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The Effect of Guided Inquiry Learning on Improving Students' Learning Outcomes and Science Process Skills on Chemical Bonding

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Abstract: The Effect of Guided Inquiry on Improving Learning Outcomes and Science Process Skills of Students on Chemical Bonding. This study aims to determine the effect of the guided inquiry learning model on student learning outcomes and KPS and its correlation to chemical bonding material. The research method used is quasi-experimental. This research was conducted at SMA Negeri 1 Berastagi. The sample of this study consisted of two classes, namely the experimental class which was taught using the guided inquiry model and the control class which was taught using the conventional learning model, each class consisted of 30 students. The instruments used are multiple choice tests (study outcomes), essay tests (science process skills), student worksheets and observation sheets on the implementation of science process skills. In this study, the data that was processed was the value of learning outcomes gain and science process skills of students in both classes. Data analysis was processed in the SPSS 21 application for windows. The data analysis technique used is analysis using the Independent Sample T-Test and to calculate the correlation, multiple correlation tests are used. The results showed that there was an influence of the guided inquiry learning model on student learning outcomes and science process skills and there was a significant correlation between student learning outcomes and student science process skills through the application of the guided inquiry learning model.

Keywords: Guided Inquiry, Learning Outcomes, Student Science Process Skills, Chemical Bonds

Abstrak: Pengaruh Pembelajaran Inkuiri Terbimbing terhadap Peningkatan Hasil Belajar dan Keterampilan Proses Sains Siswa pada Materi Ikatan Kimia. *Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran inkuiri terbimbing terhadap hasil belajar dan KPS siswa serta korelasinya pada materi ikatan kimia. Metode penelitian yang digunakan adalah kuasi experimen. Penelitian ini dilaksanakan di SMA Negeri 1 Berastagi. Sampel dari penelitian ini terdiri dari dua kelas yaitu kelas eksperimen yang dibelajarkan menggunakan model inkuiri terbimbing dan kelas kontrol yang dibelajarkan dengan model pembelajaran konvensional, masing-masing kelas berjumlah 30 siswa. Instrumen yang digunakan berupa tes pilihan ganda (hasil belajar), tes esai (keterampilan proses sains), lembar kerja peserta didik dan lembar observasi keterlaksanaan keterampilan proses sains). Dalam penelitian ini data yang diolah adalah nilai gain hasil belajar dan KPS siswa kedua kelas. Data dianalisis diolah menggunakan uji Independent Sample T-Test dan uji korelasi berganti menggunakan SPSS 21. Hasil penelitian menunjukkan bahwa terdapat pengaruh model pembelajaran inkuiri terbinbing terhadap hasil belajar dan KPS siswa serta terdapat korelasi yang signifikan antara hasil belajar dan KPS siswa melalui penerapan model pembelajaran inkuiri terbimbing.*

Kata kunci: *Inkuiri Terbimbing, Hasil Belajar, Ketdrampilan Proses Sains Siswa, Ikatan Kimia*

▪ INTRODUCTION

The world of education has an impact on the development of science and technology in industry 4.0, schools and higher education are required to be able to produce quality generations who can adapt to challenges. Various educational reform efforts have been implemented to improve the quality of education. One of the steps taken by the government to improve the quality of educational institutions is to implement a characteristic 2013 curriculum education system. The 2013 curriculum is a curriculum that requires students to play an active role in the learning process (student centered). The teacher acts as a facilitator or mediator as well as a learning designer so that students are active and creative in seeking new knowledge (Rahayu & Sutarno, 2021).

The results of the study (Nursafitri et al., 2019), in their journal said that many students considered chemical bonding material difficult to understand because students had difficulty distinguishing ionic bonds from covalent bonds which had a low impact on their chemistry learning outcomes. This can be seen from the number of students who are less active in learning, when students are given practice questions that are difficult, students do not work on questions and are not eager to find solutions to problems. Students prefer to wait for the teacher to solve the problem. This is indicated by the test results obtained by students in chemistry lessons, especially on the subject matter of chemical bonds. Data on the learning outcomes of class X students, especially on the subject matter of chemical bonds, stated that there were still students whose average score was lower than the specified KKM, which was 68.

Learning chemistry is not only mastering concepts, but the purpose of learning chemistry is to develop the ability to think and act based on the scientific knowledge it has, or better known as science process skills. Science process skills are very important skills to develop students' scientific attitudes and problem-solving skills, so that they can form students who are creative, critical, open, innovative and competitive in global competition in society (Suwandri et al., 2018). In addition, the current chemistry learning still emphasizes on the product, not the process. In fact, if the mastery of a good process will produce a good product as well. Good mastery can be realized through science process skills (Juniar and Fardilah, 2019).

