The Effect Of The Discovery Learning Learning Model on Mathematical Critical Thinking Abilities Students In Class X

Nova Febriana Simbolon[1], Rianita Simamora[2], Hunter Simanungkalit[3]

Pendidikan Matematika, Fakultas Keguruan Dan Ilmu Pendidikan

Universitas HKBP Nommensen Pematangsiantar, Pematangsiantar

Email: novafebrianasimbolon21@gmail.com

Abstract

This study aims to determine the effect of the Discovery Learning learning model on the mathematical critical thinking skills of students in grade X of Sma Negeri 5 Pematangsiantar in the academic year 2025/2026. This type of research is quantitative research. The method used by the researcher is the experimental method. This research method was chosen to see how much influence the Discovery Learning learning model has on students' mathematical critical thinking skills on the material of Arithmetic Sequences and Series at Sma Negeri 5 Pematangsiantar. According to (Sugiyono, 2021) there are several forms of experimental design, namely: 1) Pre-experimental (nondesign); 2) True-experimental and; 3) Quasi-experimental. The research design used in this study is Pre-experimental (nondesign). This research was only conducted using an experimental class without a control class. Based on the results of data analysis and discussion, it can be concluded that there is a significant influence of the Discovery Learning Model on Students' Mathematical Critical Thinking Skills on Arithmetic Sequences and Series Materials at SMA Negeri 5 Pematangsiantar. This influence can be seen from the regression equation $\hat{Y}=-6.179+0.606X$ with a regression coefficient of 0.606 and a large determination coefficient of 71% which indicates that there is a very strong relationship between the Discovery Learning Model and Students' Mathematical Critical Thinking Skills.

Keywords: Learning Model , Discovery Learning , Ability , Mathematical Critical Thinking

INTRODUCTION

In a country, education is one of the necessities of human life, education is also a process to create human resources who have critical, creative, logical and systematic thinking. The importance of education for the Indonesian state has been stated in Law Number 20 of 2003 concerning the National Education System, education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble character, and skills to become citizens who are faithful and pious, responsible, and democratic (Anawati, Mujasam, Widyaningsih, & Yusuf, 2020).

One of the most important subjects in education is mathematics. Mathematics is a crucial subject taught from elementary school through secondary school, and even through higher education. This is because mathematics is a crucial subject that can enhance students'

critical thinking skills (Subagio, Karnasih, & Irvan, 2021). Mathematics learning must be conducted systematically and regularly, have a clear structure, and be aligned with students' intellectual development and prerequisite abilities. Mathematics learning aims to help students improve their problem-solving skills, make rational decisions based on data, and convey concepts or solutions in a clear and structured manner. Furthermore, mathematics also contributes to solving various problems we face in everyday life. Mathematics also trains students to think critically, logically, innovatively, and systematically (Hi Rahman, Latif, & Saban, 2022).

Based on the description above, critical thinking skills are the abilities possessed by students to solve problems by paying attention to the steps of the solution and being able to be responsible for them. Critical thinking skills are very important for students to have in solving the problems they have. According to (Pramesti, Probosari, & Indriyanti, 2022) that "Critical thinking is an intellectual thinking process where the thinker deliberately assesses the quality of making decisions when using all these skills effectively in the right context and type of thinking by using reflective, independent, clear, and rational thinking".

Several studies show that the critical thinking skills of Indonesian students in mathematics are low. This is indicated by the research results presented by (Irawan et al., 2017) that the average results of all aspects of students' mathematical thinking skills are still below 50%, namely only 44.87%. This indicates that Indonesian students' critical thinking skills are still very low. This is a problem that needs immediate attention.

sequences are an important topic in mathematics learning , encompassing a sequence of numbers with a fixed pattern of addition or subtraction between terms. This concept not only trains students in understanding numerical patterns but also fosters critical and logical thinking skills in problem-solving. According to Susmina and Marlina (Ade, 2020) a sequence is a sequence of numbers that has a specific pattern, while a series is the sum of the elements in the sequence. In the learning process, arithmetic sequences help students recognize regularities, analyze relationships between numbers, and apply formulas systematically. However, many students still struggle to grasp this basic concept, which may indicate weak critical thinking skills. Therefore, understanding arithmetic sequences is an important focus in research to evaluate and improve the quality of the mathematics learning process in schools.

