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Utilizing Visual Media to Improve Conceptual Understanding of Geometry Among Junior High School Students

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Abstract

Purpose: This classroom action research aimed to improve junior high school students' conceptual understanding of geometry through the integration of visual media within a cooperative learning framework. **Methodology:** The study was conducted in two cycles, involving 21 students, and followed the systematic stages of planning, acting, observing, and reflecting. During the pre-cycle, traditional lecture-based instruction led to low engagement and unsatisfactory academic performance, with only 42.86% of students achieving the minimum mastery criterion (KKM). In Cycle I, the implementation of visual media such as diagrams and illustrations combined with cooperative learning activities, led to a modest increase in students' average scores and engagement levels. However, the mastery rate remained at 52.38%, indicating the need for instructional refinement. In Cycle II, improvements in media quality, structured group facilitation, and enhanced teacher support contributed to significant learning gains. The average class score rose to 80.95, and 90.48% of students met the KKM. Observations also revealed marked improvements in student activeness, collaboration, and confidence in expressing ideas. **Findings:** The findings confirm that visual media, when effectively integrated into cooperative learning, significantly enhances students' conceptual understanding of geometry-related content. **Significance:** This research suggests that visual learning strategies should be systematically embedded into science instruction to support deeper comprehension and promote inclusive, student-centered classroom environments.

Keywords: Visual Media, Conceptual Understanding, Geometry, Junior High School.

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Introduction

Mathematics is widely acknowledged as a core subject in formal education, serving not only as a tool for solving quantitative problems but also as a medium for cultivating logical reasoning, abstract thinking, and analytical skills. These cognitive skills are integral across various branches of mathematics, including one particularly significant area: geometry. Within the mathematics curriculum, geometry holds a unique position due to its inherently spatial and visual characteristics. As students engage with concepts related to shapes, sizes, positions, and dimensions, geometry supports the development of spatial reasoning and visualization abilities that are foundational for deeper mathematical understanding. Furthermore, this branch of mathematics extends its relevance beyond the classroom, providing essential knowledge applicable to disciplines such as architecture, engineering, physics, and computer science (Stahl, 2021). Thus, geometry not only enriches mathematical thinking but also bridges learning with real-world applications. However, despite its importance, geometry remains one of the most challenging areas for junior high school students. Many students struggle to understand abstract geometric concepts, such as properties of shapes, relationships between angles, area, and volume, particularly when these are presented in symbolic or purely theoretical forms (Maqoqa, 2024; Prameswari & Haryani, 2023). Initial classroom observations conducted in early 2025 at SMP Negeri 1 Kolaka confirmed that geometry remains one of the more appealing yet difficult subjects for students. Although many students expressed interest and curiosity toward the visual aspects of geometry, their actual academic performance told a different story. Based on the results of assignments and tests administered during the first semester, the majority of students did not reach the Minimum Mastery Criteria (Kriteria Ketuntasan Minimal or KKM) set by the school. Both task and quiz scores were relatively low, particularly in subtopics such as two-dimensional and three-dimensional shapes, spatial relationships, and angle measurement. This suggests that students are struggling with conceptual understanding and are unable to apply geometric knowledge in problem-solving contexts. The persistence of low achievement, despite genuine interest, points to a disconnect between teaching methods and student learning needs (Ekmekci & Serrano, 2022).

