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The Effectiveness of the Discovery Learning Model Assisted by Cermat Multimedia on Cartesian Coordinate Material

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ABSTRACT

This descriptive research aims to evaluate the effectiveness of the Discovery Learning model assisted by Cermat multimedia in teaching the topic of Cartesian coordinates at SMP Negeri 11 Gorontalo. The study examines three key aspects: (1) the teacher's proficiency in managing the learning process, (2) students' positive responses to the learning approach, and (3) students' learning outcomes. The findings indicate that the Discovery Learning model supported by Cermat multimedia is highly effective. This conclusion is supported by the teacher's performance in managing the learning process, categorized as excellent, students' consistently positive responses throughout the learning activities, and the attainment of an 80% mastery level in learning outcomes on a class-wide basis.

Keywords: Discovery learning, Multimedia, Cartesian Coordinate

1. Introduction

Mathematics teaches how to solve problems systematically and improves abstract thinking abilities. Through mathematics, students learn how to analyze situations,

understand patterns, and make data-based decisions—skills that are especially useful in a modern world increasingly dependent on technology and data. Mathematics learning is defined as a process that involves developing students' understanding, skills, and logical thinking patterns related to mathematical concepts. During this process, students study topics such as numbers, shapes, patterns, and relationships between mathematical elements with the goal of strengthening problem-solving and critical thinking abilities. One learning model that has received considerable attention is discovery learning. This model emphasizes students' active roles in understanding concepts through exploration, investigation, and problem-solving.

Despite the potential benefits, mathematics is often considered a challenging subject, leading to fear and disinterest among students. This poses a significant challenge for teachers, who must find ways to make the learning process more enjoyable and engaging, thereby reducing students' apprehension and fostering a genuine interest in mathematics [1]. Mathematics, as a field of study, evolves continuously to meet technological and societal needs. Consequently, it is a core subject at all educational levels in Indonesia, from primary to senior secondary education, aiming to equip students with high-order thinking skills. However, achieving these objectives often encounters obstacles, such as misconceptions in mathematical concepts and ineffective teaching methods. These challenges underline the importance of innovative teaching strategies that enhance students' conceptual understanding and problem-solving abilities [2].

The rapid development of interactive multimedia technology offers new opportunities for improving the learning process. Interactive multimedia integrates elements such as text, images, audio, video, and interactive features like simulations and animations. When incorporated into mathematics education, these tools can provide engaging, visual, and concrete learning experiences that enhance students' conceptual understanding and information retention. For instance, technology-based media designed to visualize abstract mathematical objects can help students better grasp complex concepts, making the learning process more effective [3].

The evolution of learning models highlights the importance of creativity in education, particularly among the millennial generation. Interactive learning media support teachers in creating dynamic and technology-enhanced classroom environments. Among these, the discovery learning model, especially when paired with interactive multimedia, emerges as a promising approach. Discovery learning is designed to enable students to uncover concepts and principles through processes such as comprehension, problem-solving, engagement, self-regulation, real-world application, and collaboration. These characteristics contribute to a more effective and enjoyable learning experience, particularly in mathematics [4].

Discovery learning has notable benefits in fostering reasoning and independent thinking. It trains students' cognitive skills, enabling them to identify and solve problems without external assistance. This approach aligns closely with mathematics education, aiming to transform how students perceive and engage with the subject [5]. By combining discovery learning with interactive multimedia, educators can create more engaging, interactive, and immersive learning experiences, helping students build a solid understanding of concepts and essential cognitive skills needed in an ever-

changing world. Furthermore, a well-designed learning process can motivate students, direct their attention, provide constructive feedback, and ultimately improve learning outcomes. Effective teaching—characterized by careful preparation, material mastery, class management, and evaluation—plays a crucial role in this process [6].

