

The Effectiveness of the Cabri 3D Media-Assisted *Deep Learning* Approach in Learning Spatial Structures for Fifth Grade Elementary School Students

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui efektivitas penerapan pendekatan *Deep Learning* berbantu media Cabri 3D dalam pembelajaran bangun ruang bagi siswa kelas V SDN Karang Sari 4. Dalam penelitian ini terdapat rendahnya pemahaman siswa pada materi bangun ruang akibat pendekatan yang digunakan dalam pembelajaran yaitu pendekatan pengajaran tradisional yang kurang melibatkan siswa secara aktif. Pendekatan *Deep Learning* berbantu media Cabri 3D diterapkan sebagai solusi, dengan menekankan pembelajaran bermakna (*meaningful learning*), berkesadaran (*mindful learning*), dan menyenangkan (*joyful learning*). Metode yang digunakan adalah kuantitatif dengan desain *one-group pretest-posttest*. Sampel penelitian adalah peserta didik kelas VA yang berjumlah 22 siswa. Teknik pengumpulan data mencakup tes (*pretest* dan *posttest*). Analisis data yang digunakan adalah uji normalitas, uji homogenitas, uji paired sampel t test dan uji n gain. Hasil uji normalitas nilai *pretest* didapatkan nilai sig 0,165 maka nilai *pretest* tersebut normal dan hasil uji normalitas nilai *posttest* didapatkan nilai sig 0,194 maka nilai *posttest* tersebut normal. Berdasarkan hasil uji homogenitas didapatkan nilai sig 0,926 maka nilai *pretest* dan *posttest* siswa adalah homogen. Sehingga kedua nilai *pretest* dan *posttest* berdistribusi normal. Berdasarkan hasil output "*Paired Samples t Test*" didapat bahwa nilai *Sig 2 tailed* yaitu $0,000 < 0,05$, Maka H_0 ditolak dan H_1 diterima. Sehingga ada perbedaan rata-rata antara *pretest* dan *posttest* materi bangun ruang. Analisis normalitas gain siswa dengan nilai rerata n gain 0,48 masuk kategori sedang. Berdasarkan rangkaian hasil uji tersebut dapat dikatakan bahwa pembelajaran *Deep Learning* berbantu media Cabri 3D efektif dalam pembelajaran materi bangun ruang.

Kata Kunci: *Deep Learning* ; Cabri 3D; Bangun Ruang

ABSTRACT

This study aims to determine the effectiveness of the application of the *Deep Learning* approach assisted by Cabri 3D media in learning spatial geometry for fifth-grade students of SDN Karang Sari 4. In this study, there was a low understanding of students on spatial geometry material due to the approach used in learning, namely the traditional teaching approach that does not involve students actively. The *Deep Learning* approach assisted by Cabri 3D media was applied as a solution, by emphasizing meaningful learning, mindful learning, and joyful learning. The method used was quantitative with a one-group pretest-posttest design. The research sample was 22 students of class VA. Data collection techniques included tests (pretest and posttest). Data analysis used was the normality test, homogeneity test, paired sample t-test and N Gain test. The results of the pretest value normality test obtained a sig value of 0.165, meaning the pretest value is normal, and the results of the posttest value normality test obtained a sig value of 0.194, meaning the posttest value is normal. Based on the results of the homogeneity test, a sig value of 0.926 was obtained, meaning the students' pretest and posttest values were homogeneous. So both pretest and posttest values were normally distributed. Based on the output results of the "*Paired Samples t Test*" it was found that the 2-tailed Sig value was $0.000 < 0.05$, so H_0 was rejected and H_1 was accepted. So there was an average difference between the pretest and posttest of the geometric shape material. The normality analysis

of student gain with an average gain value of 0.48 was in the moderate category. Based on the series of test results, it can be said that *Deep Learning* assisted by Cabri 3D media is effective in learning geometric shape material.