One of the key challenges lies in the abstract nature of geometric content, which demands the ability to mentally visualize and manipulate spatial objects. According to the Van Hiele Theory of Geometric Thought, students' progress through a series of hierarchical levels in their understanding of geometry, starting from basic visual recognition to formal deductive reasoning (Fitriyani et al., 2018; González et al., 2025; Mawarsari et al., 2024; Naufal et al., 2021). However, instructional practices in many classrooms often do not align with these developmental stages. Students are commonly taught through formula-based approaches without adequate visual or conceptual support, causing them to memorize procedures rather than develop deep understanding. As a result, students may perform calculations correctly but lack the ability to explain their reasoning or apply geometric concepts in problem-solving contexts (Amalia et al., 2024). This gap in instructional alignment underscores the need for teaching strategies that support conceptual understanding rather than rote learning. Conceptual understanding involves grasping the underlying principles that govern a mathematical idea, and being able to represent, explain, and apply it in various contexts (Nasir et al., 2022). In the case of geometry, achieving conceptual understanding requires the development of spatial visualization, the capacity to imagine and manipulate shapes in the mind's eye (Abrahamson & Abdu, 2021; Hsu & Hsu, 2024). However, not all students possess strong innate visual-spatial skills, and they may require external support in the form of instructional aids that facilitate the construction of mental models. In response to this challenge, the use of visual media has gained attention as an effective instructional intervention (Arsyad, 2016). Visual media refer to any educational materials that present information through visual elements, such as images, diagrams, drawings, physical models, animations, or interactive digital tools. According to the Cognitive Load Theory learners' working memory has a limited capacity, and instructional materials must be designed to optimize cognitive processing (Surbakti & Umboh, 2024; Sweller, 2024; Syagif, 2024). Visual media can reduce extraneous cognitive load by organizing information in ways that are easier to process and remember. This is especially critical in geometry, where learners must often handle multiple forms of information simultaneously such as textual descriptions, symbolic representations, and spatial relationships. Moreover, the Dual Coding Theory proposed by Paivio suggests that people learn more effectively when information is presented both verbally and visually (Novita et al., 2025; Saeverot & Torgersen, 2016; Scheerer-Neumann, 1974). Then applied to mathematics education, this theory supports the integration of images and diagrams with verbal explanations to enhance memory and understanding. Similarly, Mayer's Cognitive Theory of Multimedia Learning emphasizes that meaningful learning occurs when students actively select, organize, and integrate information from both visual and auditory channels (Mayer, 2024; Susilana et al., 2022). Visual media, therefore, play a crucial role in bridging abstract concepts with tangible understanding, particularly for learners with visual learning preferences or lower spatial reasoning abilities.

Research evidence supports the benefits of visual media in mathematics instruction. (Verawati et al., 2025) emphasizes the role of visual representations in promoting mathematical thinking, arguing that well-designed visuals help students recognize patterns, make connections, and solve problems more effectively. (Boaler, 2025) stated that further argue that visual learning strategies contribute to the development of mathematical mindsets, enabling students to approach complex problems with confidence and flexibility. In the Indonesian context, have shown that the use of visual media in geometry lessons significantly improves students' understanding, participation, and motivation (Gustina & Mariana, 2025; Žakelj & Klančar, 2022). These findings indicate that visual media are not merely supplementary tools, but rather essential components of effective mathematics instruction. Despite these advantages, the actual implementation of visual media in geometry classrooms remains limited, particularly in public junior high schools in Indonesia. A study by (Zhu & Xu, 2023) found that only 27% of mathematics teachers in Indonesian junior high schools frequently incorporate visual media such as diagrams, animations, or interactive geometry software in their lessons. This low utilization is often attributed to several factors, including limited access to technological resources, lack of teacher training, and insufficient institutional support. From a theoretical standpoint, this underutilization contrasts with (Mayer, 2024) which emphasizes that students learn more deeply from words and pictures than from words alone. The theory supports the integration of visual media to enhance the dual-channel processing of verbal and visual information, particularly relevant in geometry, which is inherently spatial and visual in nature. Furthermore, Piaget's theory of cognitive development highlights that students in the formal operational stage (typically adolescents) benefit significantly from visual and abstract representations to develop spatial reasoning and geometric understanding. This gap between pedagogical potential and practical application underscores the need for systemic interventions, including teacher professional development, curriculum revision, and investment in digital infrastructure, to support the effective integration of visual media in geometry instructions. Teachers often face constraints such as lack of access to visual teaching aids, limited training in instructional media, or time pressures to complete the curriculum. Moreover, some educators may underestimate the pedagogical value of visual tools or lack the knowledge of how to integrate them into their lesson plans effectively. These constraints contribute to a persistent reliance on traditional, lecture-based instruction that prioritizes symbolic manipulation over conceptual exploration.