Based on pre-observations conducted by researchers on April 23, 2025, at SMA Negeri 5 Pematangsiantar, it was found that many students were still unable to properly understand the critical thinking level of learning. During the learning process, students often only recorded and memorized information provided by the teacher without any desire to ask questions or explore further. This could be caused by ineffective learning habits because during the learning process, teachers still used monotonous learning models such as only using the lecture method, which made learning less effective. In addition, teachers used conventional learning methods that made students feel bored and not encouraged to think critically (Kristin & Rahayu, 2017).

The impact of the description above indicates that students' critical mathematical thinking skills are low. This is evident from the results of the initial ability test given to grade X-3 students at SMA Negeri 5 Pematangsiantar, on the topic of Arithmetic Sequences. The

following is an example of an answer that a grade X-3 student at SMA Negeri 5 Pematangsiantar has completed:

Figure 1. Test Questions and Answers of Class X-3 Students.

Based on the results of the students' answers above (Figure 1.1), it can be seen that students were unable to understand the problem and the important information provided . Students also experienced difficulty in using and applying arithmetic sequence formulas correctly, resulting in errors in substituting values into the formula and performing calculations (Jumiarti, Dimpudus, & Haeruddin, 2021). This resulted in final results that were illogical and did not fit the context of the problem. These errors did not only occur once, but continued to be repeated in each subproblem, without any attempt to correct or adjust the solution strategy. Students also did not demonstrate the ability to reflect on or evaluate the results obtained. The answers given were only procedural without considering the logical validity of the final results. This indicates low critical thinking skills, especially in the aspects of problem identification, information analysis, selection of solution strategies, as well as evaluation and reflection on the answers obtained. Based on these findings, it can be concluded that students have not been able to apply the concept of arithmetic sequences well in the context of problem solving, so that learning is needed that places more emphasis on mathematical critical thinking skills (Simangunsong & Pane, 2021).

Therefore, a strategic solution is provided to overcome problems that can support students' mathematical critical thinking skills , namely the *Discovery* Learning learning model , which is seen as one of the strategic solutions to overcome these problems . *Discovery* Learning *emphasizes* an active learning process, where students are guided to discover concepts or principles themselves through observation, experimentation, data processing, and conclusions. Students are trained to develop critical thinking skills, such as identifying problems, analyzing information, developing problem-solving strategies, and evaluating

the solutions obtained. With the active involvement of students in the discovery process, understanding concepts becomes more meaningful and in-depth (Istianingsih Hermawati & Andayani, 2020).

Discovery Learning model has been proven effective in improving students' critical mathematical thinking skills, as demonstrated by various significant research findings. Research by Panduwinata and (Simatupang & Simamora, 2019) demonstrated an increase in mathematics learning completion before and after the application of the *Discovery Learning model* . Meanwhile, Pratiwi and Ariawan (Romlah & Andi, 2021) demonstrated that *Discovery Learning* can encourage students to think critically, understand concepts in depth, and be more active in the mathematics learning process. This demonstrates that *Discovery Learning* not only improves learning outcomes quantitatively but also encourages in-depth conceptual understanding through critical thinking, self-discovery, and active student involvement in the mathematics learning process. Students are guided to think deeply when solving problems, discover and construct ideas independently, and then draw conclusions. This demonstrates that this discovery learning model is influential in improving students' critical mathematical thinking skills (Astiti, Rini Kristiantari, & Saputra, 2021).

Based on the description above, the author is interested in conducting research with the title The Influence of *Discovery* Learning Model on Students' Mathematical Critical Thinking Skills in Grade X of SMA Negeri 5 Pematangsiantar in the 2025/2026 Academic Year .

METHOD

This research is quantitative. The method used by the researcher is an experimental method. This research method was chosen to see how much influence the Discovery Learning model has on students' mathematical critical thinking skills in the Arithmetic Sequences and Series material at SMA Negeri 5 Pematang Siantar. According to (Simarmata, Sinaga, & Syahputra, 2022) there are several forms of experimental design, namely: 1) Pre-experimental (non-design); 2) True-experimental and; 3) Quasi-experimental. The research design used in this study is Pre-experimental (non-design). This research was conducted using only an experimental class without a control class (Forootan, Larki, Zahedi, & Ahmadi, 2022).

