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Application Hots-Based Discovery Learning Model to Improve Student Learning Outcomes

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ABSTRACT

Students' Higher Order Thinking Skills (HOTS), as seen from their learning outcomes, still need to be more optimal. This study aimed to describe applying the HOTS-based Discovery Learning model to improve student learning outcomes in curved-side geometric shapes. This research is a type of classroom action research. The subjects in this study were 9F class students at one of the public schools in Semarang. Data collection techniques are through written tests, while descriptive analysis is used. This research was conducted in 2 cycles. In cycle I, the level of completeness of students reached 57.14%, and in cycle II, the completeness reached 82.85%. The difference in mastery learning outcomes is 25.71%. From these results, using HOTS-based discovery learning is likely to improve the completeness of student learning outcomes in mathematics subject matter of curved side shapes.

Keywords: *Discovery Learning, Higher Order Thinking Skill (HOTS), Learning Outcomes*

ABSTRAK

Higher Order Thinking Skill (HOTS) siswa yang dilihat dari hasil belajarnya masih belum optimal. Tujuan Penelitian ini untuk mendeskripsikan penerapan model pembelajaran *Discovery Learning* berbasis HOTS untuk meningkatkan hasil belajar siswa pada materi bangun ruang sisi lengkung. Penelitian ini merupakan penelitian dengan jenis penelitian tindakan kelas. Subjek pada penelitian ini adalah siswa kelas 9F pada salah satu sekolah negeri di Kota Semarang. Teknik pengumpulan data melalui tes tertulis, sedangkan analisis ada yang digunakan adalah analisis deskriptif. Penelitian ini dilakukan dengan 2 siklus, pada siklus I tingkat ketuntasan siswa mencapai 57.14 % dan pada siklus II ketuntasan sudah mencapai 82.85 %. Selisih ketuntasan hasil belajar sebesar 25.71%. Dari hasil tersebut dapat dikatakan bahwa penggunaan *discovery learning* berbasis HOTS mampu meningkatkan ketuntasan hasil belajar siswa pada mata pelajaran matematika materi bangun ruang sisi lengkung.

Kata Kunci: *Discovery Learning, Higher Order Thinking Skill (HOTS), Hasil Belajar*.

INTRODUCTION

All educational processes lie in the curriculum and will never be separated, in which some components are interrelated and support one another. The curriculum occupies the leading position in all kinds of educational activities so that education goals can be created. The curriculum must improve its quality, adapt to each school's situation well and pay attention to students' needs and

developmental stages (Hidayani, 2018; Saifullah & Darwis, 2020). Each curriculum has different educational goals; some curricula focus on developing practical skills, academic success, creativity, character building, or preparing for international careers (Setiana et al., 2020). One of the challenges in achieving educational goals is producing human resources who have complete competence, namely producing graduates who are competitive, innovative, creative, collaborative, and with character (Wijaya et al., 2016; Nurdyansyah et al., 2018; Sudirman, 2020).

Learning in the context of the 2013 curriculum is an orientation to learning in the 21st century. Environmental education in the 21st century has shifted the focus from teacher-centered instruction to student-centered learning across different educational levels (Sharif & Cho, 2015; Quieng, Lim, & Lucas, 2015). The expectations for student competency in 21st-century learning have undergone a significant transformation. In the past, students were primarily required to memorize and comprehend concepts, often without any real-world context relevant to their classroom studies. However, in modern times, the focus has shifted toward developing students' abilities to analyze and solve environmental problems in their immediate surroundings rather than just memorizing information in isolation (Saputri et al., 2018; Chalkiadaki, 2018).

Since 2014, until now Indonesia has begun to use the 2013 curriculum. Even though an independent curriculum has already started to be implemented at several class levels in the education unit, the implementation of learning must still be improved both in the process and in the results. In the 2013 curriculum, students are expected to be able to learn actively and think critically and creatively. Still, schools have not fully implemented a learning model that invites students to be active and think critically and creatively. Students are expected not only to have lower-order thinking skills or Lower Order Thinking Skills (LOTS) but should also be trained to have higher-order thinking skills or Higher Order Thinking Skills (HOTS). In general, all levels of education require students to have higher-order thinking skills (HOTS) as an essential value (Heong et al., 2012; Copley, 2013; Lile & Bran, 2014; Baris, 2015; Saltan & Divarci, 2017). According to Anderson & Kratwhwol (2001), indicators for measuring Higher Order Thinking Skills (HOTS) include analyzing (analyzing-C4), evaluating (evaluating-C5), and creating (creating-C6). Level creation (C6) on HOTS is considered the highest ability important for students in the 21st century (Chalkiadaki, 2018; Saputri et al., 2018; Talmi, Hazzan & Katz, 2018).