In light of the persistent challenges observed at SMP Negeri 1 Kolaka particularly the low student performance in geometry despite their reported interest there is a pressing need to explore instructional strategies that are both practical and scalable within the classroom context. This study aims to explore how visual media can be used to improve junior high school students' conceptual understanding of geometry, particularly in topics such as two-dimensional shapes, three-dimensional objects, and spatial relationships. Khotimah and Hidayat (2022) Through a classroom action research approach, the study will document how visual tools ranging from illustrations and models to interactive digital resources affect student engagement, understanding, and learning outcomes. By grounding the research in the theoretical frameworks of Van Hiele, Mayer, Paivio, and Sweller, and drawing on empirical evidence from both local and international studies, this study aims to contribute specifically to the body of research on students' geometrical conceptual understanding. Rather than addressing mathematics education in general, the study emphasizes the development of instructional strategies that enhance students' abilities to reason spatially, recognize geometric properties, and transition between levels of geometric thinking. This focused contribution is expected to support the refinement of pedagogical practices in geometry instruction, particularly in contexts with limited visual media integration. It is expected that the results of this study will offer practical insights for mathematics teachers, curriculum developers, and educational policymakers particularly in the context of junior high school geometry instruction regarding the effective use of visual media to enhance students' conceptual understanding of geometric properties, clarify common misconceptions (such as those related to angles, shapes, and spatial relationships), and support the development of logical reasoning and spatial visualization skills. By focusing on these specific aspects, the study aims to contribute meaningfully to targeted improvements in geometry pedagogy rather than general mathematics education.

Methods

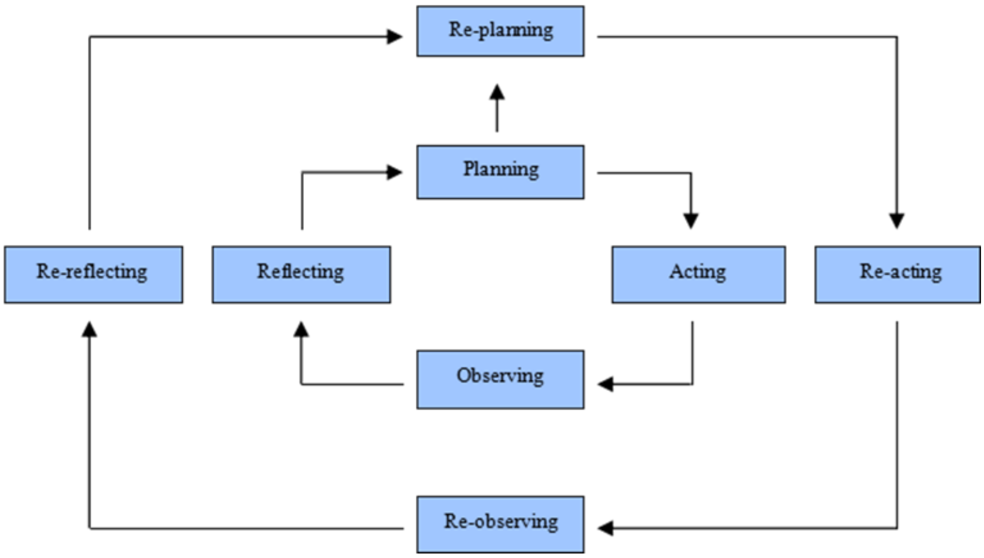
This study employed a Classroom Action Research (CAR) approach based on the model developed by Kemmis and McTaggart (1988) (Dehnad & Nasser, 2014). CAR was chosen because it provides a systematic and reflective way for teachers to improve instructional quality and student learning outcomes through iterative cycles of planning, action, observation, and reflection (Siswanto et al., 2025). The research was conducted at SMP Negeri 1 Kolaka, specifically in Class $VIII_A$, during the odd semester of the 2023/2024 academic year, in October 2024. The class consisted of 28 students, comprising 10 male students and 18 female students. This class was selected based on preliminary observations, which indicated that although students showed enthusiasm for geometry, many had difficulty understanding the concepts. The success criteria for this research were based on two indicators: The Minimum Mastery Criteria (KKM) was set at 75. The research action was deemed successful if at least 75% of students (i.e., 21 out of 28 students) achieved a minimum score of 65 on the post-test at the end of each cycle. The research was implemented over the course of three cycles, with each cycle consisting of four key stages:

Planning In this phase, the researcher and classroom teacher collaboratively identified the core problems in geometry learning, developed lesson plans, selected appropriate visual media as instructional aids, and prepared learning assessment tools. 1) Action (Implementation), The instructional plans were put into practice in the classroom. The teacher delivered the geometry lessons using visual media such as diagrams, images, and physical models to help students understand abstract geometric concepts; 2) Observation and Evaluating, While the action was being carried out, the researcher and teacher observed the learning process, monitored student engagement, collected student work, and evaluated learning outcomes through tests and documentation; 3) Reflection After each cycle, the results were analyzed to determine what aspects of the teaching strategy were effective and what needed improvement. These reflections informed the planning of the next cycle to ensure continuous improvement in student learning outcomes.

If these criteria were not met, the next cycle was conducted with improved planning and instructional strategies. The following diagram illustrates the cyclical nature of the Classroom Action Research model used in this study:

Figure 1

The Cycle of Classroom Action Research Procedure



This study involved various types of data and employed multiple techniques for data collection and analysis to ensure comprehensive findings. The data were obtained from multiple sources, including students, the teacher, documentation, and field notes. Student data were gathered through systematic observations during the implementation of Cycle I and Cycle II, evaluation results, and interviews conducted by observers. Teacher data were derived from observation sheets assessing teacher activities during the learning process. Additional data were drawn from documents such as students' learning outcomes and the Lesson Improvement Plan (RPP). Field notes, compiled throughout the teaching and learning process, provided further insights into student and teacher activities, as well as students' skills development. Two main types of data were utilized in this study: quantitative and qualitative data. The quantitative data comprised students' learning outcomes, collected through evaluation tests and student activity scores recorded in the Student Worksheets (LKS). The qualitative data included observations of student and teacher activities, as well as interview results, offering a richer understanding of the learning dynamics.

To collect these data, four primary techniques were employed:1) Observation, which was conducted to monitor and record the learning process and student participation without interfering with classroom activities. Observation sheets were used to assess student interest, engagement, and learning outcomes; 2) Interviews, which involved direct conversations with students to explore their perspectives on the application of the Cooperative Learning model in science classes. This provided valuable feedback about their experiences during the implementation; 3) Documentation, which included collecting photographs of classroom activities, student attendance lists, and grade records. These served both to visualize classroom interactions and to support other forms of data; 4) Testing, which consisted of both written and oral tests. Written tests were administered individually at the end of each cycle to evaluate cognitive achievement, while oral tests were conducted during learning through interactive questioning. For data analysis, both quantitative and qualitative approaches were applied. Quantitative data, particularly students' cognitive test scores, were analyzed descriptively by calculating the average scores and presenting them in percentages to show the overall performance improvement. On the other hand, qualitative data were analyzed using descriptive qualitative methods, where the data were grouped into relevant categories and presented in narrative form to identify patterns and draw conclusions regarding the effectiveness of the applied learning model. Through this combined data analysis approach, the study aimed to present a comprehensive understanding of the learning process and its outcomes, particularly in relation to the implementation of the Cooperative Learning approach in science education.