Based on this design, the researcher used a One-Shot Case Study. Using this design, a single measurement (test) was administered to grade X-3 students of SMA Negeri 5 Pematang Siantar. This measurement was a post-test to determine the effect of students' critical mathematical thinking skills after the researcher implemented the Discovery Learning model.

The research was conducted at SMA Negeri 5 Pematangsiantar Jl. Medan KM 6.5, Tanjung Tongah Village, Siantar Martoba District, North Sumatra. The reason for choosing this school is because the research entitled "The Effect of Discovery Learning Model on Students' Mathematical Critical Thinking Skills in Grade X of SMA Negeri 5 Pematangsiantar" has never been conducted at this school. The time used by researchers to conduct the research was ± 1 month in the odd semester of the 2025/2026 academic year.

According to (Ujud, Nur, Yusuf, Saibi, & Ramli, 2023) population is a generalization area consisting of: objects/subjects that have certain qualities and characteristics determined by researchers to be studied and then conclusions drawn.

The population of this study was all 10th grade students of SMA Negeri 5 Pematangsiantar in the 2025/2026 academic year, consisting of 10 classes with a total of 359 students. Table 3.2 shows the distribution of the number of students in the 10 classes.

According to (Setiaji, Koeswanti, & Giarti, 2018) a sample is a portion of the population's size and characteristics. If the population is large and researchers cannot study everything in the population, for example due to limited funds, manpower, and time, then researchers can use samples taken from that population. The sampling technique in this study is Random Sampling. This Random Sampling technique selects one class randomly from the population as the experimental class. The sample in this study was one class , namely class X-3, which was given the Discovery Learning learning model.

To obtain valid data and support the achievement of research objectives, systematic steps are required, outlined in research procedures. These procedures are based on established research methods, ensuring that all stages of implementation are carried out in a focused, effective, and efficient manner.

RESULTS AND DISCUSSION

Description And Results Study

Data Description

The research was conducted at SMA Negeri 5 Pematangsiantar, Pematangsiantar City, North Sumatra Province. This research was conducted on August 27, 2025 to September 8, 2025 in the 2025/2026 academic year. The purpose of this study was to see the effect of the *Discovery learning model* on students' mathematical critical thinking skills on the material of Arithmetic Sequences and Series using one sample, namely class X-3 consisting of 30 students (Ali & Setiani, 2018).

When conducting the research, learning was carried out in 4 meetings, where in the first and second meetings the treatment was carried out, in the third meeting a questionnaire was carried out and in the fourth meeting a test was carried out on students' mathematical critical thinking skills.

Table 1. Research Allocation

No.	Activity	Date
1.	Observation	April 24, 2025
2.	Proposal Preparation	April 24, 2025 - July 16, 2025
3.	Proposal Seminar	July 18, 2025
4.	Instrument Trial	August 27, 2025
5.	Study	27 August 2025 – 08 September 2025
6.	Processing data	09 September – 10 October 2025

Instrument Validation

Before conducting the research, the researcher first conducted a validation test of the research instrument, this validation was carried out to obtain an instrument that met valid criteria. The instruments tested were a test of students' mathematical critical thinking abilities and a questionnaire to lecturers and mathematics study teachers as validators, namely Mrs. Theresia Monika Siahaan, M.Pd as a Mathematics Lecturer at HKBP Nommensen University Pematangsiantar and Mrs. Desmawaty Saragih, S.Pd., M.Si as a mathematics teacher at SMA Negeri 5 Pematangsiantar. The following are the results of the validator of the students' mathematical critical thinking ability test and questionnaire (Muhamad, 2017).

Research Description

The purpose of this study was to determine whether there was an influence of the *Discovery Learning model* on the mathematical critical thinking skills of class X-3 students of SMA Negeri 5 Pematangsiantar. The data in this study were the results of students' mathematical critical thinking skills tests and student perception questionnaires.