Keywords: *Deep Learning*; Cabri 3D; Spatial Structure

INTRODUCTION

Mathematics is a subject that students must master to support the development of fundamental competencies, such as problem-solving, reasoning, conceptual understanding, and real-life applications. The process of learning mathematics encourages students to develop logical thinking skills, which play a crucial role in enhancing their mathematical conceptual understanding. Developing students' ability to understand concepts is vital, as it is frequently required in daily life (Sa'ida, 2021). A deep conceptual understanding allows students to explain a concept in their own words—rather than merely repeating textbook content—and to apply it flexibly and effectively in various situations (Giriansyah et al., 2023). This habituation aims to equip students to meet educational demands, especially amidst rapid technological advancements. The role of technology is essential in creating more effective, inclusive, and engaging learning experiences (Fathurrahman, 2024).

Based on these considerations, the ability to understand concepts is one of the essential competencies students must possess. However, in reality, the level of students' conceptual understanding remains relatively low. This is evidenced by data analysis from preliminary studies, which show that students' conceptual understanding falls into the 'fair' category, as the competency level remains below 50%.

According to the 2022 Programme for International Student Assessment (PISA) results, Indonesia ranked 69th out of 80 participating countries. This indicates that Indonesian students still face difficulties in solving mathematical problems, particularly regarding conceptual understanding. These difficulties are caused by several internal and external factors (Mardiana, 2023).

One branch of mathematics studied in elementary school is geometry. According to Nur'aini et al. (2017), geometry is a field of mathematics that studies points, lines, planes, and space, as well as their properties, measurements, and interrelationships. Safrina and Ahmad (2014) provide several reasons why geometry should be taught: (1) geometry is the only field of mathematics that connects mathematics with physical real-world shapes; (2) it allows mathematical ideas to be visualized; and (3) it provides non-singular examples of mathematical systems. However, in reality, students still face obstacles in learning geometry. Ertekin (2014) highlights that a problem in learning geometry is that representing three-dimensional objects on two-dimensional flat paper is incomplete, leading to optical illusions and differing perceptions, or making it impossible to view object configurations from different angles.

In education, most students deal with representations of three-dimensional structures on two-dimensional surfaces, such as on blackboards or paper. Consequently, the two-dimensional representation of three-dimensional images causes several problems in visualizing 3D structures (Ningsih, et al., 2024). Therefore, a solid conceptual understanding is required in learning geometric shapes. Concepts in mathematics are hierarchical, where the learning concepts of polyhedrons (flat-sided space figures) are interrelated. However, the mathematics learning process generally concentrates on procedural and mechanistic exercises rather than comprehension, which necessitates a strong grasp of the material (Baidowi et al., 2023).

According to Hendriana et al. (2017), mathematical conceptual understanding is a fundamental competency in learning mathematics. It includes the ability to absorb a theory, remember mathematical formulas and concepts, apply them in simple or similar cases, estimate the truth of a statement, and apply formulas and theorems in problem-solving. The ability to understand mathematical concepts is also the primary skill needed to achieve teaching and learning objectives systematically (Sridana, et al., 2022).

In reality, the conceptual understanding of fifth-grade students at SDN Karangsari 4 has not yet reached a high criterion, as seen from students who still make errors in understanding the concepts to be applied. Based on interviews with teachers, students' conceptual understanding is still low; students do not know which concept is appropriate to use in solving given problems. Furthermore, students experience difficulty in re-explaining the concepts they have learned. Teachers also added that when given different types of practice problems, students still struggle even though the underlying concept remains the same.

In addition, teachers have never implemented instructional media for the material on geometric shapes. According to Yustiqvar et al. (2019) and Ramdani et al. (2023), learning that utilizes media can increase students' interest and motivation in studying.

This is in line with Pendidikan J and Batubara (2018), who state that many secondary school students still experience difficulties and demonstrate poor ability in geometry. This reality is reflected in the low absorption rate of students, which is around 38.88%. Moreover, in the material of geometric shapes, students still encounter difficulties in studying and understanding geometric concepts. The ability to visualize surrounding objects in the form of geometric shapes and interpret them into two dimensions is highly required to understand geometry concepts. Awwalin and Barat (2021) also noted that most students are less capable of solving problems regarding the surface area and volume of polyhedrons. This occurs because students do not accurately understand what is being asked in the problems, they do not master the formulas for the surface area and volume of cuboids and prisms, and there is a lack of interest in working on the problems, leading to these difficulties (Lestari, et al., 2023).