Based on the results of an interview with one of the Chemistry teachers of SMA Negeri 1 Berastagi, it was found that the facts in learning that students' interest in studying chemistry was still very lacking. The teaching and learning process at SMA Negeri 1 Berastagi, chemistry is taught conventionally by using the lecture method, the learning process is only teacher-centered and students tend to be passive, resulting in low student chemistry learning outcomes which are marked by student test scores that on average do not reach number 77 which is the minimum completeness criteria for chemistry subjects at SMA Negeri 1 Berastagi. From the results of the interview, it was found that only 45% of students achieved the minimum completeness criteria score. In SMA Negeri 1 Berastagi, the chemistry material is usually explained by the teacher and then practice questions. In chemistry material, practicum activities are not carried out so that students have not been able to understand the material and have not been trained in science process skills to solve problems in practical activities, so that the objectives of learning chemistry have not been fully achieved.

To overcome these problems, it is necessary to apply appropriate learning models to improve student learning outcomes and science process skills. One of the learning

models that are expected to improve student learning outcomes and science process skills is learning using the guided inquiry learning model (Supryadi, 2019).

Several studies show that students' science process skills in the laboratory are still low. Students have not been able to carry out practical activities and have little initiative in solving laboratory problems. Therefore, the application of guided inquiry in practicum is very appropriate. The selection of this model with the consideration of several researchers shows that the application of this learning model is very helpful in achieving effective learning skills and attributes (Juniar et al., 2020).

In implementing the 2013 curriculum, one of the recommended models is guided inquiry. Inquiry learning is designed to take students directly to scientific discoveries in a relatively short time. The results of Schelenker's research show that inquiry training can improve scientific understanding, be productive in creative thinking and students become skilled in obtaining and analyzing original, new and valuable information. Guided inquiry-based learning is effective for developing students' science process skills (Juniar et al., 2017).

The research conducted by Zumrotus Sholihah and Utiya Azizah with the title of applying the guided inquiry learning model to improve science process skills on the reaction rate material, shows that the science process skills possessed by students have increased after the implementation of learning with the guided inquiry learning model of 25 students. % increased with sufficient criteria and 72% on high criteria (Sholihah & Azizah, 2019).

In accordance with previous research, namely research by Sulistyaningsih & Tengker (2020) showed that student learning outcomes using the guided inquiry learning model were greater than student learning outcomes using the lecture method on chemical bonding material. Based on the t-test, the second posttest value is with tcount 3.62 > ttable 2.011. Research Putri et al. (2018) showed that the guided inquiry learning model with molymood media was effective in reducing students' misconceptions on the sub-subject of molecular geometry in class X Science. The research of Iscak et al. (2020) showed that the guided inquiry learning model had a positive influence on students' science process skills on acid-base material.

This study aims to: (1) determine whether there is an effect of guided inquiry learning model on improving learning outcomes on chemical bonding material. (2) to find out whether there is an effect of the guided inquiry learning model on improving science process skills on chemical bonding material. (3) to find out whether there is a significant correlation between learning outcomes and students' science process skills through the application of the guided inquiry learning model.

▪ METHOD

Population and Sample

The population of this study were all students of class X IPA SMA Negeri 1 Berastagi. The sample in this study consisted of two classes taken by random sampling. Class X IPA 1 as the control class and class X IPA 3 as the experimental class. Each class consists of 30 students.

Research Design and Procedure

This research was conducted at SMA Negeri 1 Berastagi in October - December 2021. The research design used was Quasi Experimental (quasi-research) with Pretest

Posttest Control Group Design with scheme of research procedures described in Figure 1. The research design framework can be seen in Table 1.

Table 1. Research Design

Class	Pre-test	Treatment	Final test
Experiment	T1	X	T2
Control	T1	Y	T2

Information :
X : The treatment given to the experimental class is learning with a guided inquiry model.
Y : The treatment given to the control class is learning with conventional learning models
T1 : Initial ability test (*pretest*) in the experimental class and control class before being given treatment.
T2 : The final ability test (*posttest*) in the experimental class and control class after being given treatment.