The mathematics material taught in this study was Arithmetic Sequences and Series. After being given treatment in the form of the *Discovery Learning model*, a questionnaire was given to students regarding their perceptions of implementing the model, which they were to complete. Subsequently, to assess students' mathematical critical thinking skills, a mathematical critical thinking ability test was administered, which had been piloted in grades XI-1.

In this study, researchers obtained data from the results of a mathematical critical thinking ability test and a questionnaire conducted in class XI-1. The mathematical critical thinking ability test given was in the form of questions after implementing the *Discovery Learning model* well. The results of the mathematical critical thinking ability test and the perception questionnaire were used to determine whether the *Discovery Learning model* affected students' mathematical critical thinking abilities in the material of Arithmetic Sequences and Series.

The research instrument used in this study was a critical thinking ability test consisting of 4 descriptive questions and a model implementation questionnaire consisting of 20 statements. The researcher conducted a trial of the mathematical critical thinking ability test and the *Discovery Learning model implementation questionnaire* which would be used to collect data on the sample. After the trial was conducted, the next step was to collect data on students' mathematical critical thinking ability test scores and the model implementation questionnaire using questions. After the trial was conducted, the next step was to collect data on students' mathematical critical thinking ability test scores and the *Discovery Learning model implementation questionnaire scores* that had been tested. Then, class X-3 used as the sample class was given treatment using the *Discovery Learning model* with the material Arithmetic Sequences and Series. The data on student questionnaire scores implementing the *Discovery Learning model* and mathematical critical thinking ability test scores obtained using the *SPSS 26.0 program* are presented in table (SARI, 2021).

Table 2. Description of Model Implementation and Mathematical Thinking Ability

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
Model Discovery Learniing	30	39	76	1860	62,00	8,493	72,138
Kemampuan Berpikir Kritis	30	14	40	942	31,40	6,112	37,352
Valid N (listwise)	30						

In the table, the student questionnaire implemented the *Discovery Learning model* with a minimum score of 39 and a maximum score of 76. The average value of the student questionnaire implemented the model of 62.00. This shows that students have followed the steps of the *Discovery Learning model* well. The minimum score of critical thinking ability is 14 and the maximum score is 40. The maximum score of students' mathematical critical thinking test is 40 with a conversion of 100 for a score of 40. The average value of students' mathematical critical thinking based on the test results is 31.40. Based on the average value, it can be concluded that students have obtained adequate test results (Anugraini & Muflihah, 2021).

Hypothesis Test Analysis

Simple Linear Regression Test Results

The strength of the relationship between the independent variable (X) and the dependent variable (Y) and the direction of the relationship between the independent variable (X) and the dependent variable (Y) is measured using a simple linear regression test. Based on the simple linear regression test that has been carried out using the *SPSS 26.0* and *Excel programs* , the results are obtained in the table.

Table 3. Simple Lear Regression Test Results

	Coefficients [a]					
		Unstandardized Coefficients		Standardized Coefficients		
SPSS 26.0	Model	B	Std. Error	Beta	t	Sig.
	1 (Constant)	-6,179	4,585		-1,348	0.189
	Discovery Learning Model	0.606	0.073	0.842	8,270	0,000
	a. Dependent Variable: Critical Thinking Skills					

			Standard	
		Coefficients	Error	t Stat
Excel	Intercept	-6,179349904	4,585048	-1.34772
	X Variable 1	0.606118547	0.073291	8.270072

Based on calculations using *SPSS 26.0* and *Excel* as shown in table 4.12, the values obtained $a = -6,179$and $b = 0,606$, thus the regression equation obtained are as follows:

$Y^{\wedge} = -6,179 + 0,606X$

Information

$Y^{\wedge}$: students' mathematical critical thinking skills

X: Student questionnaire scores on the implementation of the *Discovery Learning model*

From the regression equation above, the following information can be obtained:

a. A value $a$of -6.179 indicates that when students do not provide a perception of the *Discovery learning model* (X=0), the value of critical thinking skills will decrease or decline.

b. The value, $b$namely the regression coefficient of 0.606, shows that each score on the questionnaire will cause an increase in mathematical critical thinking ability of 0.606.

c. positive value indicates that there is a positive influence between the independent variable (X) and the dependent variable (Y). From the explanation above, it can be concluded that the b*Discovery Learning model* has a positive influence on students' critical mathematical thinking skills.