Based on these issues, the presence of media holds significant importance because it can clarify complex material by serving as an intermediary. According to Tyaningsih et al. (2022), instructional media can be utilized as a tool capable of creating effective and efficient learning. Furthermore, the complexity of the material delivered to students can be simplified with the help of instructional media. As noted by Hikmah and Selvia (2019), instructional media can represent what a teacher may struggle to express through words or specific sentences. Similarly, Buchori (2010) argues that schools should implement technology in every educational activity—not merely as a mathematical calculation tool, but as instructional media that assists teachers in explaining concepts in the classroom. While not intended to replace the teacher's role, these technological applications can guide students through the development of mathematical topics. Numerous instructional media can be applied in mathematics learning, one of which is the Cabri 3D application.

Cabri 3D is the software that will be implemented and tested in this research. This software is used as an information and technology-based learning medium. Cabri 3D is a specialized mathematical computer program that can be used as instructional media for the material on geometric shapes. Geometric shapes (space figures) are the primary material discussed in this study. The forms within this material possess several characteristics or properties formed by various geometric structures. Students can directly identify these characteristics and practice them using the Cabri 3D software. Cabri 3D is a highly useful application for teaching and learning three-dimensional geometry. The dynamic nature of the digital diagrams produced provides useful assistance to help students develop geometric concepts. The Cabri 3D program can be used to help students and teachers overcome various difficulties and make learning 3D geometry easier and more engaging. Students are generally more interested in modeling objects or concrete examples. Therefore, it is expected that learning utilizes supportive instructional media, one of which is the Cabri 3D application (Akhirni & Mahmudi, 2015).

The use of the Cabri 3D application includes phased elements that make students more active, interested, and better able to develop their conceptual understanding. Teachers do not merely transfer knowledge to students but facilitate them in constructing their own knowledge so that they gain a deeper conceptual understanding of polyhedrons (Batubara, N., 2018).

Advances in science and increasingly sophisticated technological developments go hand in hand with changing times. These developments have a broad impact on various aspects of real life, particularly in the implementation of learning. Innovation in teaching methods is essential to prepare students for the complexities of the modern world. One compelling approach is the application of *Deep Learning* within the educational context.

The term '*Deep Learning*' is often associated with artificial intelligence technology, which is evolving rapidly. This approach allows students to understand learning more deeply

and comprehensively. This process involves integrating the latest information with students' existing knowledge. This cognitive process does not merely add new information but creates a complex and integrated network of understanding. Through this approach, students do not only learn but also become capable of thinking critically, creatively, and reflectively.

Given the importance of a learning process that supports deeper student abilities, such an approach is also required in mathematics education. One implementation of the Kurikulum Merdeka (Independent Curriculum) in mathematics learning is directing students toward critical and innovative thinking skills. This learning is linked to students' direct involvement with their learning environment. From this perspective, the newly implemented Kurikulum Merdeka is related to the *Deep Learning* approach, which serves as the current instructional plan. Both share the same goal: *Deep Learning* to enhance the critical thinking and innovation skills students will need in their future lives.

This *Deep Learning* approach can be integrated by creating learning experiences that are meaningful, mindful, and joyful. These three concepts are essential in supporting the success of in-depth learning and building a solid foundation for students within the educational context (Mahidra, 2024). Meaningful learning helps students connect new knowledge with their prior knowledge (Koskinen & Pitkäniemi, 2022). Mindful learning emphasizes how students can engage actively and consciously in the learning experience, thereby enhancing their understanding of the subject matter (Santi et al., 2024). Joyful learning highlights the importance of creating a learning environment that triggers happiness and intrinsic motivation; this enjoyable approach can significantly improve learning outcomes (Yabo, 2020).

