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Application of Discovery Learning Model to Student Learning Outcomes on Chemical Equilibrium Subject at MAN Banggai Laut

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Abstract: Application of Discovery Learning Model to Student Learning Outcomes on Chemical Equilibrium Subject at MAN Banggai Laut. This study aims to determine and describe the influence of the discovery learning model on student learning outcomes on the subject of chemical equilibrium. This research is descriptive type. The sample used was 16 class XI students, consisting of 6 male students and 10 female students. The instruments used are lesson plans, student worksheets, teacher and student activity observation sheets, and student learning outcomes tests. Data collection techniques were carried out through teacher and student activity observation sheets and learning outcomes tests. The data that has been collected is analyzed using descriptive analysis. The results of data processing and analysis on the application of the discovery learning model on chemical equilibrium subjects obtained teacher activity with an average of 82.38% and student activity with an average of 80.19%, including in the good category. The value of student learning outcomes (cognitive, affective, and psychomotor aspects) has an average of 74, and a learning effectiveness of 75% (minimum achievement criteria: 70). Based on the results of the study, it can be concluded that learning by using the discovery learning model can improve students learning outcomes.

Keywords: Discovery Learning Model, Learning Outcomes, and Chemical Equilibrium

Abstrak: Penerapan Model* Discovery Learning *Terhadap Hasil Belajar Siswa Pada Mata Pelajaran Kesetimbangan Kimia di Madrasah Aliyah Negeri Banggai Laut. *Penelitian ini bertujuan untuk menentukan dan mendeskripsikan pengaruh model pembelajaran* discovery learning *terhadap hasil belajar siswa pada pokok bahasan kesetimbangan kimia. Jenis penelitian ini adalah penelitian deskriptif. Sampel yang digunakan adalah siswa kelas XI yang berjumlah 16 orang, terdiri dari 6 orang siswa laki-laki dan 10 orang siswa perempuan. Instrumen yang digunakan adalah Rencana Pelaksanaan Pembelajaran, Lembar Kerja Peserta Didik, lembar observasi aktivitas guru dan siswa, serta tes hasil belajar siswa. Teknik pengumpulan data dilakukan melalui lembar observasi aktivitas guru dan siswa serta tes hasil belajar. Data yang telah dikumpulkan dianalisis menggunakan analisis deskriptif. Hasil pengolahan dan analisis data terhadap penerapan model* discovery learning *pada pokok bahasan*

Kesetimbangan Kimia diperoleh aktivitas guru dengan rata-rata 82,38% dan aktivitas siswa dengan rata-rata 80,19%, termasuk dalam kategori baik. Nilai hasil belajar siswa (aspek kognitif, afektif, dan psikomotorik) dengan rata-rata 74, dan efektifitas pembelajaran sebesar 75% (KKM 70). Berdasarkan hasil penelitian dapat disimpulkan bahwa pembelajaran dengan menggunakan model discovery learning dapat meningkatkan hasil belajar siswa.

Kata kunci: *Model discovery learning, hasil belajar, kesetimbangan kimia*

- **INTRODUCTION**

A well-planned learning process cannot be separated from students' understanding of the learning material. Students can understand the material in learning through interactive, inspiring and fun learning activities, so that student learning outcomes can obtain optimal results. However, the reality is that student learning outcomes in Indonesia are still below average. One of them is the result of studying chemistry. Based on the results of the PISA survey conducted by the OECD in evaluating literacy skills in reading, mathematics and science in 2018, the average score in the science field was 389, with an OECD average score of 489 (OECD, 2018).

Indonesia was ranked 74th out of 79 participating countries. This shows that the science learning outcomes (including chemistry) of students in Indonesia are still below average. The low chemistry learning outcomes are also supported by data from the 2019 National High School Examination (UN) results, where the average chemistry score for students throughout Indonesia was 50.99 (Kemdikbud, 2019). Based on this data, it shows that students in Indonesia still have difficulty understanding science lessons (including chemistry) so that the learning outcomes obtained are still far from standard.