Regression Significance Test (t-Test)

The t-test was conducted to test the research hypothesis regarding the influence of each independent variable partially on the dependent variable. Based on table 4.12, it was obtained that the calculated t value was 8.27. From the t distribution table with df = 30 - 2 = 28 and $\propto = 0,05$it was obtained that the t table = 2.048. Because the calculated t value > t table = 8.27 > 2.048, it can be concluded that Ha is accepted which states that there is a positive and significant influence of the *Discovery Learning model* on students' mathematical critical thinking abilities (Masitoh & Aedi, 2020).

Coefficient of Determination

The coefficient of determination indicates how strong the influence of the independent variable (X) is on the dependent variable (Y) (Herlambang & Hidayat, 2016). Based on the calculation of the coefficient of determination that has been carried out using the *SPSS 26.0* and *Excel programs,* the results obtained are as follows:

Table 4. Coefficient of Determination

SPSS 26.0	**Model Summary**				
	Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
	1	.842 ᵃ	0.710	0.699	3,35219
	a. Predictors: (Constant), Discovery Learning Model				

EXCELL	*Regression Statistics*	
	Multiple R	0.842333528
	R Square	0.709525773
	Adjusted R Square	0.699151694
	Standard Error	3.352193752
	Observations	30

Based on the calculations in table 4.14, the value obtained r^2 is 0.710, so the coefficient of determination value is: $KP = 0,710 \times 100\% = 71\%$.

The percentage of the coefficient of determination shows that the contribution of the variance of variable X (*Discovery Learning model) to variable Y (mathematical critical thinking ability) is 71%. Based on the results of the calculation of the coefficient of determination, it shows that the Discovery* Learning model has an influence of 71% on students' mathematical critical thinking ability.

Discussion

This research was conducted at SMA Negeri 5 Pematangsiantar, where this research took class X as the research population and took class X-3 as the research sample and the class where the researcher provided treatment.

Before conducting this research, the researcher first conducted a trial of the instrument to determine whether the test and questionnaire instruments met research standards. In this study, the instrument trial was conducted in grade 11. After the data was obtained, the test instrument was tested for validity, reliability, difficulty level, and discriminatory power. Meanwhile, the questionnaire instrument was tested for validity and reliability (Muakhirin, 2014).

Based on the trial data of the students' mathematical critical thinking ability test and the student perception questionnaire in the trial class with a sample size *N* of 33 and a significance level of α = 0.05 , the value *r tabel*= 0.344 was obtained. From the calculation of the validity of the 4 test questions and 20 questionnaire items, it was obtained that *r hitung > r tabel* both the test instrument and the questionnaire instrument were valid and suitable for use in research. Then, from the results of the test item reliability test, the Cronbach's Alpha value was obtained of 0.636 and the results of the questionnaire item reliability test, the Chronbach's Alpha value was obtained of 0.888. Research data is said to be reliable if the Chronbach's Alpha value is > 0.60, so it can be concluded that the test questions and questionnaire items are obtained that 4 test questions are in the moderate category. Finally, based on the results of the discrimination power test, it was obtained that the four test questions have moderate discrimination power (Mustafa & Dwiyogo, 2020).

After determining that the research instrument met research standards, the researcher then conducted the research. The research implementation process was as follows: First, the researcher administered treatment to the experimental class using the *Discovery Learning model* . After the treatment was implemented, the researcher administered the test instrument. mathematical critical thinking skills and student perception questionnaires on whether students can follow learning well using the *Discovery Learning model* .

After obtaining data from the research, the researcher then analyzed the research data. Before testing the hypothesis, the prerequisite tests were first carried out, namely the normality test and the linearity test. This normality test was carried out using the *SPSS 26.0* and *Excel programs* . The basis for making decisions in the normality test is that the data is declared normally distributed if the significance value (Sig) is > 0.05. Based on the calculation results, the significance value of the student's mathematical critical thinking ability test is 0.143 and the significance of the student perception questionnaire is 0.200 because the significance value is > 0.05, so the research data is normally distributed.