The effectiveness of a learning model is determined by how well time, conditions, and preparation are utilized to deliver material and organize school-based learning activities [7]. This effectiveness can be evaluated based on the teacher's teaching practices, such as preparation, material mastery, classroom management, and evaluation, as well as student behaviors, including readiness and engagement during learning activities [8]. At SMP Negeri 11 Gorontalo, mathematics teachers have reported that traditional teaching methods, such as lectures and group discussions using books and teaching aids, have become monotonous. These conventional methods have led to a lack of student interest, resulting in low comprehension of the material, boredom, and inattention during lessons [9].

Given these challenges, this research aims to evaluate the effectiveness of the Discovery Learning Model assisted by Cermat multimedia in teaching Cartesian coordinate material at SMP Negeri 11 Gorontalo.

2. Method

This research employed a descriptive methodology to evaluate the effectiveness of the Discovery Learning model assisted by Cermat multimedia on Cartesian Coordinate material. The subjects of this study were 25 eighth-grade students at SMP Negeri 11 Gorontalo during the odd semester of the 2023–2024 academic year. The objective was to assess students' understanding and responses to the implemented learning model.

Data collection was conducted through three primary techniques: observation, student response questionnaires, and learning outcomes tests. Observations were carried out twice: the first to identify issues in the learning process and the second to evaluate the implementation of the Discovery Learning model. An observation sheet was used to assess the teacher's ability to manage learning based on the Lesson Plan (RPP).

The student response questionnaire aimed to measure students' understanding and enjoyment of the Cartesian Coordinate material. The questionnaire consisted of structured statements, where students responded by selecting the appropriate option. The learning outcomes test was in essay form, designed to assess students' comprehension of the material.

Data analysis included validity and reliability testing, evaluation of the teacher's ability to manage learning, analysis of student responses, and analysis of learning outcomes. The validity of test items was determined using the product-moment correlation formula. The reliability of the instrument was calculated using a reliability formula, yielding a coefficient of 0,91, which indicates a very high level of reliability.

The teacher's ability to manage learning was evaluated based on the average observation score, categorized using specific criteria. This ability was considered effective if it reached at least the "Good Enough" category. Student responses were analyzed as percentages, with learning deemed effective if at least 75% of students provided positive

responses. Learning outcomes data were analyzed using descriptive statistics, including the mean, median, mode, and standard deviation. Classical completeness was achieved if at least 70% of students scored 75 or higher, meeting the minimum mastery criteria (KKM) set by the school.

Overall, the learning model was considered effective if the teacher's management ability reached the "Good Enough" category, at least 75% of students provided positive responses, and at least 70% of students achieved a score of 75 or higher.

3. RESULTS AND DISCUSSION

3.1 Teacher's ability to manage learning

The observation of teacher abilities was carried out by one observer, namely the researcher who conducted this research. In this observation there were 23 aspects observed. This was done to find out the effectiveness of the application of the Discovery learning learning model with the help of interactive learning media. Observations were carried out three times according to the number of meetings stated in the RPP.

Based on the average from each meeting, every aspect observed shows a good or very good category. Of the 23 aspects observed, 19 aspects showed the good category and 4 aspects were in the quite good category.

The average of each aspect observed always shows a number greater than 2.80. Referring to the criteria for teacher ability to manage learning, an average score greater than 2.80 shows that the teacher's ability to manage learning is categorized as Fair or Good. Thus, the teacher's ability to manage learning using the discovery learning model with the help of interactive multimedia learning has reached the effective category.

Based on the results of other research, there are supporting factors consisting of active classroom management, teacher competence, interesting learning methods, as well as assessment and feedback [10]. These elements work together to create an environment where students can thrive in their mathematics education [11].

3.2 Positive Student Response

Positive student response questionnaires were given to 25 students who were subjects in the research. This questionnaire contains 16 questions that represent four aspects of assessing students' positive responses.

