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THE EFFECT OF RESEARCH-BASED LEARNING MODELS USING THE PHOTOMATH APPLICATION ON MATHEMATICS LEARNING OUTCOMES OF GRADE X STUDENTS

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ABSTRAK

Pembelajaran matematika sering dikaitkan dengan hasil belajar. Hasil belajar matematika adalah kemampuan yang dimiliki oleh siswa, termasuk kemampuan kognitif, afektif, dan psikomotorik setelah mengikuti proses pembelajaran matematika. Penelitian ini bertujuan untuk menentukan pengaruh Model Pembelajaran Inkuiri melalui Aplikasi Photomath terhadap hasil belajar matematika siswa kelas X Br. 2 Sekolah Menengah Kejuruan Negeri 1 Pematangsiantar pada tahun ajaran 2025/2026. Jenis penelitian yang digunakan dalam penelitian ini adalah penelitian kuantitatif. Dalam penelitian ini, bentuk desain yang digunakan adalah One-Shot Case Study. Penelitian ini akan dilaksanakan di Sekolah Menengah Kejuruan Negeri 1 Pematangsiantar, yang berlokasi di Jl. Bali No. 5, Bantan, Kec. Siantar Bar., Kota Pematang Siantar, Sumatera Utara 21142. Periode pelaksanaan penelitian direncanakan berlangsung selama sekitar 1 bulan pada semester ganjil tahun ajaran 2025/2026. Berdasarkan hasil analisis data dan pembahasan, dapat disimpulkan bahwa terdapat pengaruh positif dan signifikan dari penggunaan model pembelajaran inkuiri melalui aplikasi Photomath terhadap hasil belajar matematika siswa kelas X BR 2 SMPK Negeri 1 Pematangsiantar pada tahun ajaran 2025/2026. Pengaruh tersebut ditunjukkan melalui persamaan regresi Y = 10,639 + 0,069X, dengan nilai b = 0,069. Melalui uji t, yaitu thitung > ttabel (2,109 > 2,048), hal ini menunjukkan signifikansi, dan dengan menggunakan koefisien determinasi, dapat dilihat bahwa pengaruhnya sebesar 13,7%.

Keywords:
Model Pembelajaran, Inkuiri, Photomath Hasil Belajar Matematika

ABSTRACT

Mathematics learning is often associated with learning outcomes. Mathematics learning outcomes are the abilities possessed by students, including cognitive, affective, and psychomotor abilities after participating in the mathematics learning process. This study aims to determine the Effect of the Inquiry Learning Model Through the Photomath Application on the Mathematics Learning Outcomes of Class X Br. 2 Students of State Vocational School 1 Pematangsiantar Academic Year 2025/2026. The type of research used in this study is quantitative research. In this study, the design form used is One-Shot Case Study. This research will be carried out at State Vocational School 1 Pematangsiantar, which is located at Jl. Bali No. 5, Bantan, Kec. Siantar Bar., Pematang Siantar City, North Sumatra 21142. The research implementation time is planned to last for approximately 1 month in the odd semester of the

2025/2026 academic year. Based on the results of data analysis and discussion, it can be concluded that there is a positive and significant influence of the use of the inquiry learning model through the photomath application on the mathematics learning results of class X BR 2 students of SMPK Negeri 1 Pematangsiantar in the 2025/2026 academic year. The influence is shown through the regression equation Y = 10.639 + 0.069X, with a b value = 0.069. By means of the t-test, namely thitung > ttabel (2.109 > 2.048) that it is significant and by using the coefficient of determination it can be seen that the influence is 13.7%.

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1. Introduction

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 morals, and skills needed by themselves, society, nation and state. According to Law Number 20 of 2003 concerning the National Education System, Article 3, the goal of national education is to develop the potential of students to become people who believe in and fear God Almighty, have noble morals, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. (Kurniawan, 2013).

Mathematics ability in Indonesia is currently experiencing a worrying condition, this is in line with the results of international surveys such as the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) which show that Indonesian students' mathematics achievement is still lagging behind other countries (Puspendik Kemendikbud., 2019). In PISA 2022, Indonesia was ranked 68th with a score of 379. Similar results were also seen in TIMSS. In TIMSS 2015, Indonesia was ranked 44th out of 49 countries with an average score of 397 in mathematics (Suherman & Susanti, 2020) . Mathematics is one of the subjects studied from elementary school to university level with concepts learned ranging from the concrete to the abstract. Through mathematics, students are also taught and prepared to be able to face global challenges. Whether we realize it or not, mathematics lessons are one of the keys to student success in facing the world of work and social life. Indonesia still lags far behind other countries, although some individual Indonesian students have achieved success on the international stage. This is not a reflection of Indonesian education. This is a common occurrence globally (Zahra & Yahfizham, 2024) Education, namely student learning outcomes in mathematics, are very low. This is caused by a lack of student activity in the mathematics learning process. (Sibuea et al., 2022).

