The Effect of Discovery Learning Model to Improve Learning Outcomes and Chemical Process Skills

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Abstrak

Tujuan dari penelitian ini adalah untuk meningkatkan hasil belajar dan keterampilan proses kimia melalui model pembelajaran *Discovery Learning* pada materi laju reaksi. Penelitian ini dilakukan di SMA Negeri 3 Pematangsiantar di kelas XI MIA 2 semester gasal tahun ajaran 2021∕2022 subjek berjumlah 29 siswa. Jenis penelitian ini adalah penelitian tindakan kelas yang terdiri dari perencanaan, pelaksanaan tindakan, observasi dan refleksi dengan menggunakan model pembelajaran *Discovery Learning*. Tes digunakan untuk mengukur hasil belajar kemampuan awal siswa dan hasil belajar, dan lembar observasi digunakan untuk mengukur keterampilan proses kimia. Pembelajaran dengan menggunakan model *Discovery Learning* terbukti efektif dalam meningkatkan hasil belajar siswa dan keterampilan proses kimia. Nilai yang dicapai masih dikategorikan dalam kriteria Sangat Baik. Berdasarkan analisis keterampilan proses kimia, keberhasilan penerapan dalam meningkatkan keterampilan proses sains siswa sebesar 82,57% pada pertemuan kedua siklus I meningkat lagi sebesar 90,5% pada pertemuan kedua siklus II. Kesimpulan penelitian ini adalah penerapan pembelajaran dengan menggunakan model *Discovery Learning* terbukti efektif dalam meningkatkan hasil belajar siswa dan keterampilan proses sains siswa SMA Negeri 3 Pematangsiantar di kelas XI MIA 2.

Kata Kunci: model pembelajaran *discovery learning,* hasil belajar, keterampilan proses sains, laju reaksi

Abstract

The purpose of this research is to improve learning outcomes and chemical process skills through the Discovery Learning learning model on the reaction rate material. This research was conducted at SMA Negeri 3 Pematangsiantar in class XI MIA 2 with 29 students as the subject. This type of research is classroom action research which consists of planning, implementing actions, observing, and reflecting using the Discovery Learning learning model. The test is used to measure the learning outcomes of students' initial abilities and learning outcomes, and the observation sheet is used to measure chemical process skills. Learning using the Discovery Learning model is proven to be effective in improving student learning outcomes and chemical process skills. The value achieved is still categorized in the Very Good criteria. Based on the analysis of chemical process skills, the success of the application in improving students' science process skills was 82.57% at the second meeting of the first cycle and increased again by 90.5% at the second meeting of the second cycle. This study concludes that the application of learning using the Discovery Learning model has proven to be effective in improving student learning outcomes and science process skills of SMA Negeri 3 Pematangsiantar students in class XI MIA 2.

Keywords: discovery learning learning model, learning outcomes, science process skills, reaction rate

INTRODUCTION

Education and people are inseparable because they are interrelated. Education is very important to support human life. Humans are equipped with thoughts and reason to live life, with thoughts and minds possessed through education, humans can develop and increase their knowledge Putri et al., (2019); Herlambang, (2021). Education is a means through which students develop their potential in accordance with educational goals. The education taken is formal and non-formal education, where formal education is like school while non-formal education is like tutoring, playgrounds, music courses, and education outside of formal education White & Lorenzi, (2016); Latchem, (2018). So, the need for education for all people is to obtain quality human beings. The quality of education, especially in Indonesia, continues to be developed and evaluated by the government and teaching staff. One of the efforts made is curriculum development. Currently, the curriculum applied in Indonesia is the 2013 curriculum or K13 (Sudarsana, 2016).

The current 2013 curriculum requires students to play an active role in the teaching and learning process so that learning strategies are needed that support the achievement of these goals. Students as learning subjects must play an active role in learning Ekawati, (2017); Ratnaningsih, (2017). Student activity is assessed from its role in learning, such as asking, answering questions, and giving responses. In addition, student activity is a form of independent learning, namely students try to learn everything on their own volition and ability or their efforts so that in this case the teacher only acts as a guide, motivator, and facilitator Sari, (2016); Siswanti, (2019). In the learning process, the teacher has an important role in creating learning conditions that encourage the active role and understanding of students. Efforts to create learning conditions that can involve the active role of students require the ability of teachers to apply appropriate and varied learning models so that students will play an active role and achieve the expected results.