Results and Discussions

1. Pre-Cycle Phase

During the pre-cycle phase, instruction on geometry-related science concepts specifically the topic of *light and its properties* was delivered primarily through a traditional lecture method. This conventional, teacher-centered approach limited opportunities for student interaction and engagement. The teacher functioned as the sole source of information, while students were expected to listen and take notes passively. Consequently, the classroom atmosphere became monotonous, and students exhibited low motivation, minimal enthusiasm, and limited participation throughout the lessons. Observation during this phase indicated that students tended to be disengaged, with many failing to respond actively to questions or take part in classroom discussions. The lack of interactive activities or visual reinforcement further hindered their ability to comprehend the scientific material particularly abstract concepts related to light behavior and properties. This situation not only affected student motivation but also resulted in suboptimal academic performance. The results of the formative assessment conducted at the end of the pre-cycle phase confirmed these observations. Out of 21 students, only 9 (42.86%) achieved a score equal to or greater than the Minimum Mastery Criterion (KKM). Meanwhile, 12 students (57.14%) failed to meet the benchmark. The distribution of scores ranged from a minimum of 50 to a maximum of 80, with an overall class average of 66.43. These figures clearly signaled the need for instructional improvement. The analysis of this initial data suggested that the lecture method alone was insufficient for facilitating conceptual understanding of scientific content, particularly among students who struggled with abstract thinking. Geometry-based science topics, such as the reflection, refraction, and absorption of light, require a high level of visualization and spatial reasoning skills that are difficult to nurture through verbal explanation alone. This situation indicated a pressing need to adopt a more student-centered learning model that promotes interaction, collaboration, and multi-sensory engagement. In particular, the integration of visual media was identified as a promising alternative to enhance student comprehension. Visuals such as diagrams, animations, illustrations, and models were expected to help bridge the gap between abstract scientific concepts and students' existing cognitive frameworks. In conclusion, the pre-cycle findings provided a strong rationale for designing and implementing a visual media-based instructional intervention in the subsequent research cycles. The low engagement levels and inadequate mastery of learning objectives during this phase underscored the necessity of employing more dynamic, student-friendly teaching strategies to support deeper learning and improved outcomes.

2. Cycle I Implementation

In response to the instructional limitations identified during the pre-cycle phase, the first cycle of this classroom action research involved the integration of visual media as a central pedagogical tool aimed at enhancing students' conceptual understanding of geometry-related science topics. Recognizing that abstract content often hinders comprehension at the junior high school level, the instructional strategy was deliberately revised to incorporate illustrated diagrams, concept maps, and visual aids, which were embedded into cooperative learning activities. These media were chosen to provide more concrete representations of abstract geometric concepts, helping students form mental models that supported deeper understanding. The implementation of this revised teaching approach yielded measurable improvements. Based on the post-cycle evaluation, the average class score increased to 72.86, a notable improvement from the pre-cycle average of 66.43. Moreover, the number of students who met or exceeded the Minimum Mastery Criterion (KKM) increased from 9 to 11 out of 21 students, or 52.38%. The highest score recorded was 85, while the lowest was 60, indicating a narrowing of the performance gap among students. In addition to cognitive outcomes, classroom observations were conducted to assess student engagement and behavior during the learning process. The observation data showed that 71.43% of students actively participated in class activities, 57.14% demonstrated effective collaboration within their discussion groups, and 47.62% showed confidence in expressing their ideas during class discussions. These results indicated a positive trend in student behavior, but still fell short of the research objectives. A significant number of students remained passive or disengaged during peer discussions, and the overall group dynamics were still unbalanced.

The teacher's performance during Cycle I was also assessed through a structured observation rubric. The total performance score was 35 out of 48, which placed the teaching within the "good" category. The teacher demonstrated competence in presenting the material, organizing students into collaborative groups, and using visual media effectively. However, the reflection phase revealed several critical areas for improvement. It was observed that high-achieving students tended to dominate group discussions, limiting opportunities for others to participate meaningfully. Furthermore, students with lower academic achievement appeared hesitant and less confident, often withdrawing from the group learning process.