Mathematics learning is often associated with learning outcomes. Mathematics learning outcomes are the abilities possessed by students, including cognitive, affective,

and psychomotor abilities after participating in the mathematics learning process (Tohir, 2020) . Furthermore, learning outcomes are a benchmark for seeing students' success in understanding the material after carrying out learning activities and obtaining it through evaluation, and the quality of success is obtained from tests at the end of learning (Paba et al., 2020). To assist in evaluating the learning outcomes of each cognitive style, an educational classification method known as the Revised Bloom's Taxonomy is used (Damayani & Yahfizham, 2024). Taxonomy in the field of education functions to classify instructional objectives which are categorized into three domains, namely: the cognitive domain, related to thinking; the affective domain, related to attitudes; and the psychomotor domain, which is skill-oriented. The revised Bloom's taxonomy is a change from nouns to verbs. Changes are made to be in accordance with educational objectives that indicate that students are able to do something (nouns) with something (verbs). The taxonomy revision was carried out by Krathwohl and Anderson in the cognitive domain, namely: 1. remember; 2. understand; 3. apply; 4. analyze; 5. evaluate; and 6. create.

Exponents are the general form of a number with a power of an, where a is called the base number and n is called the exponent. Exponents are one of the materials taught in vocational school class X. One of the lessons that studies exponents involves understanding the concept of repeated multiplication. Exponent material is included in the prerequisite material needed in many other mathematical materials such as algebra, calculus, and trigonometry (Amijaya et al., 2018).

One of the efforts that can be made to solve the above problems is by using an effective learning model to improve optimal learning outcomes, namely the inquiry learning model, on the grounds that this inquiry learning model has never been implemented in schools. The use of the inquiry learning model can create interesting and enjoyable learning (Junaidi & Duling, 2020) . states that "the inquiry 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 own findings with confidence". The inquiry model emphasizes the process of searching and finding, the role of students in this model is to search and find their own solutions to problems in a subject matter while the teacher acts as a facilitator and guide for students to learn. In general, inquiry is a varied process and encourages students to investigate problems and find information. Therefore, in order to achieve student learning outcomes and create a more effective learning process, it is important to apply various teaching methods in the learning process, one effort that can be made is to use the inquiry learning model (Permatasari et al., 2019) .

Mathematics learning becomes more optimal when the inquiry model is combined with the Photomath application. This combination is important because inquiry encourages students to ask questions and find solutions, while Photomath serves as a verification tool after students have conducted the inquiry or found the answer themselves, rather than as an instant solution. Utilizing Photomath can also facilitate step-by-step understanding and prevent students from becoming monotonous in their learning. Based on observations, Photomath has never been implemented in learning. (Ante et al., 2020).

Based on the description of the problem above, the researcher is interested in conducting research with the title "The Effect of the Inquiry Learning Model Through the Photomath Application on the Mathematics Learning Outcomes of Class X Students of BR. 2 SMK NEGERI 1 Pematangsiantar TA. 2025/2026".

2. Method

The type of research used in this study is quantitative research. According to Sugiyono (Mahanani & Muchtar, 2019), Quantitative research methods can be interpreted as research methods based on the philosophy of positivism, used to research certain populations or samples, sampling techniques are generally carried out randomly, data collection uses research instruments, data analysis is quantitative/statistical with the aim of testing predetermined hypotheses.

In this research, the design used is One-Shot Case Study. The treatment given to the experimental class was the use of the Inquiry learning model. Researchers only conducted treatment once which was thought to have had an effect. Then a test is held and conclusions are drawn (Siahaan, 2018)

This research will be conducted at SMK Negeri 1 Pematangsiantar, located at Jl. Bali No. 5, Bantan, Kec. Siantar Bar., Pematang Siantar City, North Sumatra 21142. The selection of this location is based on accessibility considerations and the availability of classes relevant to the research topic. (Asni et al., 2020) . The research implementation period is planned to last for approximately 1 month in the odd semester of the 2025/2026 academic year. According to Sugiyono (2024), population is a generalization area consisting of: objects/subjects that have certain qualities and characteristics determined by the researcher to be studied and then conclusions drawn. Thus, the population in this study is all class X BR students at SMK Negeri 1 Pematangsiantar in the 2025/2026 academic year.