In learning chemistry, it is hoped that it will not only provide as much knowledge as possible to students but also be able to stimulate thinking, be scientific and creative, as well as students' responsibility for everyday events that are relevant to chemistry lessons. In addition to understanding the concept of chemistry, students are expected to be able to apply it in everyday life and realize its impact on the environment and try to find solutions so that they can preserve the surrounding environment. Seeing this reality, a learning solution is needed, with an appropriate learning model, it is hoped that students will be more active and can collect information with effective question stimuli to realize student competence, so that learning can be accepted by students and teachers. The nature of learning chemistry as part of science cannot be separated from the activities of minds-on, hands-on, and hearts-on, namely, students can hone thinking skills, practice, and have noble character. With these three skills, students are expected to be active in thinking and process activities to hone science skills so that students can find new concepts from their learning activities and have strong characters in their social life. Education is an interaction between educators and students, to achieve educational goals that take place in a certain environment. This interaction is called educational interaction, which is the mutual influence between educators and students Hwang & Hariyanti, (2020);(Pi et al., (2021). The function of education is to prepare students. Preparing means that students are essentially not ready, but need to be prepared and are preparing themselves (Maryanti et al., 2020). In the learning process, the development of students' potential and potential must be carried out in a comprehensive and integrated manner. Unbalanced development of student potential makes education tend to be more concerned with the development of one particular aspect of personality. The growth and development of students is a goal to be achieved by all schools and teachers.

According to A. Putri et al., (2020); Kartika et al., (2020) Discovery Learning model is a series of learning activities that maximally involve all students' abilities to search and investigate systematically, critically, logically, analytically so that they can formulate their findings. Knowledge gained by discovery learning shows several advantages, namely, the knowledge lasts longer or is easier to remember when compared to knowledge learned in other ways, discovery learning outcomes have a better transfer effect and overall discovery learning

can improve students' reasoning and learning. skills to think critically. The Discovery Learning learning model was chosen with a scientific approach because this model provides opportunities for students to think, find, argue, and work together through scientific learning activities so that they can train and improve critical thinking skills and problem-solving and gain knowledge of important concepts. which will have an impact on improving learning outcomes (Ponidi et al., 2020). Discovery Learning learning system, the teacher does not directly present the lesson material, but students are allowed to find a problem by using a problem-solving approach (Simamora & Saragih, 2019). According to Herdiana et al., (2017); Marian, (2019) Discovery Learning has the following steps: (1) Problem identification, (2) Developing possible solutions (hypotheses), (3) Data collection, (4) Data analysis and interpretation (5) Conclusion testing.

The five steps of the Discovery Learning model according to Herdiana et al., (2017) can be explained as follows: 1). Problem identification, at this stage the teacher provides opportunities for students to find and collect as many problems as possible related to the theme to be studied. 2). Developing solutions, at this stage students are invited to create a hypothesis on a predetermined problem. 3). Data collection, at this stage the teacher gives time to students to collect data related to the problem. The data can be from direct observation, the internet, books, experiments, or other sources. 4). Analysis and interpretation of data, at this stage, students analyze the data they have found, then develop statements to support the data. After that, the data were tested for hypotheses and concluded. 5). Test conclusions, after there are conclusions from students, new data appears and at this stage, testing is carried out on the results of the conclusions.

This discovery learning model also makes students find their concepts from the knowledge obtained, so that student learning outcomes will increase. Problems that are solved and found on their own without special assistance, provide superior results because students find new rules of a higher level, so it is very important to encourage students to find problem-solving with their thoughts Simamora et al.,(2017). Research conducted by Azzajjad et al., (2020); Junina & Halim, (2020); Purwaningsih et al.,(2020); von Lilienfeld & Burke, (2020) states that the discovery learning model has an effect on improving student chemistry learning outcomes.