After conducting the normality test, the researcher then conducted a linearity test. The linearity test was also conducted using *SPSS 26.0* and *Excel* . The basis for decision making in the linearity test is that the independent variable (X) is said to have a linear relationship with the dependent variable (Y) if the significance value in *Deviation From Linearity* > 0.05. Based on the calculation results, the significance value is 0.685 because the significance value is > 0.05, so there is a linear relationship between the independent variable (X) and the dependent variable (Y) (Suharno, 2020).

After conducting the prerequisite tests, the researchers then continued their research by conducting hypothesis tests consisting of simple linear regression analysis, t-tests, and coefficients of determination. Based on calculations in the simple linear regression analysis, the regression equation obtained was:$Y^{\hat{}} = -6{,}179 + 0{,}606X$ (Wahyuni & Ulum, 2025).

Because the regression coefficient (b) is positive, this indicates that there is a positive influence of the *Discovery Learning model* on students' mathematical critical thinking abilities. For the t-test, based on the results of calculations using the *SPSS 26.0* and *Excel programs, a value* of 8.27 *t tabel*was obtained (Tri Pudji Astuti, 2019).. The value of α *t hitung*= 2.048. Because *t hitung > t tabel* α, it is concluded that the independent variable (X) has a significant effect on the dependent variable (Y). Based on the calculation of the coefficient of determination, the value is obtained $r^2 = 0{,}710$, this indicates that the variable X (*Discovery Learning model*) has an effect of 71% on the variable Y (students' mathematical critical thinking abilities).

Based on the description above, it can be concluded that there is a positive influence of the *Discovery Learning model* on students' mathematical critical thinking skills. Therefore, the hypothesis stating that there is a positive and significant influence of the *Discovery Learning model* on students' mathematical critical thinking skills on the material of Arithmetic Sequences and Series at SMA Negeri 5 in Pematangsiantar is accepted as true.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that there is a significant influence of the *Discovery Learning Model* on Students' Mathematical Critical Thinking

Skills on Arithmetic Sequences and Series Material at SMA Negeri 5 Pematangsiantar. This influence can be seen from the regression equation $Y^{\hat{}} = -6,179 + 0,606X$ with a regression coefficient of 0.606 and a large determination coefficient of 71% which indicates that there is a very strong relationship between the *Discovery Learning Model* and Students' Mathematical Critical Thinking Skills.

Suggestion

Based on the results of this study, the researcher would like to provide the following suggestions:

1. For mathematics subject teachers at SMA Negeri 1 Pematangsiantar, they can try using the *Discovery Learning model* so that the learning model used is more varied and can increase activity and improve the quality of education.
2. *Discovery Learning* model has a positive influence on students' mathematical critical thinking skills in the material of Arithmetic Sequences and Series so that other researchers can try using the *Discovery Learning model* for other mathematical materials.
3. By implementing the *Discovery Learning model* , it is hoped that students will become more active in learning and can interact better with their classmates so that they can more easily understand the material in mathematics learning.

REFERENCE

Ade, P. (2020). *Pengaruh Model Pembelajaran Discovery Learning Terhadap Hasil Belajar Pendidikan Kewarganegaraan Siswa Kelas Iv Sekolah Dasar Negeri 14 Bermani Ilir Kabupaten Kepahiang*. Iain Bengkulu. Opgehaal Van Http://Repository.Iainbengkulu.Ac.Id/Id/Eprint/5172

Ali, M., & Setiani, D. D. (2018). Pengaruh Model Discovery Learning Terhadap Hasil Belajar Peserta Didik Pada Konsep Jamur. *Bioedusiana: Jurnal Pendidikan Biologi*, 3(2), 59–63.