According to Sugiyono (Nurmayani et al., 2018) A sample is a portion of the population and its characteristics. In determining the sampling technique, researchers used purposive sampling. Purposive sampling, according to Sugiyono (Rahmadhani & Fitria, 2020), is used. is sampling using certain considerations according to the desired criteria to determine the number of samples to be studied. The sample of this study was 30 students of SMK Negeri 1 Pematangsiantar class X BR 2 who were selected to be samples in the research that the researcher will conduct with the hope that the research results can describe the entire population.

The test used in this study was a mathematics learning outcome test in the form of essay questions. The test aimed to influence the mathematics learning outcomes of class X BR 2 students. The test was conducted only once, namely the test that was conducted after the treatment (test) was given to influence students' mathematics learning outcomes after the application of the Inquiry learning model.

According to Sugiyono (Juliana, 2018) A questionnaire is a data collection technique that involves providing respondents with a set of written questions or statements to answer. A questionnaire is an efficient data collection technique if the

researcher knows exactly which variables to measure and what to expect from the respondents. Questionnaires are administered to assess students' perceptions of learning using the Inquiry learning model. He states that observation is a complex process, a process composed of various observation and memory processes. This observation technique is used by researchers to collect data by directly observing the learning model used during class and systematically recording the phenomena being investigated to obtain the necessary data.

Documentation, a data collection technique that involves collecting teacher and student documents to clarify the primary data obtained. This documentation can take the form of photographs, recordings, student work, etc. The results of this study will be more credible if supported by photographs or existing academic and artistic works. The documentation method used in this study was to obtain student names and school identification data.

According to Sugiyono (Zahidah et al., 2020) data analysis is an activity after data from all respondents or other data sources have been collected. Activities in data analysis are: grouping data based on variables and type of respondent, tabulating data based on variables from all respondents, presenting data for each variable studied, carrying out calculations to answer the problem formulation, and carrying out calculations to test hypotheses.

3. Result and Discussion

Description of Research Results

Based on the research that the researcher has done, the researcher wants to explain whether there is an influence of the inquiry learning model through the photomath application on the mathematics learning outcomes of class X BR 2 students at SMK Negeri 1 Pematangsiantar, the researcher conducted the research using quantitative methods. The implementation of the research and data collection were carried out at SMK Negeri 1 Pematangsiantar Jl. Bali No. 5, Bantan, West Siantar district, Pematang Siantar City, North Sumatra Province in Class X BR 2. The research took place on July 23, 2025 to August 7, 2025. The learning process was carried out using the inquiry learning model through the photomath application on the material of Exponents and exponential equations in class X BR 2. The population used in this study were all class X students. The sample in the study consisted of 1 class, namely class X BR 2 with a total of 30 students (Zahidah et al., 2020) .

The research instruments used in this study were questionnaires and tests, with the questionnaire consisting of 20 statements and the test consisting of 20 multiple-choice questions consisting of six indicators of students' mathematics learning outcomes. The questionnaire and test were submitted to 2 (two) validators, namely Drs. Ropinus Sidabutar, M.Pd. (Lecturer at HKBP Nommensen University, Pematang Siantar in the field of mathematics education) and Evi M, Purba, S.Pd. (Mathematics teacher at SMK Negeri 1 Pematangsiantar) to determine whether the questionnaire and test were suitable for use in research. The results of instrument validation from 2 validators, the researcher concluded that the questions were suitable for use without revision.

Research Description

The aim of this research was to determine whether there was an influence of the learning model. inquiry through photomath application on mathematics learning outcomes of class X BR. 2 students at SMK Negeri 1 Pematangsiantar . The data in this study are the results of the students' mathematics learning outcomes test. The mathematics material taught in this study is Exponents and Exponential Equations. After being given treatment in the form of an inquiry learning model through the photomath application , a student questionnaire was given to implement the model which will be filled in by the students. After that, to see the students' mathematics learning outcomes, a student mathematics learning outcome test was given that had been tested first in class XI to 1. In this study, researchers obtained data from the results of the student questionnaire implementing the model and the student mathematics learning outcome test carried out in class X BR 2. The questionnaire was used to see whether students had implemented the inquiry learning model through the photomath application according to the steps, while the student mathematics learning outcome test was a question given after implementing the inquiry learning model through the photomath application . The results of the questionnaire on the implementation of the model and the results of the students' mathematics learning outcomes test were used to determine whether the inquiry learning model through the photomath application had an effect on students' mathematics learning outcomes (Ansori et al., 2021) .