This also happened at MAN Banggai Laut. Based on interviews conducted at the school, the chemistry teacher said that one of the learning materials that students often have problems with is chemical equilibrium. This can be seen from the learning results which are still below the Minimum Completeness Criteria (KKM), where the KKM that must be achieved is 70. Meanwhile, from the results of daily tests, the students' scores are unsatisfactory with a completeness score of 41%, and an incomplete score of 59%. Another problem faced is that students still lack understanding in balancing reaction equations, in terms of calculations, many are still reluctant to ask teachers about learning material that they do not understand, there is an opinion that learning chemistry is difficult, there is a lack of literature used by both teachers and students, and there has not been a learning model that is considered to increase student activity and learning outcomes.

Efforts that can be made to overcome this problem are by implementing a model Discovery Learning in learning in the classroom. Learning model Discovery Learning is a learning model that produces something new and creates more meaningful learning by activating students to be able to search for and discover for themselves the concepts and learning principles being studied (Setyowati et al., 2018). By implementing the model Discovery Learning in the teaching and learning process it can improve student learning outcomes, especially for material that requires good understanding of concepts and mathematical skills (Meiliawati, 2018).

This is in accordance with research conducted by (Abdjul, 2022) which discusses the application of learning models Discovery Learning To improve biology learning

outcomes for class Discovery Learning can significantly improve the biology learning outcomes of class X SMA Negeri 1 Buntulia students.

▪ METHOD

The type of research used is descriptive research using a quantitative approach. Descriptive research method with using a quantitative approach aims to describe or explains an event or occurrence that is happening at the present moment form meaningful numbers (Sudjana, 1997). This research was carried out from 23 September 2022 to 02 March 2023. The population and sample in this research were all 16 class XI science students at MAN Banggai Laut. The sampling technique used was saturated sampling.

The instruments used in this research were RPP, LKPD, teacher and student activity observation sheets and tests. Data collection techniques used include observation and learning outcomes (50% Cognitive, 30% Affective and 20% Psychomotor). The data analysis technique used is descriptive analysis technique. The data to be analyzed are observation sheets of teacher and student activities, and assessments of student learning outcomes.

Teacher and student activity observation sheet

The results of observations of teacher and student activities are added up for each category. Then the percentage will be calculated using the formula:

$$\%activity = \frac{F}{N} X\ 100\%$$

Information:
F = Frequency of teacher/student activities that appear
N = Number of all activities

The average number of percentages during the meeting for all teacher and student activities is summarized according to the teacher and student activity assessments in Table 1.

Table 1. Assessment of Teacher and Student Activities

No.	Percentage Rate	Category
1	90-100	Very good
2	70-90	Good
3	40-70	Enough
4	20-40	Not good
5	0-20	Very not good

(Sudijono, 2010).

Assessment of Learning Outcomes

Student learning outcomes are obtained from the cognitive, affective and psychomotor domains. With a proportion of 50% cognitive achievement rate, 30% affective achievement rate, and 20% psychomotor achievement rate (Kamaludin, Soebali, & Kardi, 2017).

Minimum Completeness Criteria (KKM) for chemical equilibrium material at MAN Banggai Laut is 70. To determine the effectiveness of learning using Discovery Learning using the formula for the percentage of completeness of learning outcomes with the following effectiveness criteria:

$$\mathbf{T} = \frac{\text{Number of students who completed}}{\text{Total number of students}} \boldsymbol{X}\ \mathbf{100\%}$$

Information:
T = Completeness of learning outcomes

The criteria for learning effectiveness based on the completeness of learning outcomes can be seen in Table 2.

Table 2. Learning Effectiveness Criteria Based on Completeness of Learning Outcomes

No.	Percentage Rate	Category
1	≤ T ≥ 80%	Very effective
2	70% ≤ T < 80%	Effective
3	60% ≤ T < 70%	Effective enough
4	50% ≤ T < 60%	Less effective
5	T < 50%	Less than once

(Trianto, 2011).

▪ RESULT AND DISCUSSION

Based on research data regarding the application of the model Discovery Learning on the subject of chemical equilibrium at MAN Banggai Laut, results were obtained consisting of teacher and student activities as well as student learning outcomes.