Based on the results of observations with one of the mathematics subject teachers on October 26, 2022, at a public school in the city of Semarang, several students were still experiencing difficulties in understanding and solving problems that were included in the HOTS category questions, so that many student learning outcomes were still below the limit of completeness. Therefore, learning can be said to be not optimal. One effort that can be used to overcome these problems is by applying the HOTS-based Discovery Learning learning model. A learning model that trains students to make observations, experiments, or scientific actions so that students can construct their knowledge is discovery learning (Kristin, 2016; Fajri, 2019; Ana, 2019). This opinion is also reinforced by Yuliani (2021) & Muliawarni (2022), who state that with discovery learning through HOTs skills, students can discover concepts from their learning and train critical, logical, innovative, active, and creative thinking. Students equipped with essential skills thinking possess the

ability to provide logical reasoning when faced with complex decision-making scenarios and are capable of comprehending the interrelationships between various systems (Husamah, Fatmawati, & Setyawan, 2018; Mukminah, 2019; Nurjanah, 2019). Therefore, these skills need to be accustomed to being trained in learning in schools so that they become provisions for students to face the future through interaction between teachers and students (Mahanal, Zubaidah, Bahri, & Dinnuriya, 2016; Nasution, 2017).

Another relevant research result belongs to Putri (2019), which states that applying the discovery learning model can improve the high-level thinking skills of fourth-grade students at SD Negeri 8 Katon. Students build their knowledge and find existing problems themselves, and students actively carry out activities, develop concepts and give meaning to the things that have been learned. The results of Meylani's research (2021) also show that applying the HOTS-based discovery learning model significantly increases learning outcomes, namely a t count of 8.36 in class IV SDN 171. He says that students are more interested and active in participating in every activity in the activity and learning, thus triggering increased cognitive abilities or student learning outcomes. Likewise, the results of research conducted by Kurniawan (2020) show that the use of the HOTS-based discovery learning model in curved side geometric shapes has succeeded in increasing student learning outcomes in class IX-C SMPN 1 Singaparna, Tasikmalaya Regency. HOTS-based discovery learning facilitates students to discover new concepts through their own experiences, in solving complex problems or projects, by utilizing the knowledge and skills they have learned before.

To determine whether there is an increase in student learning outcomes on curved side geometric shapes, it is necessary to conduct classroom action research to improve the quality of learning in the school. So the purpose of this classroom action research is to determine how to increase student learning outcomes in material curved side shapes by applying HOTS-based discovery learning. Learning outcomes that will be improved are students' ability to think critically and creatively and analyze and synthesize information and solve complex problems. This classroom action research can improve students' adaptability in facing new challenges in the future. In addition, this research can improve teachers' skills in implementing and carrying out the learning process. It can increase the variety of learning for teachers to enhance the quality of mathematics learning and school quality.

METHOD

The research methodology used in this study is a classroom action research design. Susilo (2022) described that classroom action research is a systematic and cyclical investigative process conducted by teachers or prospective teachers to improve various aspects of teaching and learning, such as systems, processes, competencies, and learning situations. It is a controlled and self-reflective approach that focuses on improving based on the data collected during the research process. This study consisted of two cycles, each of which consisted of 4 stages, namely (1) planning, which is the first stage in classroom action research, the process of which begins with preparing a learning plan by the findings of the problem and initial ideas from observations, the activities consist of compiling a syllabus, learning plans, student activity sheets, media, observation

sheets, (2) implementation, at this stage the teacher carries out learning using the HOTS-different from the model (3) observation, this stage is carried out during the learning process, namely observing the activities of students and teachers including the attitudes and activities of students and teachers during the learning process, besides that at the end of this cycle tests are carried out to find out student learning outcomes, (4) reflection, this stage is carried out to find out the weaknesses and strengths when learning takes place. If the results are obtained per the indicators of success, then it will be continued in the second cycle until the indicators of success are achieved. The relationship between the four stages can be seen as a cycle described in Figure 1.