The research instrument used in this study was a student questionnaire implementing the model consisting of 20 statements and student mathematics learning outcomes consisting of 20 multiple-choice questions. The researcher conducted a trial of the questionnaire implementing the inquiry learning model through the photomath application and the student mathematics learning outcome test which would be used to collect data on the sample. After the trial was carried out, the next step was to collect data on the questionnaire scores for the implementation of the model and the student mathematics learning outcome test scores using the questions that had been tested (Waruwu et al., 2024) . Then, class X BR 2, which was used as the sample class, was given treatment using the inquiry learning model through the photomath application on the material Exponents and Exponential Equations. The data on the questionnaire scores for students implementing the inquiry learning model through the photomath application and the student mathematics learning outcome test scores obtained using *the SPSS 26.0 program* is presented in Table 4.9

Table 1. Description of the Learning Mode and Test Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
angket	30	47	80	63.83	7.670
tes	30	12	18	15.07	1.437
Valid N (listwise)	30				

In the figure, the student questionnaires implementing the inquiry learning model through the photomath application are obtained with a minimum score of 47 and a

maximum score of 80. The maximum score of the student questionnaire implementing the model is 80. The average value of the student questionnaire implementing the model is 63.83. This shows that students have followed the steps of the inquiry learning model through the photomath application well. The minimum score of the students' mathematics learning results is 12 and the maximum score is 18. The maximum score of the mathematics learning results test is 18 with a conversion value of 100 for a score of 18. The KKM value for the mathematics learning results obtained by students is 60. The average value of the students' mathematics learning results is 15.07. Based on the average value of the learning results, it shows that students have obtained learning results above the KKM value.

t-Test Analysis

The regression coefficient is tested using the t-test. Assuming other variables are constant, this test is used to assess the significance of the influence of the independent variable on the dependent variable.

Table 2. Test Results with t-Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	10.639	2.114		5.034	.000
	angket	.069	.033	.370	2.109	.044

a. Dependent Variable: tes

Based on the table, the sig. value for the influence of variable X on variable Y is 0.044 < 0.05. Given n = 30, then df = n − k = 30 − 2 = 28. With df = 28, then t_{tabel} with $\alpha = 5\%$is 2.048. Therefore, the value obtained is $t_{hitung} > t_{tabel}$ 2.109 > 2.048. So based on the significance value (sig.) and the value t_{hitung}, the hypothesis H1 is accepted, namely there is an influence of the inquiry learning model through the photomath application on students' mathematics learning outcomes (Putri & Ariani, 2020) .

Discussion

This research was conducted at SMK Negeri 1 Pematangsiantar involving Class X BR2 who will be given an inquiry model treatment through the photomath application. Trialing the test instruments and questionnaires before the research is highly recommended. This aims to determine whether the statements or questions are in accordance with the research guidelines. In this study, students of class XI TO 1 at SMKS 2 Tamansiswa became the trial class for the student questionnaire implementing the model and testing the results of student mathematics learning (Mayassari et al., 2023) .

Then the validity, reliability, difficulty level, and question discrimination tests were conducted. Based on the trial of the student questionnaire implementing the model and the student mathematics learning outcome test that had been carried out with the number of trial students, N = 30 and a significance level of 5% obtained r_{tabel}= 0.361. From the results of the validity test calculation on the model implementation

questionnaire and the student mathematics learning outcome test, it was obtained that 20 model implementation questionnaires and 20 multiple choice questions of the student mathematics learning outcomes had a $_{\text{calculated r value}} > r_{\text{table}}$, so it can be concluded that the 20 student questionnaires implementing the model and the 20 student mathematics learning outcome tests were declared valid. Then for the decision-making criteria in the Cronbach's Alpha technique if the $_{\text{calculated r value}} > 0.70$ then the model implementation questionnaire and the student mathematics learning outcome test are said to be reliable, so the questionnaire and test can be used in research. From the results of the reliability test that has been carried out, the Cronbach's Alpha value for the questionnaire was 0.856. 0.856 > 0.70, it can be concluded that this questionnaire is reliable. Meanwhile, the results of the reliability test of the test obtained a Cronbach's Alpha value of 0.797. Because 0.797 > 0.70, it can be concluded that this test is reliable. Furthermore, in the calculation of the difficulty level test, it shows that there are 6 questions categorized as difficult, 7 questions categorized as medium, and 7 questions categorized as easy. Then, for the discriminating power, it shows that there are 9 questions categorized as sufficient, 7 questions categorized as good, and 4 questions categorized as very good.

After knowing that the student questionnaire implemented the model and the mathematics learning outcome test that had been tested had met the research standards, the researcher then conducted research with the initial stage of providing treatment to the sample using the learning model. inquiry through the photomath application . After completing the learning using the model, a student questionnaire was given to determine whether the students had implemented the learning model that had been applied. After administering the questionnaire, the researcher gave a mathematics learning outcome test on the material Exponents and Exponential Equations to determine the results of students' mathematics learning after being given the treatment (Syafruddin & Jeranah, 2020) .