If there are deficiencies, the conclusions can be revised. According to Walid et al., (2019); Astari et al., (n.d.) the Discovery Learning learning model has two operational steps that must be carried out, namely the preparation and implementation steps. Mastery of student knowledge competence, especially science can be more optimal by teaching teachers, choosing learning models and learning resources or media that are in accordance with the material and characteristics of students. So that the environment as a learning medium in supporting or assisting the discovery learning model provides a huge opportunity for students to increase their knowledge and hone their abilities and achieve learning goals and motivate students in learning. Based on the description that has been presented, the title raised is the Effect of the Discovery Learning Model to improve learning outcomes and chemical process skills.

METHOD

The place of this research was carried out in class XI MIA 2 SMA Negeri 3 Pematangsiantar located on Jalan Pane, East Siantar District, Pematangsiantar City. This research activity is carried out in the odd semester of the 2021/2022 academic year for 2 months starting from the first week of October to the second week of November which includes the preparation of proposals to the preparation of the Classroom Action Research report. This classroom action research was carried out in a participatory collaborative manner between the researcher and the chemistry teacher of class XI MIA 2 SMA Negeri 3 Pematangsiantar. The subjects of the class action research were students of class XI MIA 2 SMA Negeri 3 Pematangsiantar for the academic year 2021/2022 with a total of 29 students consisting of 14 male students and 15 female students. While the object of this research is the improvement of chemistry learning outcomes and students' critical thinking skills on the reaction rate material.

The research method used in this research is Classroom Action Research (CAR) with two cycles. Each cycle consists of the stages of planning, action, observation, and reflection. This research was conducted with the aim of improving the quality of learning and overcoming various problems in the classroom such as critical thinking skills and student chemistry learning outcomes. Classroom Action Research (CAR) cycle carried out with reference to theory Wulandari et al., (2019); Meesuk et al., (2020).

This research consists of 2 cycles. Each cycle is carried out in 2 meetings. This is intended so that students and teachers can adapt to the applied learning model. So that the results of classroom action research can be used in the next teaching and learning process. In order for this classroom action research to be successful without any obstacles that interfere with the smooth running of the research, the researcher arranges the stages that are passed in classroom action research, namely: (1) planning, (2) implementation, (3) observation and (4) reflection.
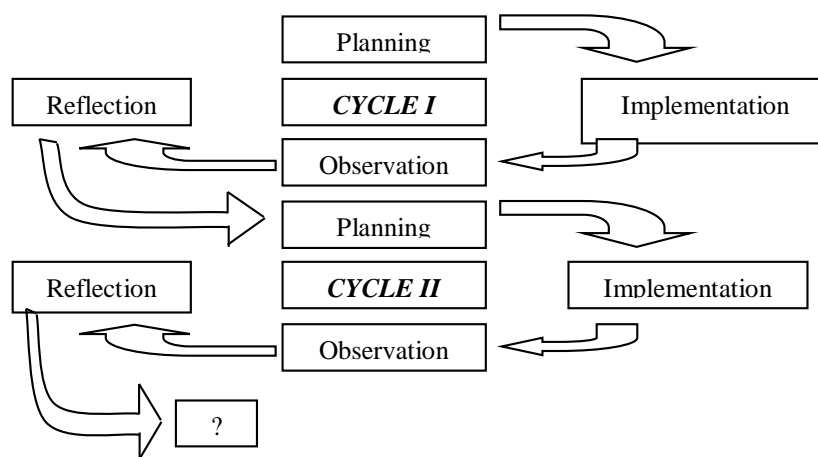

Figure 1. Classroom Action Research Cycle (Meesuk et al., 2020)

At the planning stage, actions will be taken based on the existing problems, namely the application of the Discovery Learning learning model to chemistry teaching and learning activities at SMAN Pematangsiantar. At this stage, the researcher designed a learning device consisting of a syllabus, lesson plans, student worksheets, and observation sheets for teacher and student activities.

In carrying out the research also involves observers and supervisors, the task of the observer is to see the activities of teachers and students during the learning process, this is done to provide input and opinions on the implementation of the learning being carried out so that inputs from observers can be used to improve learning in the next cycle. Observations are intended to see the activities of teachers and students during the learning process.

The results obtained in the observation stage were collected and analyzed. From the results of observations, teachers can reflect on themselves by looking at the observation data of teachers and students during the learning process. The results obtained from the observation stage were then collected and analyzed, from the results of observations whether the activities carried out had been found to improve the learning outcomes of chemistry and science process skills in the chemistry subjects of students in class XI MIA 2 SMAN 3 Pematangsiantar.