Teacher and student activities

Teacher and student activities during learning are measured using activity observation sheets. A total of 2 people were observers, namely a chemistry teacher and a physics teacher at MAN Banggai Laut. Application of the model Discovery Learning in the case of chemical bonds, there are 3 junctions. Teacher activities during the 3 meetings are presented in Figure 1.

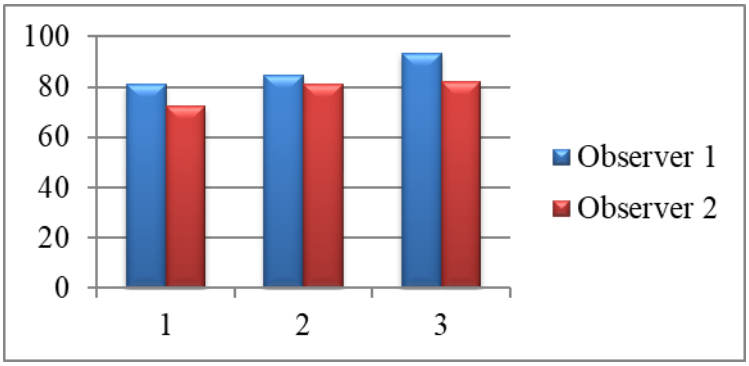

Figure 1. Graph of teacher activity observation results

Based on the research data on teacher activities contained in Figure 1, it can be seen that using a learning model Discovery Learning teacher activity has increased. At meeting 1 it can be seen that the teacher activity score was 76.61%, meeting 2 increased to 82.77%, and meeting 3 increased by 87.76%. So the average percentage obtained was 82.38%, included in the good category, namely 70 - 90 (Sudijono, 2010).

This increase in teacher activity is marked by the teacher's self-evaluation regarding the results of assessing the implementation of learning at the previous meeting and making improvements at the next meeting. The teaching activities carried out by the teacher are as expected, this is shown by the analysis of teacher activity observation data which shows good criteria. In this case it shows, learning chemistry by applying a learning model Discovery Learning can improve the quality of learning. Apart from that, student activities during the 3 meetings are presented in Figure 2.

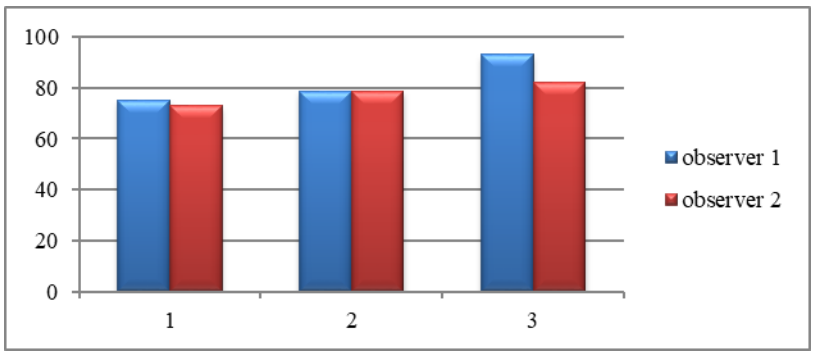

Figure 2. Graph of student activity observation results

Based on research data on student activities in Figure 2, it can be seen that using a learning model *discovery learning* Student activity has increased. At meeting 1 it can be seen that the student activity score was 74.11%, meeting 2 increased to 78.82%, and meeting 3 increased by 87.64%. So the average percentage obtained was 80.19%, included in the good category, namely 70 - 90 (Sudijono, 2010).

This increase in student activity is because students are starting to know the model Discovery Learning which is applied by the teacher in the learning process so that students can apply it directly. Apart from that, there are other factors that influence the increase in the percentage of students implementing learning at each meeting, namely the emotional relationship between students and teachers becomes closer at each meeting, so that students feel more comfortable in the learning process in class.