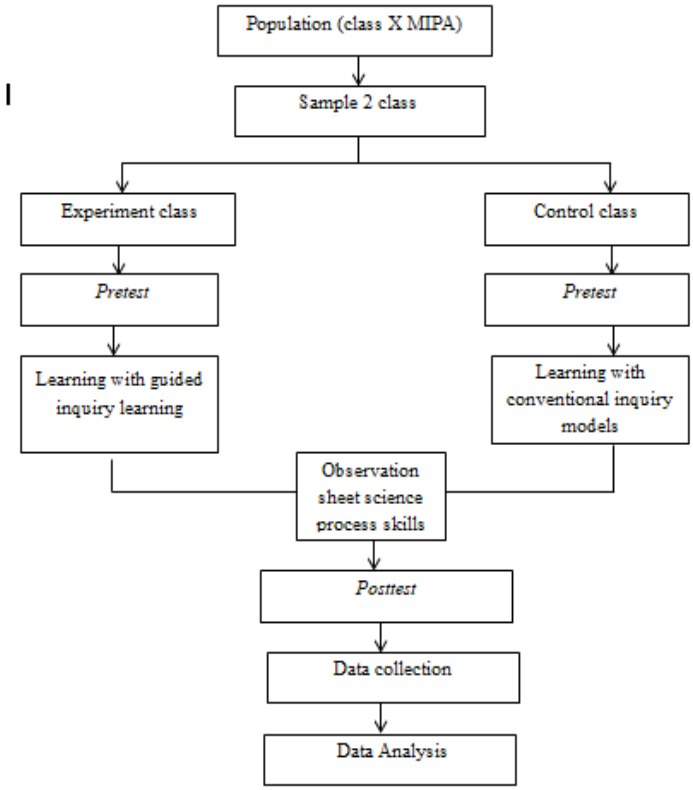

Figure 1 . Research procedure

Data collection technique

In this study, the research instrument consisted of a test instrument and a non-test instrument. The test instrument is the objective test and the non-test instrument is the Science Process Skill implementation observation sheet. Before testing the validity and reliability of the instrument, the instrument was first validated by a validator expert.

Data analysis technique

In this study, the data that was processed was the value of learning outcomes gain and KPS of students in both classes. Data analysis was processed on the SPSS 21 application *for windows*. The data analysis technique used is analysis using the *Independent Sample T-Test* and to calculate the correlation, multiple correlation tests are used.

▪ RESULT AND DISCUSSION

This result presented two research data namely pretest and posttest which the descriptive of those data described in Table 2.

Table 2 Descriptive Data Results Learn Student

Data	Statistics	Class	
		Experiment	Control
Pretest	Minimum Value	25	20
	Mark Maximum	75	70
	Average	45	44.83
	Standard Deviation	15.43	15
Posttest	Minimum Value	80	65
	Mark Maximum	95	95
	Average	88.33	84.67
	Standard Deviation	5.14	7.87

Based on the data above, it is known that the difference in the average value of student learning outcomes at the pretest is not much different. With this, it can be concluded that the initial abilities of students before being given treatment are the same. However, for the posttest score, it was found that the posttest score in the experimental class taught using the guided inquiry learning model was higher. Previous research conducted by Juniar et al (2020) , stated that the application of the guided inquiry model could improve student learning outcomes. This shows that this learning model is very influential on increasing students' pretest scores to posttest scores.

N-Gain Test

The value of learning outcomes analyzed is the Gain value of the two classes obtained from the test given after the end of the treatment from both classes. Data on the increase in gain in both classes can be seen in Figure 2

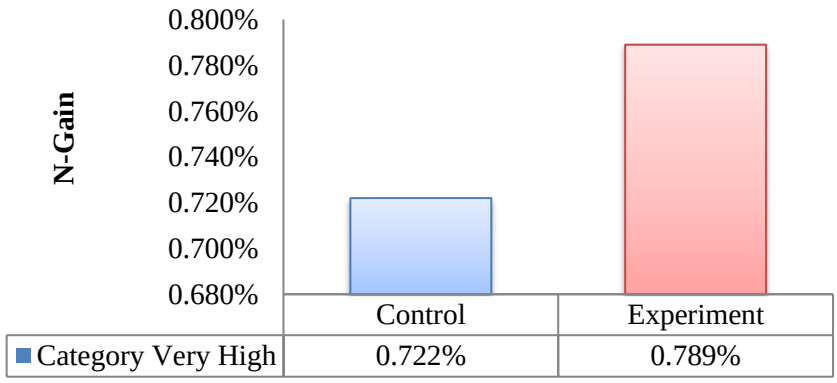

Figure 2 Percentage of N-Gain Student Learning Outcomes

Based on Figure 2, the results of the increase in student learning outcomes in the experimental class were 78.9% higher than the increase in learning outcomes in the control class 72.2%. The high average increase in learning outcomes and science process skills in the experimental class is due to the guided inquiry learning model being applied in the experimental class. In the guided inquiry model, students are accustomed to independent learning to find knowledge gradually according to the syntax of the guided inquiry learning model and to use their own knowledge without depending on the teacher in the classroom. This provides good benefits for increasing student science process skills. While in the control class the teacher is still the center of learning, as a result, students feel that learning becomes saturated, unattractive, and students are less active in the learning process (Fitriyani et al., 2017).