Similarly, Hendriana (2019) revealed in their research that student worksheets (LKPD) based on Cabri 3D can improve student learning outcomes, particularly in the material of geometric shapes. As a reference and comparison for this study, it is necessary to present previous research related to this topic, specifically the study conducted by Evi Suharyanti, Theofelus Galih S., Margi Rahayu, and Kriswandani (2021) titled "Reforming Mathematics Through The Concept Of Cooperative Learning By Using The Technique Think-Pair-Share Focusing On Cube And Cuboid To Improve The Study Result And Activity Of Students From Banyubiru 1 State Middle School Class Of VIIIIE In Semarang District On Their Second Semester." The results of that study showed that learning using the think-pair-share (TPS) cooperative model produced better mathematics achievement and increased student activity in class VIIIIE of SMP Negeri 1 Banyubiru.

Based on the description above, the researcher intends to conduct a study titled "The Effectiveness of the *Deep Learning* Approach Assisted by Cabri 3D Media in Learning Geometric Shapes for Fifth-Grade Elementary Students." This research aims to determine the effectiveness of the *Deep Learning* approach assisted by Cabri 3D media on the conceptual understanding of geometric shapes among fifth-grade students at SDN Karang Sari 4.

METHOD

This research employs a quantitative methodology with a pre-experimental approach. The specific design used in this study is the one-group pretest-posttest design. The research will be conducted with fifth-grade students at SDN Karang Sari 4 during the odd semester of the 2025/2026 academic year. The instruments to be validated include the test questions (post-test), the Cabri 3D instructional media, and the *Deep Learning* teaching module.

The data collection technique used in this study is a student learning outcome test. Before the test questions are utilized for the research, a validity test is conducted, specifically using content validity. The data analysis techniques in this study consist of prerequisite tests and hypothesis testing. Prerequisite tests serve to ensure whether the data to be analyzed meet the requirements for further testing. In this case, the prerequisite tests include normality and homogeneity tests. The hypothesis test used in this research is the t-test for normally distributed data. The assessment criteria for the normalized gain (n-gain) are as follows:

Table 1: N-Gain Score Assessment Criteria

Nilai skor N-Gain Interpretasi	
$0,70 \leq g \leq 100$	Tinggi
$0,30 \leq g \leq 0,70$	Sedang
$0,00 < g < 0,30$	Rendah

RESULTS

Effectiveness is a measure of the successful implementation of the *Deep Learning* approach assisted by Cabri 3D media in determining student learning outcomes for the material on geometric shapes. The research subjects consist of 22 students in the fifth grade at SDN Karang Sari 4. The instrument used to test effectiveness is a multiple-choice test on geometric shapes, comprising 25 questions.

To test the effectiveness of the *Deep Learning* approach assisted by Cabri 3D media in improving student learning outcomes, analysis of variance (ANOVA) is utilized. Analyzing with ANOVA requires certain prerequisites to be met, including: 1) The data must originate from a population with a multivariate normal distribution, and 2) The variance-covariance matrices between populations must be equal (homogeneity). To satisfy these requirements, several assumption tests are conducted: 1) Normality Test, and 2) Test of Homogeneity of Variance-Covariance Matrices. The data used for these tests consist of the pre-test and post-test scores.

- a. The Normality Test

The normality test is used to determine whether both sets of data are normally distributed. The hypotheses for this test are as follows: H_0 : If the significance value (Sig.) is greater than 0.05, the data is considered normal. H_1 : If the significance value (Sig.) is less than 0.05, the data is considered not normal. The results of the normality test can be observed in the 'Sig.' column. If the Sig. value is greater than 0.05, the data is confirmed to be normal. The data utilized for this normality test are the pre-test and post-test scores for the material on geometric shapes. Based on the normality test results, the pre-test scores yielded a Sig. value of 0.165, indicating that the pre-test data is normal. Furthermore, the post-test scores yielded a Sig. value of 0.194, indicating that the post-test data is also normal. Consequently, both the pre-test and post-test scores are normally distributed. The analysis then proceeds to the homogeneity test.