Increased student learning activities also occur due to the application of learning models Discovery Learning further train students to discover their own concepts and learning experiences through direct involvement or during group discussions. This is in line with Bruner in the Ministry of Education and Culture (2013). Stated that the learning process will run well and creatively if the teacher gives students the opportunity to discover a concept or theory on their own, either by direct observation or by group discussion.

According to (Cintia et al., 2018), learning Discovery Learning involving students in the process of mental activity through exchanging opinions, discussions, reading information from various sources themselves, or carrying out their own observations and experiments. Discovery Learning directs students to discover concepts through various information or data obtained through observation or experimentation.

Learning model Discovery Learning at the level of *problem statement* (problem identification) and *data collection* (data collection) most influences the results of increasing teacher and student activity. At stage *problem statement*, students are very active in formulating problems from identifying problems in the stimulus provided. Students formulate problems in the form of questions which are assisted by the teacher regarding the appropriateness of the subject matter, so that students can understand the information obtained. This is also supported by a statement from the research results of (Widiadnyana I W et al., 2014) stating that this activity raises students' critical attitudes towards the theories that are used as the basis for answering problems. From this attitude, empirical reasoning will emerge to understand the information obtained.

Next stage *data collection*, students are very active in searching for and collecting relevant information from various sources through various methods, students search and collect information assisted by the teacher regarding the results of the information that has been obtained, so that students discover the concept of knowledge they have learned to solve problems at this stage. *problem statement*. This is in line with (Illahi, 2012) who stated that Discovery Learning is a model that involves students directly in teaching and learning activities, so that students are able to use their mental processes to discover the knowledge concepts they learn when they collect data to solve a problem.

Learning outcomes

Results of analysis of learning outcomes data for class XI IPA MAN Banggai Laut students using a learning model Discovery Learning presented in table 3.

Table 3. Analysis of Learning Results

$\bar{\chi}$ (APK)	$\bar{\chi}$ (APA)	$\bar{\chi}$ (APP)	$\bar{\chi}$ (Nilai)
36	24	14	74

Keterangan :
$\bar{\chi}$ (APK) : average value of Cognitive Achievement Score
$\bar{\chi}$ (APA) : average value of Affective Achievement Score
$\bar{\chi}$ (APP) : average value of Psychomotor Achievement Score

Based on the learning outcome analysis data in table 3, it can be seen that the average learning outcome for class XI IPA MAN Banggai Laut students is 74. The learning outcomes obtained indicate that the application of the model Discovery Learning can run well. This is because the learning outcome value obtained is greater than the set KKM, namely 70.

The learning outcomes obtained can occur due to the application of the learning model Discovery Learning further train students to discover their own concepts and learning experiences through direct involvement both during group discussions so as to trigger student activity in the learning process. This is in line with Bruner in the Ministry of Education and Culture (2013) who stated that the learning process will run well and creatively if the teacher gives students the opportunity to discover a concept or theory on their own, either by direct observation or by group discussion.

These learning outcomes are also supported by an increase in student learning activities which can be seen in (Figure 2). During the learning process using models Discovery Learning Student activities are carried out in groups, where students can

search for information and explain the information obtained to their friends and there is no feeling of awkwardness about asking questions that are unclear and not yet understood with friends who understand better.

Learning model Discovery Learning could be a solution to improve students' abilities seen from the effectiveness of learning using learning models Discovery Learning. Effectiveness of learning in class XI IPA MAN Banggai Laut using models Discovery Learning based on the completeness of student learning outcomes are presented in Figure 3.

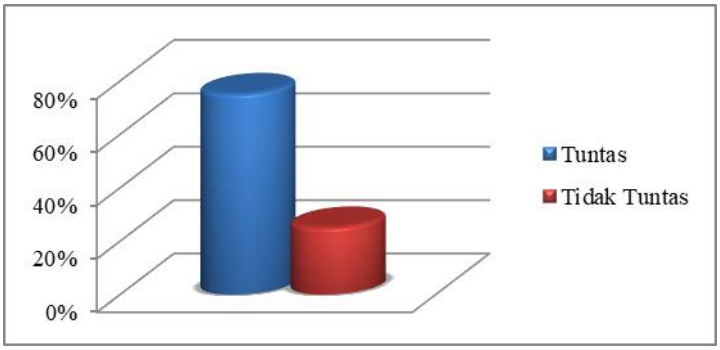

Figure 3. Graph of model learning effectiveness *discovery learning* based on the completeness of learning outcomes

