concepts. The Van Hiele theory provides a framework for understanding how students progress through these levels of geometric thinking, which can be valuable for educators in designing effective teaching strategies and materials tailored to students' cognitive development in geometry. Additionally, this research offers a comprehensive analysis of students' responses based on the levels of geometric understanding achieved, along with recommendations for the development of students' creative thinking skills in the context of geometry. Therefore, the novelty of this research lies in the comprehensive analytical approach based on the Van Hiele theory, which can serve as a foundation for the development of teaching methods and curricula in the future context of geometry.

The findings of this research differ from previous studies. Students with specific learning styles determine the level of creativity in solving geometry problems (Restanto & Mampouw, 2018). Prospective teacher candidates can solve Higher Order Thinking Skills (HOTS)-oriented problems at the analysis and evaluation levels. Among the three research subjects, all of them were able to meet the indicators of the analysis and evaluation levels quite well. In terms of creativity, only one prospective teacher was able to meet 2 out of 4 creative indicators. Meanwhile, the other 2 prospective teachers were only able to meet 1 out of 4 creative indicators (Maimunah et al., 2020). The weaknesses of students in process skills lie in errors in using concepts, errors in using data, and errors in using calculation algorithm (Saragih, 2020).

As for the contributions and bene-

1

fits of this research, they include: 1) Improvement in learning: Teachers can use the results of this research to adjust teaching methods to enhance students' understanding of geometry; 2) Reference for curriculum development: The findings can serve as a reference for developing the mathematics curriculum, particularly in teaching geometry; 3) Reference for future research: Researchers can use this research as a basis for further studies on students' creative thinking skills in geometry; 4) Contribution to education quality: With a better understanding of students' geometry comprehension levels, this research can contribute to efforts to improve the quality of education in Indonesia.Therefore, this research has the potential to have a positive impact on geometry learning and curriculum development in the education context.

Some limitations of this research include: 1) The limited sample size of only 20 students. Future researchers could expand the sample size to obtain more representative results; 2) The focus of this study was on the topics of points, lines, and angles. Subsequent researchers could broaden the scope to examine students' creative thinking skills in other geometry topics. Considering these limitations, future researchers could continue this study with a broader and more in-depth approach to enrich the understanding of students' creative thinking skills in geometry.

Implication of Research

The research highlights the significance of understanding students' levels of geometric comprehension and creative thinking skills, particularly in the topics of points, lines, and angles. Based on Van Hiele's theory, students predominantly operate at the levels of visualization, analysis, and informal reasoning but have not fully reached the advanced stages of formal deduction and abstraction. This finding underscores the necessity for targeted teaching strategies that align with students' cognitive development stages, fostering deeper understanding and creative exploration of geometric concepts. The study identifies students' creative thinking skills through indicators such as fluency, flexibility, originality, and elaboration, which are foundational to solving geometric problems effectively. Moreover, the research contributes to educational practices by offering insights for curriculum development, instructional adjustments, and further studies on enhancing creative thinking in geometry. While the study demonstrates progress in students' understanding, it also reveals areas for improvement, such as developing formal proof skills and abstract reasoning. These findings provide valuable implications for improving geometry education quality, emphasizing the integration of conceptual clarity with creative and critical thinking development.

Limitation

The limitations of this study include the following: (1) Limited Sample Size: The research involved only 20 students, which may not provide a fully representative understanding of the broader population's creative thinking abilities in geometry. Future studies should include a larger and more diverse sample size to enhance generalizability; (2) Restricted Scope of Topics: The study focused specifically on points, lines, and angles, leaving out other important geometric concepts such as polygons, circles, and three-dimensional shapes. Expanding the range of topics could provide a more comprehensive analysis of students' creative thinking skills in geometry; (3) Reliance on Van Hiele's Theory: While the Van Hiele theory is a robust framework for assessing geometric understanding, it may not fully capture all aspects of students' creative thinking processes. Future research could incorporate additional theories or frameworks to provide a more holistic view; (4) Limited Time Frame: The study was conducted within a constrained period, which may have restricted the ability to observe longitudinal development in students' geometric understanding and creative thinking skills. Long-term studies are recommended for deeper insights; (5) Dependence on Written Responses: The research relied heavily on analyzing students' written answers, which might not capture the full spectrum of their thought processes. Including verbal explanations or observational methods could enrich the findings.

These limitations highlight areas for improvement and offer directions for future research to deepen understanding of students' creative thinking skills in the context of geometry.

CONCLUSIONS

Based on the research findings, it can be concluded that students' creative thinking skills in the topic of points, lines, and angles demonstrate their ability to identify, describe, and understand the fundamentals of the subject matter. The students can achieve a level of understanding in visualization, analysis, and informal understanding in Van Hiele's theory, but have not yet reached the levels of formal deduction and abstraction. Nevertheless, students have shown creative thinking skills in analyzing the given images, especially in terms of fluency, flexibility, originality, and elaboration. Although their ideas are not entirely original, they are able to combine existing concepts in an informative and detailed manner.

The results of this research are significantly important in improving the quality of geometry education in schools. By knowing the students' level of geometric understanding, teachers can adjust the teaching methods to enhance students' understanding and creative thinking skills. Additionally, the research results can serve as a reference for curriculum development and further research in the field of geometry. Therefore, this research can make a significant contribution to improving the quality of education in Indonesia.

The limitations of this research may include several aspects, such as: 1) the limited sample size of this study. Future researchers can expand the sample size to obtain more representative results; 2) the scope of the material only focuses on the topics of points, lines, and angles. Future researchers can broaden the scope of the material to examine students' creative thinking skills in other geometry topics; 3) the research method only uses descriptive qualitative methods. Future researchers can consider using other methods or a combination of methods to obtain a more comprehensive understanding.