Table 2: Normality Test Results"

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
<i>pretest</i>	.215	22	.009	.936	22	.165
<i>posttest</i>	.146	22	.200*	.940	22	.194
a. Lilliefors Significance Correction						
*. This is a lower bound of the true significance.						

b. Uji Homogenitas

The homogeneity test employed is the Levene's test, conducted using the SPSS 16 program to determine whether the sample data possess equal variances (homogeneous). The hypotheses for this test are as follows: H_0 : if the significance value (Sig.) is greater than 0.05, the variances of two or more groups of population data are considered equal (Homogeneous). The evidence for the homogeneity test results can be found in Appendix 18. H_1 : if the significance value (Sig.) is less than 0.05, the variances of two or more groups of population data are considered not equal (heterogeneous). The results of the homogeneity test can be observed in the 'Sig.' column. If the Sig. value is greater than 0.05, it is concluded that the variances of two or more groups of population data are equal (Homogeneous). The data utilized for the homogeneity test regarding the material on geometric shapes are the pre-test and post-test scores. Based on the homogeneity test results, a Sig. value of 0.926 was obtained, indicating that the students' pre-test and post-test scores are homogeneous. Consequently, the analysis proceeds to the hypothesis testing, specifically the Paired Sample T-test.

Table 3: Homogeneity Test Results

Test of Homogeneity of Variances			
nilai			

Levene Statistic	df1	df2	Sig.
.009	1	41	.926

c. Uji Paired Sampel T-Test

The Paired Sample T-test was conducted using the SPSS 16 program to determine whether there is a significant difference in the implementation of the *Deep Learning* approach assisted by Cabri 3D media on students' pre-test and post-test scores for geometric shapes. The hypotheses are as follows: H_0 : If the significance value (Sig.) is greater than 0.05, there is no significant difference between the average pre-test and post-test scores. H_1 : If the significance value (Sig.) is less than 0.05, there is a significant difference between the average pre-test and post-test scores. The results of the paired sample t-test for the students' scores can be observed in the 'paired samples test' table. Based on the output, the Sig. (2-tailed) value is 0.000, which is less than 0.05 ($0.000 < 0.05$). Consequently, H_0 is rejected and H_0 is accepted. This indicates that there is a significant difference between the average pre-test and post-test scores for the material on geometric shapes. The results of the paired sample t-test demonstrate a significant mean difference between the pre-test and post-test. Following this, the n-gain test was conducted to determine the magnitude of the improvement between the pre-test and post-test scores.

Table 4 Paired Sampel T Test Result

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	nilai- kelas	76.318	9.091	1.370	73.554	79.082	55.687	43	.000

d. N Gain

The effectiveness of the *Deep Learning* approach assisted by Cabri 3D media was analyzed using the n-gain test. The n-gain test is employed to calculate the magnitude of the improvement between the pre-test and post-test scores for the material on geometric shapes. This improvement can be observed from the students' n-gain acquisition according to the resulting table. The recapitulation of the n-gain test results for the pre-test and post-test scores on geometric shapes is presented in the table below.

Tabel 5 N-Gain Result

No.	Komponen	Hasil	
		Pretest	Posttest

1.	Jumlah peserta didik	22	22
2	Nilai rerata	71,5	85,1
3.	<i>Normalitas Gain</i>	0,48	
4.	Kategori	Sedang	

Based on the data, the normalized gain for the material on geometric shapes indicates that the learning outcomes of fifth-grade students at SDN Karang Sari 4 have improved, as evidenced by the acquisition of pre-test and post-test scores. The analysis of the students' normalized gain (n-gain) yielded an average score of 0.48, which falls into the 'Medium' category.

Based on the series of tests conducted, it can be concluded that the *Deep Learning* approach assisted by Cabri 3D media effectively improves student learning outcomes in geometric shapes. Therefore, it is established that the *Deep Learning* approach assisted by Cabri 3D media is effective in enhancing the learning outcomes of fifth-grade elementary students regarding the material on geometric shapes.

DISCUSSION

1. Alur Penelitian

"This study aims to determine the effectiveness of implementing the *Deep Learning* approach assisted by Cabri 3D media in teaching geometric shapes to fifth-grade students at SDN Karang Sari 4. The research was conducted over four sessions, consisting of one session for the pre-test, two sessions for the learning intervention using the *Deep Learning* approach assisted by Cabri 3D media, and one session for the post-test. Based on observations during the learning process in the first intervention session, the material discussed was 'Identifying the Properties of Geometric Shapes.'