FINDINGS AND DISCUSSION

The data obtained from the research results in the form of figures are analyzed to prove the presented hypothesis. Data analysis of research results includes each student's acquisition, average grade value, and classical completeness, in addition to which it is discussed. Learning outcomes were performed at the beginning and end of sessions 1 and 2. The results of this test were used to determine the level of students 'understanding

of the reaction rate material provided by the teacher. Receiving student tests in each cycle may indicate an increase or decrease in each student's learning outcomes. As described in the table before cycle for cycle 2, it appears that the student's learning outcomes begin with the following;

Table 1
Obtaining test scores for students of class XI MIA 2 Before and after the action

	Initial value	Cycle value 1		Cycle value 2	
		Pretest	Posttest	Pretest	Posttest
The Highest Score	90	96	100	98	100
Lowest Value	15	49	44	62	65
Average	57,03	70,45	78,28	81,64	88,45
Completeness (%)	34,50	62,1	79,3	85,7	89,7
	15 Learners	20 Learners	23 Learners	25 Learners	26 Learners

From the table above, it can be concluded that there is an increase in the average value of each cycle. So this applied model has a positive impact on the learning process in terms of increasing the class average value which increases every cycle. Data on the increase in the percentage of learning outcomes before and after the Discovery Learning model can be seen in the following graph:
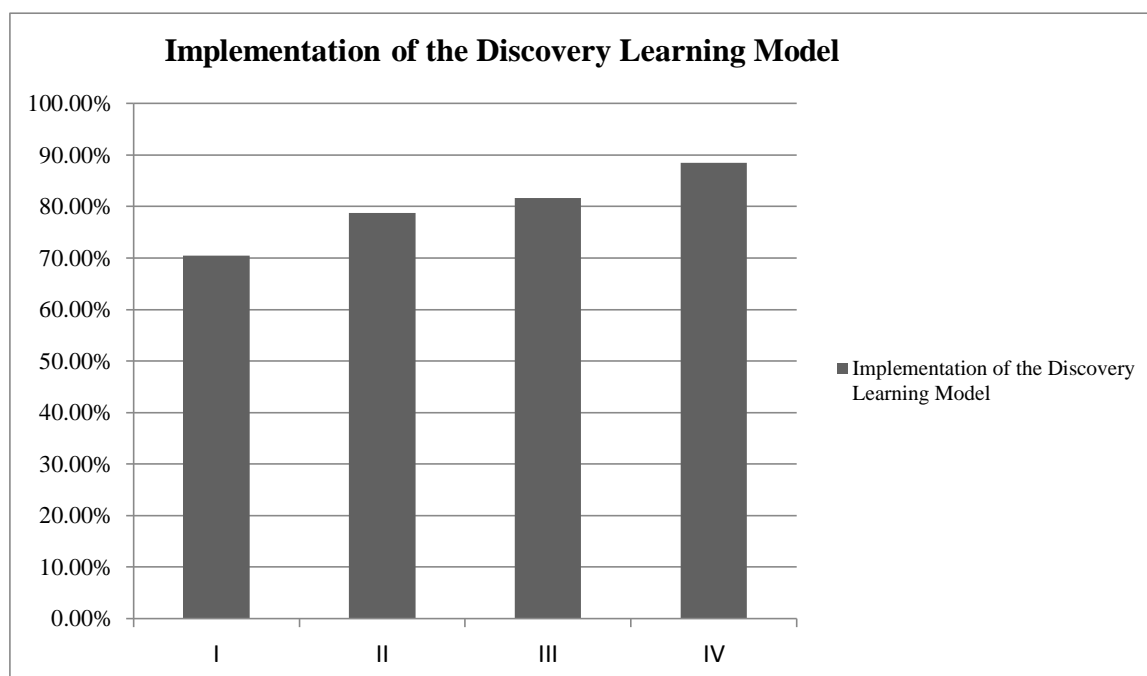

Figure 2. Percentage of learning outcomes before and after the Discovery Learning model

Based on the results of observations obtained data that chemical process skills using the Discovery Learning model have increased in each meeting by correcting deficiencies that occurred in the previous meeting. The details regarding improving students' critical thinking skills using the Discovery Learning model can be seen in the table:

Table 2
Results of Observation Sheet for Critical Thinking Skills

Number	Indicator	Percentage Meeting 1 (%)	Percentage Meeting 2 (%)	Percentage Meeting 3(%)	Percentage Meeting 4 (%)
1	Making Observations	75	86	86	90
2	Formulate a hypothesis	75	90	90	90

3	Have a discussion	75	74	86	86
4	Skills of students asking questions	78	82	90	90
5	Skills of students to answer question	70	82	90	90
6	Making Conclusions	70	76	86	98
7	Applying the concept	82	86	86	86

From the table above, it can be concluded that there is an increase in the average value of each cycle. So this applied model has a positive impact on the learning process in terms of increasing the class average value which increases every cycle. Meanwhile, the relationship between improving learning outcomes and students' science process skills can be seen in the following graph:
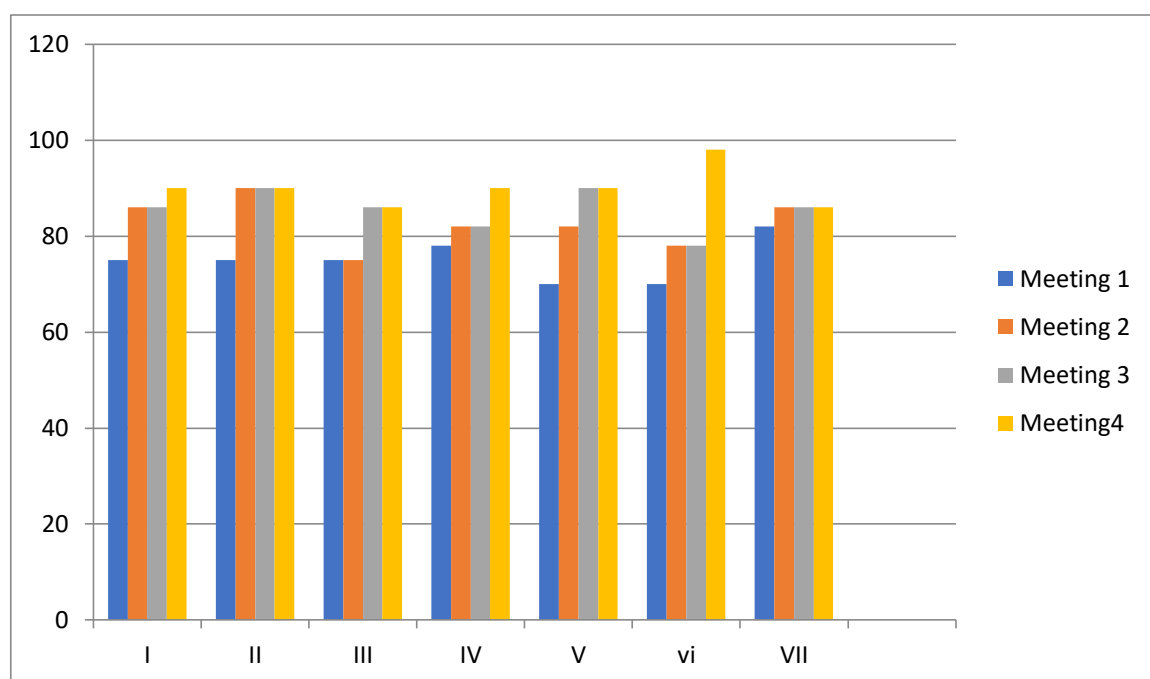

Figure 3. Improving student learning outcomes and chemical process skills

Discussion

Learning using the Discovery Learning model is proven to be effective in improving students' chemical process skills. In learning, the activities of students during the learning process are considered. The more active students are, the more effective learning will be. This is in accordance with Bell's (1978) statement, in the discovery that students have the opportunity to be actively involved in learning. The fact shows that the participation of students in learning increases when the concept discovery stage is used.