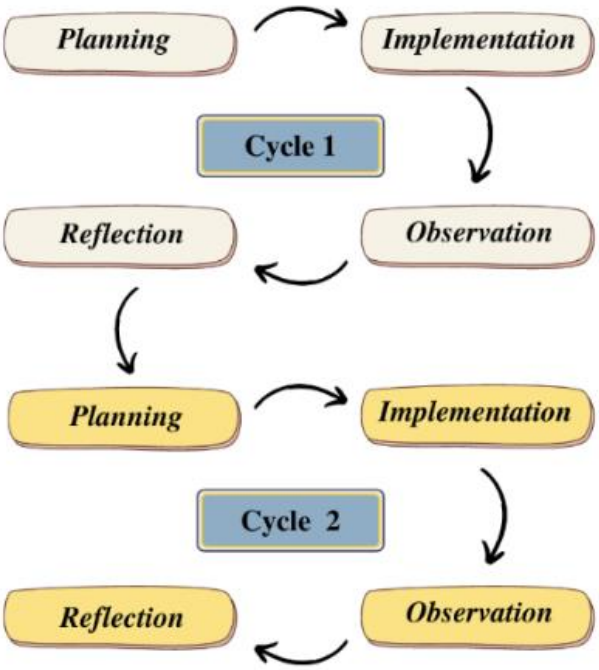

Figure 1. Class Action Research Cycle

The research subjects in this study were all class IX F SMP N 21 Semarang students, with the problem variable being to improve student learning outcomes in curved side geometrical material. In contrast, the action variable applied the HOTS-based discovery learning model. Data was obtained from students in the form of values accepted, results of behavioral observations, observations of teacher and student activities, and results of diary notes. The data obtained from the teacher were in the form of teacher observations and the results of the teacher's diary notes. Data were obtained from colleagues in the form of student observations and teacher observations. From the three data sources, the results were analyzed and then concluded.

Data collection techniques include tests and notes. The test scoring criteria consists of a scale of 0-4, namely: a scale of 0 if the student does not answer the questions at all. On a scale of 1, if the student cannot analyze, evaluate, or create what the student writes does not make sense and leads to an incorrect answer. Scale 2: If students can analyze, evaluate, or develop what students write that doesn't make sense and leads to wrong answers. Scale 3, if students can explore, evaluate or create what students write, makes sense, but resolutioners need to be more fitting. Scale

4, if students can analyze, evaluate or create what students write makes sense with correct and appropriate answers. The following formula obtains value:

$$\mathrm{V} = \frac{\text{number of scale scores}}{\text{total score}} \times 100.$$

The data analysis technique used descriptive analysis by determining the mean, median, mode, lowest score, highest score, classical completeness, and individual skill. Calculation of the success rate of student learning after the learning process takes place in each cycle includes (a) class average, using the formula written by Sugiyono (2012), namely:

$$\bar{\mathrm{x}} = \frac{\text{the total value}}{\text{many students}}.$$

(b) the mean value, (c) the mode to find out the value that often appears, (d) the percentage of classical completeness using the formula proposed by Aqib (2016), namely:

$$\mathrm{P} = \frac{completed\ students}{\text{many students}}.$$

Classical completeness criteria if more than 75% of students get scores more than or equal to minimum completeness criteria (MCC), namely 80, while individual completeness is if students get scores more than or similar to 80. The indicator of success in this study is that the knowledge aspect experiences classical fullness of more than or equal to 75%.

RESULT AND DISCUSSION

Classroom Action Research (CAR) intends to improve the learning process, which has implications for improving student learning outcomes. Before holding CAR in class IX F at a public school in the city of Semarang, researchers made observations first on October 26, 2022, and October 27, 2022, to find out the condition of students in the learning process, see how the teacher conveys learning material, and see the teacher's assessment to see success in teaching, by observing the results obtained that the learning process has not provided the direct experience to students.

Learning activities carried out are dominated by providing theoretical material and limited media in the learning process so that students become busy, pay less attention to material, are passive, and are less interested in learning mathematics, so that students do not achieve the minimum completeness criterion of more than or equal to 80 and the classical criterion completeness of more than 75% cannot be achieved.

Process of Cycle 1

The researcher prepared an action plan to improve student learning outcomes on curved-side geometrical material using the HOTS-based discovery learning model in the Planning Stage. The planning steps are (1) determining the problems obtained through observation, (2) designing the HOTS-based discovery learning model learning process that is appropriate to the material to be taught, and (3) preparing lesson plans, student worksheets, assessment rubrics, and evaluation

tools. Before learning is implemented, the researcher consults with colleagues about the learning device.