Additionally, the teacher's facilitation during group tasks was not yet fully effective. Although all student groups received assistance, the support was not equitably distributed, and some students continued to struggle without sufficient guidance. This imbalance contributed to uneven levels of engagement and comprehension among groups. In summary, while the implementation of visual media in Cycle I resulted in moderate improvement in both conceptual understanding and student engagement, the overall outcomes did not yet meet the success criteria established for the study. The insights gathered from this cycle provided a solid foundation for planning more targeted improvements in Cycle II, particularly in relation to student interaction, differentiated support, and fostering inclusive group dynamics that benefit all learners, these elements play a critical role in supporting students' conceptual understanding of geometry. Collaborative interaction allows learners to articulate and negotiate mathematical ideas, which promotes deeper comprehension. Differentiated support ensures that instructional strategies are tailored to varying levels of readiness, enabling all students regardless of their prior knowledge to access and internalize abstract geometric concepts. Furthermore, inclusive group dynamics create a learning environment where diverse perspectives are valued, thus encouraging peer explanation, error analysis, and conceptual clarification. Collectively, these instructional features contribute significantly to building a robust understanding of geometric relationships and principles.

3. Cycle II Implementation

Following the analysis and reflection on the outcomes of Cycle I, substantial and strategic modifications were implemented in Cycle II to address the previously identified shortcomings. These modifications focused primarily on enhancing student engagement and conceptual understanding through the more deliberate and effective use of visual media. The visual materials were redesigned to be clearer, more contextually relevant, and directly aligned with the geometry content being taught. In addition to this, structured peer tutoring was introduced as a method to foster collaborative learning and to empower high-achieving students to support their peers. Furthermore, the teacher's role was adjusted to include more targeted facilitation during group activities, ensuring that support was distributed equitably and that students who required assistance received timely and appropriate guidance. The instructional design also emphasized cooperative learning strategies, where students were organized into small, heterogeneous groups and tasked with problem-solving and discussion activities. Each group was encouraged to share responsibilities, deliberate over solutions, and present their conclusions to the class. This approach aimed to promote inclusivity, boost confidence, and cultivate critical thinking and communication skills among all learners. The impact of these instructional improvements was both positive and significant. The average class score rose to 80.95, a notable increase from the 72.86 achieved in Cycle I. Moreover, 19 out of 21 students (90.48%) reached the mastery level, meeting or exceeding the Minimum Mastery Criterion (KKM), while only 2 students (9.52%) scored below the threshold. The range of student scores in Cycle II extended from a minimum of 65 to a maximum of 90, with four students attaining the highest score. This distribution of achievement suggests not only an upward shift in average performance but also a narrowing of the performance gap among students. Observation data from Cycle II further substantiated the improvements in student behavior and engagement. A remarkable 90.48% of students were observed to be actively engaged in the learning process, reflecting a high level of motivation and attentiveness. In terms of collaborative behavior, 85.71% of students demonstrated effective cooperation during group tasks, a significant increase from the first cycle. Similarly, 85.71% exhibited the confidence to express their ideas and participate in academic discussions, indicating an enhanced learning environment that supported student voice and autonomy.

Teacher performance, as evaluated through structured observation, showed corresponding improvements. The teacher received a total performance score of 45 out of a possible 48 points, which falls within the category of "very good" based on the evaluation rubric. This rating reflected the teacher’s improved ability to facilitate learning, manage time effectively, and orchestrate meaningful classroom interactions. The instructional atmosphere transitioned from a predominantly teacher-centered approach to a more student-centered and multi-directional interaction model, in which students actively engaged in dialogue not only with the teacher but also with their peers. This shift fostered a learning environment characterized by increased collaboration, mutual support, and higher levels of cognitive engagement. In Cycle II, this transformation became evident through the integration of well-designed visual media, cooperative learning strategies, and structured teacher facilitation, all of which contributed to a significant improvement in students’ conceptual understanding of geometry. Indicators of success included a notable increase in achievement scores, more constructive classroom behavior, and enhanced quality of interaction between students and teachers. These outcomes affirm that the instructional modifications implemented during this cycle were effective and aligned with the intended research objectives. The success of this intervention reinforces existing literature on the efficacy of visual media in science and mathematics instruction. Studies by Suryani (2017) and Rahmawati and Suprapto (2020) underscore the value of visual learning strategies in helping students bridge the gap between concrete experiences and abstract reasoning. This is particularly relevant in geometry, where spatial relationships and abstract structures often pose difficulties for students. In alignment with Bruner's theory of representation, the use of iconic (visual) representation is instrumental in guiding students from enactive experiences toward symbolic understanding. By presenting information visually, learners are better able to construct mental models that support deep conceptual comprehension, especially in geometric contexts.