Based on the student's positive response questionnaire, it can be seen that on average students show positive attitudes towards the material, the learning model used and the presentation of the material with the learning media used. This can be seen from the large percentage obtained. The students' positive response to the learning material was 89.2%, the students' positive response to the learning model used was 87.67% and the students' positive response to the presentation of the material using interactive learning media was 89.6%, with an overall average student response of each indicator observed was 88.82% [12]. The results obtained are in line with other research, where positive responses to assessments in mathematics learning lead to improved academic

performance, increased engagement, development of good study habits, a supportive learning environment, and long-term benefits for students [13].

Based on the table of criteria for positive student responses where if each aspect of the assessment reaches 70% then the student's positive response is said to be effective. By looking at the results of students' positive responses which reached more than 85%, the students' positive responses were categorized as very positive or effective [14].

Student responses can also be seen during the learning process where the enthusiasm and passion of students in following the learning sequence from the beginning to the end of learning is very great. Even though the lesson time is at the end of school hours, students' enthusiasm is still felt when they are asked questions, they are able to solve and solve existing problems [15]. Apart from that, positive student responses can also be seen from the activeness of students who are willing to ask questions when experiencing difficulties, continue to answer questions given by the teacher and remain focused while learning is in progress.

3.3 Student Learning Results Test

A student learning outcomes test is given at the end of the lesson with 9 questions in the form of essays on Cartesian coordinates material. Based on tests on student learning outcomes in class VIII mathematics by applying the discovery learning model with the help of interactive learning media on Cartesian coordinate material, it is said to be effective. This can be seen from the test scores on students' learning outcomes which have an average score of 77. Referring to the minimum completeness standard of 70, out of 25 students there are 80% or 20 students who have met the completeness criteria. And 20% or 5 students have not met the completeness criteria [16].

This shows that mathematics learning by applying interactive learning models and multimedia-assisted interactive learning can be categorized as effective with a completion rate reaching 80%. Through the achievements that have been obtained, we can conclude that students have understood the material on Cartesian coordinates very well [17]. During the learning process, students are also more active in finding solutions to problems given by the teacher. Apart from that, the use of supporting learning multimedia also makes students more enthusiastic and less likely to get bored during the learning process [6].

In the group work process, some students seemed to prefer asking questions to students who they considered to have superior abilities, thereby creating more active communication between students. When students have problems that they cannot solve, this is where the teacher's role is to direct students so that students can more easily understand and remember concepts well [18].

The results obtained are in line with the results of other research that, in the first cycle, 73.08% of students scored above the minimum completeness criteria. This shows that slightly more than 73% of students demonstrated adequate understanding of the material and this percentage increased to 81.88%. This shows that at the end of the second cycle, almost 82% of students were able to meet or exceed the minimum criteria. Thus, the increase from 73.08% to 81.88% represents an increase of 8.8% in the proportion

of students achieving a satisfactory score [19]. This increase reflects the effectiveness of the discovery learning model in increasing students' understanding of mathematical concepts related to relationships and functions [20].

By looking at the three indicators of the effectiveness of implementing the discovery learning model with the help of interactive multimedia, we can conclude in Table 1.

Table 1. Three indicators of effectiveness in learning

Indicator	Achievement	Category
Student learning outcomes	80% of students have reached the completion criteria.	Effective
Student Response	Positive student responses from every aspect of the assessment reached more than 85% or were said to be very positive	Effective
Teacher's ability to manage learning	Of the 25 aspects observed, 19 aspects reached the very good category and 4 aspects reached the quite good category.	Effective

4. CONCLUSION

Based on the research conducted with Class VIII students at SMP Negeri 11 Gorontalo, it can be concluded that the implementation of the discovery learning model, supported by interactive multimedia, is effective in teaching Cartesian coordinate material. This is evidenced by three key indicators: the teacher's ability to manage the learning process, which was rated as good to very good; a classical learning completeness of 80% of students; and positive student responses exceeding 85%, indicating a strong student engagement. However, a limitation of this study was the assessment of student learning outcomes, as some students faced challenges that could not be fully addressed. Nevertheless, this research highlights that the use of appropriate teaching models and learning tools can significantly enhance students' academic performance.

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