Based on the data on the learning outcomes of the first cycle, the average value of the pretest I was 70.45, the highest score obtained by the students was 95, and the lowest score was 49, while the posttest I learning outcomes obtained the average posttest I score of 78.28, the highest score. obtained by students was 98 and for the lowest score was 44, while the second cycle obtained an average value of pretest II of 81.64, the highest score obtained by students was 96, and for the lowest value of 62 while the posttest II learning outcomes obtained an average value Posttest II average was 88.45, the highest score obtained by students was 98 and the lowest score was 65.

The application of the Discovery Learning learning model can improve the critical thinking skills of class XI MIA 2 SMA Negeri 3 Pematangsiantar students for the 2021-2022 academic year. The success of the application is shown by a change in the process of the first cycle the percentage of critical thinking students who

are in the critical criteria from 74.25% rose to 82.57% while in the second cycle the percentage of critical thinking students who were in the critical criteria rose from 85.42% to on very critical criteria 90.5%. Based on the results of observations obtained data that critical thinking skills using the Discovery Learning model have increased in each meeting by correcting deficiencies that occurred in the previous meeting.

The Discovery Learning model has an effect on the psychomotor or skills of students, where at the time of learning students can think critically with the teacher providing opportunities for students to learn actively, the teacher also provides the opportunity to answer students' own ideas in solving problems by developing analytical skills. and processing the information obtained, students become more skilled in speaking in expressing opinions. Then students group together to discuss the results of their answers together so that student learning activities increase. This is in accordance with the opinion of Dina, (2019); Inde et al., (2020); Atiyah et al., (2020) stating that the Discovery Learning model can improve student learning activities.

This increase in student learning activities is caused by many factors, including the Discovery Learning model which requires students to be more active in finding concepts & materials, and discussion activities that train students to be active in the learning process. With the discussion, students are more courageous in expressing opinions, responding to statements from friends and teachers, and asking questions about things that are not understood. The Discovery Learning model also affects the affective domain or student attitudes, especially at the data collection stage. Students are required to record all data or information obtained from observing the images in order to find the expected concepts & materials so that from this activity an honest and open attitude will be formed. Students' critical thinking skills have also been developed through the application of this Discovery Learning model.

One of the teacher's strategies in developing critical thinking skills is practicum. This development is also seen when designing experiments, namely, when determining experimental variables, experimental tools, and materials, students are very active in asking questions and enthusiastic in finding out the answers. In the practicum method, students are given the opportunity to experience themselves or do it themselves, follow a process, observe an object, analyze, prove and draw their own conclusions about a particular object, state, or process. Thus, students are required to experience for themselves, seek the truth, or seek law and draw conclusions or processes they experience. With this practical learning, students' critical thinking skills can also develop. Because the practicum is not just to present whether the reaction is in accordance with the theory but also to develop the thought process by asking why the reaction is like that and so on. From the data above, it can be concluded that there is an increase in the average value of each cycle. So the Discovery Learning model that is applied has a positive impact on the learning process in terms of increasing the average class value which increases every cycle.

CONCLUSION

The application of the Discovery Learning learning model can improve chemistry learning outcomes and chemical process skills in class XI MIA 2 SMA Negeri 3 Pematangsiantar for the 2020-2021 academic year. The success of the implementation is indicated by a change in the process of the first cycle, the increase in the average value of the class after the action from the initial pretest of 87.70% increased to 91.70% at the time of posttest. The increase in the number of students who achieved the KKM score was 17.24%. The value achieved is still categorized in the Good criteria and has reached the success indicators that the researchers determined. During the pretest, the number of students who completed the test was 20 students, then during the posttest, it rose to 25 students. In the second cycle, the success was shown by the increase in the average grade after the action from the pretest at 64.1% to 81.3% at the posttest. An increase in the number of students who achieved the KKM score of 7.0%. The value achieved is still categorized in the Very Good criteria and has reached the success indicators that the researchers determined. During the pretest, the number of students who completed the test was 26 students, then during the posttest, it increased to 29 students. The application of the Discovery

Learning learning model can improve the critical thinking skills of class XI MIA 2 SMA Negeri 3 Pematangsiantar SMA Negeri 3 Pematangsiantar Academic Years 2020-2021. The success of the implementation is shown by a change in the process of the first cycle, the percentage of students' chemical process skills from 74.25% rose to 82.57%, while in the second cycle the percentage of students' chemical process skills from 85.42% rose to a very critical criterion of 90.5%.

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