After obtaining the model implementation scores and the results of the students' mathematics learning test scores, the data was analyzed. The results of the calculations The average score for implementing the inquiry model through the Photomath application was 63.83 and the average score for learning outcomes was 15.07.

There are normality tests and linearity tests as prerequisites before hypothesis testing. The normality test uses the *Kolmogorov-Smirnov model* in the *SPSS 25.0 program* with a sig. value criterion of > 0.05. The normality test of the inquiry model implementation data through the Photomath application obtained significant results (Sig.). of 0.200 > 0.05, then the data on the implementation of the inquiry model through the photomath application is normally distributed. Meanwhile, the significant result (Sig.) of the student mathematics learning outcome data is 0.076 > 0.05, so the learning outcome data is normally distributed (Setyawan, 2020) .

After conducting a normality test, the researcher conducted a linearity test. In this linearity test using *the SPSS 25.0 program* , the significant result (Sig.) of *the Deviation from Linearity row* was 0.423 > 0.05, indicating a linear relationship between the independent variable (X) and the dependent variable (Y). Therefore, it can be concluded

that there is a linear relationship between the inquiry learning model through the Photomath application and students' mathematics learning outcomes (Rahayu, 2022) .

Next, the researcher conducted a hypothesis test consisting of a simple linear regression test and a t-test. Based on the simple linear regression test, the regression equation Y = 10.639 + 0.069X was obtained, meaning that for every 1 additional score for the model implementation, the regression equation Y = 10.639 + 0.069X was obtained. inquiry through the photomath application , then the results of students' mathematics learning will increase by 0.069. In addition, the *sig. value obtained in the regression line is 0.044 <0.05, so H1 is accepted, meaning there is an influence of* the inquiry learning model through the photomath application on students' mathematics learning outcomes. Furthermore, the *R Square value* is 0.137, so the contribution of the variance of the variable X (inquiry learning model through the photomath application) on the Y variable (students' mathematics learning outcomes) for the Exponent and Exponential Equation material by 13.7%.

Next, the final hypothesis test is the t test. The sig. value obtained for the influence of variable X on variable Y is 0.044 < 0.05. Given n = 30, then df = n − k = 30 − 2 = 28. With df = 28, then t_{tabel} with $\alpha = 5\%$is 2.048. Therefore, the value obtained is $t_{hitung} > t_{tabel}$ 2.109 > 2.048. So based on the significance value (sig.) and the value t_{hitung} , the hypothesis H_1 is accepted, namely there is an influence of the inquiry learning model through the photomath application on students' mathematics learning outcomes on the material of Exponents and Exponential Equations.

Based on the description above, it can be concluded that there is an influence of the inquiry learning model through the photomath application on students' mathematics learning outcomes in the material on Exponents and Exponential Equations (Wulandari, 2024) .

The hypothesis states that there is an influence of the inquiry learning model through the photomath application Regarding the results of the mathematics learning of class X students on the material Exponents and Exponential Equations, the truth is accepted or H_1 is accepted

4. Conclusion

Based on the results of data analysis and discussion, it can be concluded that there is a positive and significant influence of the use of the inquiry learning model through the photomath application on the mathematics learning results of class X BR 2 students of SMPK Negeri 1 Pematangsiantar in the 2025/2026 academic year. The influence is shown through the regression equation Y = 10.639 + 0.069X, with a value of b = 0.069. By means of the t-test, namely thitung > ttabel (2.109 > 2.048) that it is significant and by using the coefficient of determination it can be seen that the influence is 13.7%.

Suggestion

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

1. For Teachers

By understanding that the inquiry learning model through the photomath application has an influence on students' mathematics learning outcomes, teachers are expected to have learning strategies that best suit the characteristics of the students they teach in order to create a more active, effective, and efficient learning process. Therefore, the selection of the inquiry learning model through the photomath application can be used as an alternative in the learning process in the classroom.

2. For Students

By understanding how the inquiry learning model through the Photomath application influences students' mathematics learning outcomes, it is hoped that students will expand their collection of problems, from the simplest to the most varied. Pay close attention while the teacher is teaching. Determine good and efficient learning methods, and students should be able to play an active role in teaching and learning activities so that the learning process can run smoothly.

3. For Further Researchers

For future researchers who wish to conduct the same research, it is recommended to develop this research by preparing other material presentations and optimizing time to improve students' mathematics learning outcomes.

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