Anawati, R. Y., Mujasam, M., Widyaningsih, S. W., & Yusuf, I. (2020). Pengaruh Model Discovery Learning Berbasis Alat Peraga Sederhana Fisika Materi Usaha Dan Energi Terhadap Higher Order Thinking Skills (Hots). *Curricula: Journal Of Teaching And Learning*, 5(3), 119–128. Https://Doi.Org/Http://Doi.Org/10.22216/Jcc.2020.V5i3.4446

Anugraini, A. P., & Muflihah, M. (2021). Penerapan Student Team Achievement Divisions (Stad) Menggunakan Alat Peraga Untuk Meningkatkan Prestasi Belajar Matematika. *Prismatika: Jurnal Pendidikan Dan Riset Matematika*, 4(1), 31–37. Https://Doi.Org/10.33503/Prismatika.V4i1.1410

Astiti, N. K. A., Rini Kristiantari, M. G., & Saputra, K. A. (2021). Efektivitas Model Pembelajaran Discovery Learning Dengan Media Powerpoint Terhadap Hasil Belajar Ipa Siswa Sd. *Journal Of Education Action Research*, 5(3), 409–415. Https://Doi.Org/10.23887/Jear.V5i3.36695

Forootan, M. M., Larki, I., Zahedi, R., & Ahmadi, A. (2022). Machine Learning And Deep Learning In Energy Systems: A Review. *Sustainability*, *14*(8), 4832. Https://Doi.Org/10.3390/Su14084832

Herlambang, A. D., & Hidayat, W. N. (2016). Edmodo Untuk Meningkatkan Kualitas Perencanaan Proyek Dan Efektivitas Pembelajaran Di Lingkungan Pembelajaran Yang Bersifat Asinkron. *Jurnal Teknologi Informasi Dan Ilmu Komputer*, *3*(3), 180. Https://Doi.Org/10.25126/Jtiik.201633193

Hi Rahman, M., Latif, S., & Saban, M. M. (2022). Implementasi Model Discovery Learning Untuk Meningkatkan Kemampuan Literasi Sains Siswa Kelas Xi Man 2 Halmahera Utara. *Jurnal Pendidikan Fisika*, *10*(2), 259. Https://Doi.Org/10.24127/Jpf.V10i2.5660

Istianingsih Hermawati, L., & Andayani, E. (2020). Kompetensi Pedagogik Guru, Model Discovery Learning, Dan Gaya Belajar Terhadap Kemandirian Belajar. *Jurnal Penelitian Dan Pendidikan Ips*, *14*(1), 22–30. Https://Doi.Org/10.21067/Jppi.V14i1.4761

Jumiarti, A., Dimpudus, A., & Haeruddin, H. (2021). Efektivitas Model Pembelajaran Discovery Learning Dan Problem Based Learning Ditinjau Dari Hasil Belajar Matematika Siswa Pada Materi Turunan. *Primatika : Jurnal Pendidikan Matematika*, *10*(1), 33–42. Https://Doi.Org/10.30872/Primatika.V10i1.404

Kristin, F., & Rahayu, D. (2017). Pengaruh Penerapan Model Pembelajaran Discovery Learning Terhadap Hasil Belajar Ips Pada Siswa Kelas 4 Sd. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *6*(1), 84–92.

Masitoh, L. F., & Aedi, W. G. (2020). Pengembangan Instrumen Asesmen Higher Order Thinking Skills (Hots) Matematika Di Smp Kelas Vii. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *4*(2), 886–897. Https://Doi.Org/10.31004/Cendekia.V4i2.328

Muakhirin, B. (2014). Peningkatan Hasil Belajar Ipa Melalui Pendekatan Pembelajaran Inkuiri Pada Siswa Sd. *Jurnal Ilmiah Guru "Cope"*, (01), 51–55.

Muhamad, N. (2017). Pengaruh Metode Discovery Learning Untuk Meningkatkan Representasi Matematis Dan Percaya Diri Siswa. *Jurnal Pendidikan Uniga*, *10*(1), 9–22. Https://Doi.Org/Https://Dx.Doi.Org/10.52434/Jp.V10i1.83

Mustafa, P. S., & Dwiyogo, W. D. (2020). Kurikulum Pendidikan Jasmani, Olahraga, Dan Kesehatan Di Indonesia Abad 21. *Jartika Jurnal Riset Teknologi Dan Inovasi Pendidikan*. Https://Doi.Org/10.36765/Jartika.V3i2.268

Pramesti, D., Probosari, R. M., & Indriyanti, N. Y. (2022). Effectiveness Of Project Based Learning Low Carbon Stem And Discovery Learning To Improve Creative Thinking Skills. *Journal Of Innovation In Educational And Cultural Research*, *3*(3), 444–456. Https://Doi.Org/10.46843/Jiecr.V3i3.156

Romlah, S. A., & Andi, H. J. (2021). *Pengaruh Model Pembelajaran Discovery Learning Berbantuan Video Pembelajaran Terhadap Hasil Belajar Fisika Siswa Sma*. *8*(2), 1–5.