Given this strong body of evidence and the positive outcomes observed in this study, several pedagogical implications emerge. First, junior high school science and mathematics educators are encouraged to systematically integrate visual media into their instructional design. Tools such as diagrams, infographics, three-dimensional models, animations, and interactive visuals can play a central role in enhancing students' spatial reasoning and conceptual clarity. Second, these visual tools should be embedded within collaborative learning environments such as cooperative learning models to promote peer discussion, shared problem-solving, and social construction of knowledge. Third, teachers must be equipped not only with the skills to utilize visual media effectively but also with the pedagogical expertise to manage inclusive group dynamics and deliver differentiated instruction that responds to varied learning styles and needs. Overall, the findings suggest that when visual media are thoughtfully integrated into instruction supported by cooperative structures and responsive teaching practices, they can significantly enhance students' conceptual understanding in geometry and foster more meaningful and inclusive learning experiences.

Reflection and Interpretation

The progression observed from the pre-cycle through Cycle I to Cycle II provides compelling evidence of the effectiveness of integrating visual media into the teaching of geometry-related science content. The use of images, diagrams, and other visual aids significantly enhanced students' conceptual understanding, as reflected in both their cognitive performance and active classroom participation. Quantitative data clearly demonstrate this improvement. During the pre-cycle, the average class score was 66.43, with only 9 out of 21 students (42.86%) meeting the Minimum Mastery Criterion (KKM). Following the implementation of visual media in Cycle I, the average score rose to 72.86, and 11 students (52.38%) achieved mastery. By Cycle II, the instructional strategies had been refined, and the results improved substantially: the average class score reached 80.95, and 19 students (90.48%) met the KKM. These results indicate a consistent upward trend in student achievement as instructional quality and student engagement improved. This progression confirms that the application of visual media enhances not only students' retention of facts but also their ability to understand abstract concepts. In geometry and science, which often deal with non-concrete ideas such as the behavior of light, spatial reasoning, or geometric shapes, visual representations bridge the gap between theoretical content and tangible understanding. This finding is aligned with Panjaitan et al. (2023) who reported that visual media plays a pivotal role in improving students' learning outcomes in science by making the content more accessible and engaging. Likewise, emphasized the effectiveness of using pictures and visual tools to facilitate comprehension in mathematics and science, particularly in lower and middle-grade students (Faradiba et al., 2024).

From a theoretical perspective, this study strongly aligns with Bruner's Cognitive Development Theory, particularly the iconic representation stage. Learners in the iconic stage process information through visual images and diagrams before transitioning to symbolic or abstract understanding (Bronkhorst et al., 2021; Gök, 2023). By incorporating visual elements into science instruction, students are provided with concrete visual anchors that help them grasp and internalize abstract concepts. This scaffolding is critical in developing higher-order thinking skills and deeper comprehension. Additionally, the cooperative learning model employed throughout this research functioned as a supportive instructional framework. Cooperative learning fosters social interaction, collaboration, and shared responsibility among learners. When combined with visual media, this model allowed students to co-construct meaning through discussion, comparison of mental models, and active engagement with the learning materials. It also minimized the tendency for passive learning, which had characterized the pre-cycle phase. As noted by Slavin (2015) cooperative learning increases achievement when students work interdependently and are individually accountable especially when learning materials are accessible, such as through visual representation.