The learning activity flow utilizes the *Deep Learning* approach, which consists of three phases in the core activities: understand, apply, and reflect. In the first session, the preliminary activities incorporated two main principles of the *Deep Learning* approach, meaningful and mindful which included: the teacher opening the lesson with a prayer led by a student, followed by an attendance check. The next activity involved introducing geometric shapes using Cabri 3D media. The teacher displayed various types of geometric shapes to the students. During this activity, students identified the shapes shown via the projector using the Cabri 3D media. The students were highly enthusiastic as they could directly visualize the geometric images. This activity encouraged students to be active in expressing their opinions.

The following activity involved several provocative questions (triggering questions) posed by the teacher, such as: 'What are the properties of geometric shapes?' This question encouraged students to reason critically about the characteristics of geometric figures. After the questions were posed, students responded with diverse opinions. Subsequently, the teacher connected the material to be studied with the previously conducted apperception activities. The teacher also communicated the learning objectives to be achieved by the students. The core activities followed the three phases

of the *Deep Learning* approach (understand, apply, and reflect) by implementing three principles: joyful learning, mindful learning, and meaningful learning.

In the understand phase, the teacher explained the material on geometric shapes using Cabri 3D media. The teacher provided an example of a cube within the Cabri 3D software and invited students to analyze its properties. During the explanation, the teacher also provided concrete examples of cubes found within the school environment. Following the explanation, the teacher conducted interactive quizzes regarding the material taught. The objective of this phase is to build conceptual understanding and arouse students' interest in the subject matter. In the Apply phase, the teacher divided the students into four groups. In this activity, students engaged in discussions to complete the assigned task: analyzing the properties of geometric shapes on the student worksheets (LKPD). This phase is designed to train students in integrating theoretical knowledge with practical application while enhancing their critical reasoning and collaborative skills.

Next is the Reflect phase. In this phase, each group presented their work in front of the class under the teacher's guidance. Following the presentations, the teacher facilitated a Q&A session between groups. Afterward, the teacher and students together formulated conclusions based on the group presentations. In this phase, students shared their experiences and the new understandings they gained during the learning process while working on the provided worksheets. This reflection also aims to internalize the learning so that students can connect concepts with daily life and develop a sustained awareness of learning. In the closing activity, the teacher and students summarized the day's lesson on the 'properties of geometric shapes.' The teacher then expressed appreciation to the students for their participation in the lesson and concluded the session with a prayer and a closing greeting.

The second session focused on the topic of 'Determining the Volume of Geometric Shapes.' The learning flow utilized the *Deep Learning* approach, consisting of the three core phases: understand, apply, and reflect, while implementing the three principles of joyful, mindful, and meaningful learning. In the preliminary activities, the teacher applied the mindful and meaningful principles. The session began with a prayer led by a student, followed by an attendance check. The teacher then provided a stimulus in the form of triggering questions or real-world problem situations related to the formulas of geometric shapes found in daily life. An example of such a statement was: 'what is the volume of water in a bathtub? are you able to calculate it?' after posing these questions, students responded with a wide range of opinions. Subsequently, the teacher connected the day's topic with the previous material and communicated the learning objectives to be achieved.

The core activity followed the three phases of the *Deep Learning* approach (Understand, Apply, and Reflect). In the understand phase, the teacher presented the material on 'Determining The Formulas For Geometric Shapes' using Cabri 3D media. Through Cabri 3D, students were presented with clear, visual representations of the geometric shapes. In the Apply phase, students were divided into four groups and provided with student worksheets (LKPD) regarding the calculation of volume. The students then worked collaboratively to complete the worksheets. In the reflect phase,

each group presented their work in front of the class under the teacher's guidance. Following the presentations, the teacher and students collectively drew conclusions, and students performed a self-evaluation regarding their achievement of the learning objectives. In this phase, students shared their experiences and the new insights gained while working on the worksheets.

This reflection aimed to internalize the learning, enabling students to connect concepts with daily life and develop a sustained awareness of learning. In the closing activity, which incorporated the Meaningful and Mindful principles, the teacher and students summarized the lesson on 'determining the formulas for geometric shapes.' Finally, the teacher expressed appreciation for the students' participation and concluded the lesson with a prayer and a closing greeting.