Sari, D. N. (2021). Pengaruh Penggunaan Discovery Learning Dengan Scramble Terhadap Keaktifan Belajar Dan Hasil Belajar Matematika Siswa Kelas X Sma N 1 Klego

Kabupaten Boyolali Semester Ii Tahun Pelajaran 2020 / 2021. *Secondary: Jurnal Inovasi Pendidikan Menengah*, 1(3), 136–149. Https://Doi.Org/10.51878/Secondary.V1i3.320

Setiaji, R., Koeswanti, H. D., & Giarti, S. (2018). Perbedaan Penggunaan Discovery Learning Dan Problem Solving Terhadap Hasil Belajar Ipa Siswa Kelas 4 Sd Gugus Cokro Kembang Jenawi Karanganyar. *Jurnal Basicedu*, 2(1), 11–18.

Simangunsong, A. D. B., & Pane, E. P. (2021). Pengembangan Modul Kimia Dasar Berbasis Discovery Learning Pada Materi Stoikiometri. *Edukatif: Jurnal Ilmu Pendidikan*, 3(6), 4415–4425. Https://Doi.Org/Https://Doi.Org/10.31004/Edukatif.V3i6.1472

Simarmata, S. M., Sinaga, B., & Syahputra, H. (2022). Analisis Kemampuan Pemahaman Konsep Matematika Siswa Dalam Penerapan Model Discovery Learning Berbantuan Matlab. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 6(1), 692–701. Https://Doi.Org/10.31004/Cendekia.V6i1.1227

Simatupang, J. M., & Simamora, P. (2019). Pengaruh Model Pembelajaran Discovery Learning Terhadap Hasil Belajar Siswa Pada Materi Pokok Momentum, Impuls Dan Tumbukan Kelas X Semester Ii Di Sma N 1 Pancurbatu Tp. 2016/2017. *Inpafi (Inovasi Pembelajaran Fisika)*, 6(4). Https://Doi.Org/10.24114/Inpafi.V6i4.12482

Subagio, L., Karnasih, I., & Irvan, I. (2021). Meningkatkan Motivasi Belajar Siswa Dengan Menerapkan Model Discovery-Learning Dan Problem-Based-Learning Berbantuan Geogebra. *Jurnal Pendidikan Matematika Raflesia*, 6(2), 15–26. Https://Doi.Org/Https://Doi.Org/10.33369/Jpmr.V6i2.15733

Suharno, S. (2020). Penggunaan Model Pembelajaran Flipped Classroom Untuk Pembelajaran Daring Sosiologi Di Masa Pandemi Covid-19 Kelas X.Ips Sma Negeri 1 Juwana Kab. Pati Tahun 2020. *Ijtimaiya: Journal Of Social Science Teaching*, 4(2), 120. Https://Doi.Org/10.21043/Ji.V4i2.8571

Tri Pudji Astuti. (2019). Model Problem Based Learning Dengan Mind Mapping Dalam Pembelajaran Ipa Abad 21. *Proceeding Of Biology Education*, 3(1), 64–73. Https://Doi.Org/10.21009/Pbe.3-1.9

Ujud, S., Nur, T. D., Yusuf, Y., Saibi, N., & Ramli, M. R. (2023). Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Hasil Belajar Siswa Sma Negeri 10 Kota Ternate Kelas X Pada Materi Pencemaran Lingkungan. *Jurnal Bioedukasi*, 6(2), 337–347. Https://Doi.Org/10.33387/Bioedu.V6i2.7305

Wahyuni, N. S., & Ulum, M. (2025). Implementasi Metode Outdoor Learning Dalam Meningkatkan Motivasi Belajar Siswa Pada Mata Pelajaran Pendidikan Agama Islam. *Jiip - Jurnal Ilmiah Ilmu Pendidikan*, 8(6), 6117–6124. Https://Doi.Org/10.54371/Jiip.V8i6.8295