At the implementation stage, cycle I was carried out in two meetings with a time allocation of 5 hours of lessons (5 x 40 minutes). The first meeting was held on Wednesday, 2 November 2022, at the 9th and 10th hours at 14.00 – 15.10, while the second meeting was held on Thursday, 3 November 2022, at the 8th to 10th hour at 13.10 – 15.10. Documentation of cycle one implementation can be seen in the following Figure 2.

Figure 2. Documentation of cycle one implementation

The observation stage was carried out by colleagues using observation sheets and carried out during the implementation of learning. The observation sheet found that the teacher had carried out the teaching coherently and involved students in applying the HOTS-based discovery learning model. However, there is still a lot of confusion in data collection and processing of student data, so many students ask questions that the knowledge discovery process is not maximized.

At the reflection stage of the cycle I, there was several inputs from colleagues regarding the division of groups that should not be homogeneous but could be made heterogeneous. If this is still done, it will make students with low abilities embarrassed and afraid to express their opinions. When the division of groups takes a long time, learning is not optimal. At the second meeting, several concepts in the LKPD were wrong, giving rise to misconceptions. Therefore, during the learning process, students do not understand the material taught by the teacher. The teacher must be able to convey the material thoroughly and control and master the class so that students can focus on learning.

The results of learning in cycle one after applying the HOTS-based discovery learning model are shown in the Table 1.

Table 1. Data on Student Learning Outcomes Cycle 1

No	Achievement	Cycle 1 Results
1	Average Value	74,82
2	Frequently occurring values	81,25
3	Lowest value	50
4	The highest score	87,5
5	Unfinished students	15
6	Completed students	20
7	Percentage of learning incompleteness	42,86%
8	Percentage of learning completeness	57,14%

Based on the results of the table, student learning outcomes in the subject of curved side chambers cycle 1, there are still many students who have not reached the MCC. The MCC that students must achieve is 80. Out of 35 students, only 20 students have completed it, while 15 have not. The percentage of completeness achieved was 57.14%. The class average has not yet reached the MCC, which is still 74.47. The lowest score obtained by students in the action cycle was 50, while the highest score in action cycle 1 was 87.75. Based on these learning outcomes, learning has not been carried out optimally. There are still many students who only master facts or information. In addition, students also have not been able to apply it critically and creatively in different situations. Thus, there is a need for improvement in the second cycle, so it is hoped that student learning outcomes can improve the ability to analyze and synthesize information and solve complex problems.

Process of Cycle 2

The researcher prepared an action plan to improve student learning outcomes on curved-side geometrical material using the HOTS-based discovery learning model in the Planning Stage. The planning steps are (1) determining the problems from the reflection results of cycle 1 to provide solutions using the HOTS-based discovery learning model, (2) designing the learning process of HOTS-based discovery learning models that are appropriate to the material to be taught, (3) compile learning implementation plans, student worksheets, assessment rubrics, and evaluation tools. Before learning is carried out, the researcher consults with colleagues about the learning tools.

At the implementation stage, cycle two is carried out in two meetings with a time allocation of 5 hours of lessons (5 x 40 minutes). The first meeting was held on Wednesday, 9 November 2022, at the 9th and 10th hours at 14.00 – 15.10, while the second meeting was held on Thursday, 10 November 2022, at the 8th to 10th hours at 13.10 – 15.10. Documentation of cycle two implementation can be seen in Figure 3.

Figure 3. Documentation of cycle two implementation

The observation stage was carried out by colleagues using observation sheets and carried out during the implementation of learning. The observation sheet found that the teacher had carried out the teaching coherently and involved students in applying the *HOTS-based discovery learning model*.

At the reflection stage of cycle 2, improvements have been made from the reflection results in cycle 1. Learning can be said to be excellent and conducive according to the expectations of the

researchers at the 1st meeting and 2nd meeting. The implementation of learning is carried out following the syntaxes of the discovery learning model so that there is an increase in student learning outcomes

The results of learning in cycle two after applying the HOTS-based discovery learning model are shown in the following Table 2.

Table 2. Data on Student Learning Outcomes Cycle 2

No	Achievement	Cycle 2 Results
1	Average Value	86,34
2	Frequently occurring values	87,75
3	Lowest value	75
4	The highest score	100
5	Unfinished students	6
6	Completed students	29
7	Percentage of learning incompleteness	17,15%
8	Percentage of learning completeness	82,85%

Based on the table of student learning outcomes on the curved side of the 2nd cycle, the number of students who have reached the MCC has increased. The MCC score that students must achieve is 80. Out of 35 students, 29 have completed it, while six others have not. The percentage of completeness reached 82.85%, and the average class value was 86.34. The lowest score obtained by students in action cycle 2 was 75, while the highest score in action cycle 2 was 100. Based on these learning outcomes, learning appears to have been carried out optimally. Many students do not only master facts or information but can apply the candy and creatively in different situations. Students are also able to improve their ability to analyze and synthesize information, as well as solve complex problems.