2. Discussion on the Effectiveness of *Deep Learning* Assisted by Cabri 3D Media in Teaching Geometric Shapes to Fifth-Grade Elementary Students

The analysis results of this study describe the effectiveness of the *Deep Learning* approach assisted by Cabri 3D media. One of the primary impacts of implementing *Deep Learning* in education is the improvement of conceptual understanding and long-term retention. According to Otto et al. (2020), *Deep Learning*-based instruction enables students to integrate various sources of information and deepen their understanding of the material being studied. This learning model emphasizes exploration and reflection, ensuring that students do not merely memorize information but also understand the fundamental principles underlying a concept. This approach is also in line with Constructivism theory (Vygotsky, 1978), which emphasizes that effective learning occurs when students actively build their own understanding through social interaction and independent exploration. With its analytical capabilities, *Deep Learning* allows the educational system to identify students' areas of weakness and adapt materials accordingly, thereby increasing the effectiveness of individualized learning.

Deep Learning not only enhances conceptual understanding but also assists students in developing critical thinking and problem-solving skills. M. Elbashbishy (2024) and Ru (2024) demonstrate that this learning model encourages students to think more analytically, connect concepts across various disciplines, and seek solutions to complex problems. This approach aligns with Bloom's Taxonomy (Bloom & Krathwohl, 1956), where higher-order thinking levels—such as analysis, synthesis, and evaluation—become the primary goals of learning. *Deep Learning* helps students reach these levels of understanding by providing problem-based scenarios that require systematic resolution. Consequently, students become more practiced in identifying patterns, analyzing relationships between concepts, and making decisions based on available data.

Furthermore, the enhancement of collaboration and social interaction in *Deep Learning* also contributes to increased social interaction and student collaboration within the learning environment. Mystakidis (2021) highlights that this approach encourages students to work in groups, share insights, and discuss various perspectives to solve a problem. In AI-supported virtual environments, students can learn collaboratively through interactive simulations and team-based projects. This is consistent with Bandura's Social Learning theory (McLeod, 2016), which states that learning occurs through observation and social interaction. *Deep Learning* creates an environment that

allows students to learn from one another, share strategies, and improve communication and teamwork skills. Thus, this approach not only improves academic outcomes but also develops the soft skills essential for success in the professional world.

Furthermore, the implementation of the *Deep Learning* approach is rendered more effective when presented with the assistance of Cabri 3D media. This is consistent with the findings of Tama (2020), where the average post-test scores of the experimental class were higher than those of the control class, and $t_{hitung} > t_{tabel}$ leading to the rejection of H_0 . Based on these results, students in the experimental and control classes demonstrated different levels of conceptual understanding, as each student possesses a distinct mindset in processing information and often faces difficulties when presented with varied problem sets. In this study, the post-test results for the material on geometric shapes indicated that the scores were significantly higher than the pre-test results. This aligns with the research by Purba et al. (2023), which concluded that the mathematical conceptual understanding of students learning with Cabri 3D media is superior to those learning through conventional methods. These results are further supported by Hikmah et al. (2019), whose study showed that the improvement in mathematical representation skills among students using Cabri 3D software outperformed those in traditional learning environments. This is also reinforced by Hendriana (2019), who concluded that the developed student worksheets (LKPD) could enhance students' mathematical conceptual understanding, particularly in geometry. Cabri 3D-based worksheets also facilitate easier use of the software for students, making the learning process more effective and efficient.

CONCLUSION

Based on the results of the data analysis and discussion, the researcher found that there is a significant difference in the average mathematics learning outcomes of fifth-grade students at SDN Karang Sari 4 for the 2025/2026 academic year after being taught using the *Deep Learning* approach assisted by Cabri 3D media. Thus, these findings demonstrate that the implementation of *Deep Learning* assisted by Cabri 3D media is effective in enhancing the conceptual understanding of geometric shapes among fifth-grade students at SDN Karang Sari 4 for the 2025/2026 academic year.

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