Effectiveness of learning using learning models Discovery Learning if 75% completeness is obtained then the learning is in the effective category. According to (Trianto, 2011), learning is said to be effective if completeness is in the interval 70% ≤ T < 80%. Based on this, it is known that class Discovery Learning can improve student learning outcomes. Research shows that the application of discovery learning models can improve the learning outcomes of MAN 4 Aceh Besar students in harmonic vibration materials (Rosnidar et al., 2021). The use of the discovery model and problem-based learning can also improve student learning outcomes and help students actively participate in learning (Paramitha et al., 2023).

Learning model Discovery Learning provide an influence in improving student learning outcomes, where before using the learning model Discovery Learning the incomplete value for chemical equilibrium material is 59%, after applying the learning model Discovery Learning the incomplete value for chemical equilibrium material from class XI IPA is 25%. This is more influenced by the model Discovery Learning at the level of *verification* (proof).

Model level Discovery Learning which influences the learning outcomes of class XI IPA MAN Banggai Laut students, namely stage *verification* (proof), where at this stage it shows that students are very active in searching for and collecting information based on examples encountered in everyday life, students carry out proofs assisted by the teacher on the results of group discussions obtained, so that students find understanding of a concept that has been studied. This is also supported by research which states that this activity (proof stage) creates a critical attitude and a willingness to change views on answers, because evidence is revealed from the information that has been learned, so that students will gain an understanding of a concept that has been learned (Harel & Sowder, 2007; Widiadnyana I W et al., 2014).

The Discovery Learning model has been proven to improve Physics learning outcomes in all domains, namely cognitive, affective, and psychomotor. The systematic

learning stage makes it easier for students to follow learning activities conceptually. The implementation of this model provides an opportunity for all students to be actively involved in searching for and discovering their own concepts (Boud & Molloy, 2013; Haryadi, 2021; O'Flaherty & Phillips, 2015; Payu, 2023).

This is also supported by research by (Haryadi, 2021) which states that by using a model Discovery Learning Physics learning outcomes in all domains, namely cognitive, affective and psychomotor, have increased. The systematic learning stage makes it easier for students in learning activities to become more conceptual and easier to follow. This is due to the application of the learning model Discovery Learning provide opportunities for all students to be actively involved in searching for and discovering a concept for themselves.

Research on the effectiveness of chemical representation-based LKPD using the *discovery learning* model carried out by (Rosilawati et al., 2024) can improve science process skills (KPS) on factors that influence the direction of shifts in chemical equilibrium. The first indicator that can be seen is that student activity in the experimental class when working on LKPD has increased from the first, second and third meetings. Another indicator can be seen from the significant difference in the average n-gain between the experimental class and control class variables.

The Discovery Learning model was also used by (Yolanda & Juwitaningsih, 2024) to see its effect on students' activities and learning outcomes in colloidal materials. The Discovery Learning model used with the help of power points in the experimental class provides different learning results from the control class which uses conventional methods. This is supported by the average score obtained by students in the experimental class of 78.9, which is somewhat better than that obtained by the control class of 55.9. The success of this research is also supported by the results of learning activities obtained by experimental class students which were 75.3, better than the control class which was 52.7.

▪ CONCLUSION

The conclusion of this research is the application of the learning model *discovery learning* can improve student learning outcomes on the subject of chemical equilibrium in class XI IPA MAN Banggai Laut. Based on descriptive analysis calculations for teacher and student activities, the average results are 82.38% and 80.19%, including in the good category. Student learning outcomes (seen from cognitive, affective and psychomotor aspects) average 74. And learning effectiveness is 75% (KKM 70), included in the effective category. The application of the Discovery Learning model can improve student learning outcomes and has important implications for learning, classroom management and teacher development.

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