DISCUSSION

HOTS-based discovery learning model in curvilinear subjects is because learning is carried out according to the steps of the model. According to Hanifah & Wasitohadi (2017:95), discovery learning involves students actively learning to find their knowledge through activities. Learning. By learning discovery, students can think analytically and try to solve their problems. Table 3 presents a recapitulation of student learning outcomes from each cycle.

Table 3. Comparison of Learning Outcomes in Cycle 1 and Cycle 2

No	Achievement	Cycle 1 Results	Cycle 2 Results
1	Average Value	74,47	86,25
2	Frequently occurring values	81,25	87,5
3	Lowest value	50	75
4	The highest score	87,75	100
5	Unfinished students	15	6
6	Completed students	20	29
7	Percentage of learning incompleteness	42,86%	17,15%
8	Percentage of learning completeness	57,14%	82,85%

Based on Table 3, student learning outcomes by applying the HOTS-based discovery learning model have increased in every aspect. The average student score in cycle 1 was 74.47,

while the average in cycle 2 was 87.75. In cycle one, the percentage of learning completeness was 57.14%, with 20 students achieving mastery. In cycle 2, the rate of student learning completeness reached 82.85%, with several students achieving the knowledge of 29 people. The diagram of the number of students who came to specific points in both cycles can be seen in the following Figure 4.

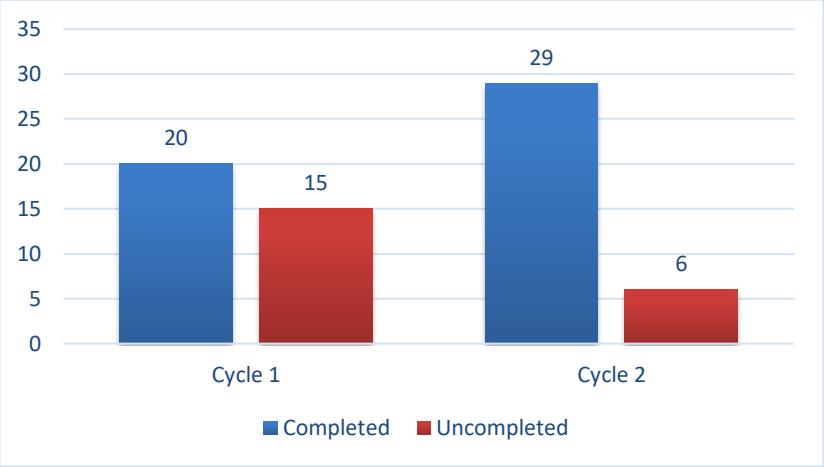

Figure 4. Student completeness diagram

Based on Figure 4, an increase in student learning outcomes by applying the HOTS-based discovery learning model has seen a rise. In cycle 1, 20 students scored above 80. Whereas in cycle 2, students who scored above 80 totaled 29 people. This is in line with Kurniawan's opinion (2020) that the use of the HOTS-based discovery learning model on curved side geometrical material has succeeded in increasing student learning outcomes in class IX-C SMPN 1 Singaparna, Tasikmalaya Regency. Likewise, Aiman's research (2020) results on the material for the smallest common multiple and the most significant common factor experienced an increase of 41% after implementing learning using the HOTS-based discovery learning model. So it can be concluded that to improve student learning outcomes can use the HOTS-based discovery learning model. This can be seen during learning, students can develop critical thinking skills and have greater control over the learning process, and students can solve complex problems or projects by utilizing the knowledge and skills they have previously learned on the evaluation results.

CONCLUSION

Based on the results and discussion, class action research cycle one and cycle two by applying the HOTS-based discovery learning model to improve student learning outcomes in curvature subjects, it can be concluded that the HOTS-based discovery learning model enhances student learning outcomes in Class 9F in one of one State Junior High School in the city of Semarang on curved side geometrical materials with results in the first cycle with a student completeness level reaching 57.14% and in the second cycle with completeness going 82.85%. The difference in mastery learning outcomes is 25.71%.

SUGGESTION

This research only measures student learning outcomes. In the future, it is hoped that applying the HOTS-based discovery learning model can improve student learning outcomes in other materials.

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