Qualitative data gathered through observations further support this interpretation. In Cycle I, student engagement was moderate, with many students still hesitant to participate fully. However, in Cycle II, 90.48% of students were observed to be active, with 85.71% showing confidence in contributing during discussions. The group collaboration rate also improved, suggesting that students were not only understanding the material better but were also more motivated and confident in working with peers. Teacher performance also evolved across the cycles. In Cycle I, the teacher's total observation score was 35, placing instructional practice in the "good" category. However, by Cycle II, the score increased to 45 qualifying as "very good" demonstrating improved pedagogical strategies, classroom management, and ability to support student learning through both individual and group-based approaches. These findings suggest that integrating visual media in cooperative learning environments promotes deeper conceptual understanding by addressing diverse learning styles, enhancing student motivation, and facilitating active learning. Visual media serve as cognitive tools that help students decode complex ideas and construct meaningful knowledge. This approach is especially relevant in geometry and science, where abstract thinking is required, and where traditional lecture-based instruction often falls short in engaging students meaningfully. In conclusion, the positive trajectory from the pre-cycle to Cycle II underscores the transformative potential of visual media when thoughtfully embedded within a cooperative learning framework. Not only did student achievement improve quantitatively, but their classroom behavior, motivation, and willingness to engage in higher-level thinking also showed significant growth. This affirms the initial hypothesis and reinforces the call for more interactive, student-centered, and visually supported instruction in junior high school science and mathematics classrooms.

Conclusions

The findings from this classroom action research unequivocally affirm that the integration of visual media within a cooperative learning framework significantly enhances students' conceptual understanding, particularly in geometry-related science topics. This conclusion is supported by both quantitative and qualitative data collected throughout the study. During the pre-cycle phase, students demonstrated relatively low academic performance, with average achievement scores falling below the Minimum Mastery Criterion (KKM), accompanied by limited engagement and passive classroom behavior. However, as visual media and cooperative strategies were systematically introduced across three learning cycles, a clear and measurable progression was observed culminating in 90.48% of students meeting or exceeding the KKM by the end of Cycle II. The use of visual media such as diagrams, illustrations, geometric models, and concept-based images played a crucial role in facilitating students' comprehension of abstract concepts. These tools helped learners to visualize relationships, construct mental representations, and engage in geometrical reasoning. When embedded in cooperative learning activities, visual media not only served as instructional aids but also as catalysts for meaningful dialogue, collaborative problem-solving, and peer-assisted learning. Students were given opportunities to articulate their understanding, confront misconceptions, and co-construct knowledge through structured group interactions. Qualitative observations further revealed a transformative shift in classroom dynamics. Students became more confident, participative, and intrinsically motivated to learn. The teacher's role evolved from being the sole provider of knowledge to a learning facilitator who guided discussions, posed strategic questions, and provided scaffolding tailored to students' needs. This pedagogical shift reflects constructivist learning principles, wherein students are positioned as active agents in their own learning process. The learning environment thus became more inclusive, dialogic, and student-centered, fostering not only cognitive growth but also social and emotional development. Importantly, the iterative nature of the classroom action research allowed for continuous reflection and refinement of instructional practices. With each cycle, interventions were adapted to address challenges and optimize student learning outcomes. This cyclical process contributed to the robustness of the findings and the reliability of the instructional approach. In conclusion, the strategic integration of visual media within cooperative learning settings has proven to be an effective and evidence-based method for enhancing students' conceptual understanding of geometry in science education. The research objectives were successfully achieved, demonstrating improvements not only in academic performance but also in student engagement, classroom interaction, and learning motivation. As such, visual media should be recognized as a core component of innovative pedagogy, particularly in subjects requiring abstract and spatial reasoning. Teachers are encouraged to design instruction that combines visual tools with collaborative learning structures and differentiated support, in order to cultivate deeper understanding, foster inclusivity, and promote active student participation in the learning process.

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