Normality test

This test is performed to understand that the data is normally distributed or not. Results calculation test result gain normality study student class experiment and control with use test *Chi- squared* on level $\alpha = 0{,}05$with criteria Sig> 0,05 so declared normally distributed.

Table 3. Results Test Normality Gain Result Learn Student

Kolmogorov -smirnov test	**Unstandardized Residual**
Kolmogorov- smirnov value	0.630
asymp . Sig. (2-tailed)	0.822

Homogeneity Test

The homogeneity test aims to determine whether the distribution of the data has a homogeneous variance or not so that the research sample from the beginning is stated in the same state. The homogeneity test was carried out using the *Levene's Test approach* . Based on the homogeneity test calculation from the learning outcomes gain data for each class, homogeneous data was obtained as presented in Table 5 below.

Table 4. Results Test Result Gain Homogeneity Learn Student

Levene Statistics	df1	df2	sig.
1.304	1	58	.256

Because sig > 0.05, it can be concluded that the data gain of learning outcomes is homogeneous.

Hypothesis testing

After knowing that the data is normally distributed and homogeneous, it is possible to test the hypothesis by using the *Independent T-Test*. This test is to determine whether the hypothesis in this study is accepted or rejected. The test criteria if Sig < 0,05 then Ha is accepted and H0 is rejected.

Hypothesis Test I

Test hypothesis first is there is the influence of the learning model inquiry guided to enhancement results study student on Theory bond chemistry. Results test the obtained hypothesis are:

Table 5. Test of Hypothesis I

Gain Learning Outcomes	t-test for Equality of Means	df	Sig. (2-tailed)
Equal variances assumed	-2.673	58	0.010

Based on Table 5 obtained the value of *sig. (2-tailed)* of 0.010. By looking at the data, it can be concluded that sig < 0.05 then Ha is accepted and Ho is rejected. Hypothesis testing was carried out using the Independent T-Test Test from the N-Gain data on student learning outcomes, the value of sig. (2-tailed) of 0.010. By looking at the data, it can be concluded that sig < 0.05, then Ha is accepted, meaning that there is an influence of the guided inquiry learning model on improving learning outcomes in chemical bonding material. It can be concluded that the percentage increase in learning outcomes in the experimental class is higher than the control class.

This is in line with previous research conducted by Juniar et al (2020b), stated that with the application of the guided inquiry model can improve student learning outcomes. This shows that this learning model is very influential on increasing students' pretest scores to posttest scores. Then, Hubbi et al (2017) which concluded that learning with the guided inquiry model can improve the learning outcomes.

Test of Hypothesis II

Test hypothesis first is there is the influence of the learning model inquiry guided to enhancement science process skills student on Theory bond chemistry. Results test the obtained hypothesis is

Table 6 Test Hypothesis II

Gain science process skills	t-test for Equality of Means	df	Sig. (2-tailed)
Equal variances assumed	-6,008	58	0.000

Based on Table 6 obtained the value of *sig. (2-tailed)* of 0,000. By looking at the data, it can be concluded that sig < 0,05 then Ha is accepted and Ho is rejected. Based on the hypothesis test carried out using the Independent T-Test Test from the N-Gain data for students' science process skills, the value of sig. (2-tailed) of 0.000. By looking at the data, it can be concluded that sig < 0,05, then Ha is accepted, meaning that there is an influence of the guided inquiry learning model on improving students' science process skills on chemical bonding material. It can be concluded that the percentage increase in science process skills in the experimental class is higher than the control class.

This result is supported by Juniar et al (2018), which stated that there was a significant improvement in all aspects of students' attitudes and academic achievement through the use of the experimental guided inquiry learning model. In guided inquiry, students are more confident and the experiment becomes more meaningful. Then, Almunthasari et al (2016) which concluded that his learning model significantly increased students' science process skills.

Test Correlation

The correlation test used in this study used the *SPSS 21 program for windows* at the value of = 0,05 where if the value of Sig> 0,05 then Ho is accepted, while if Sig <0,05 then Ha is accepted. Correlation test was performed using multiple correlation test on *SPSS 21 for windows.* The results of the correlation test can be seen in Table 8

Table 7. Correlation Test of Learning Outcomes and KPS

	Sig. (2-tailed)	Information
Gain Learning Outcomes	0.000	There is significant correlation
Science Process Skills Gain	0.000	

Based on Table 7, the *sig (2-tailed) value is* 0.000. By looking at the data, it can be concluded that sig < 0.05 indicates that there is a significant correlation between the gain in learning outcomes and the gain in students' science process skills. Based on the correlation test, the sig (2-tailed) value is 0.000. By looking at the data, it can be concluded that sig < 0.05 indicates that there is a significant correlation between the gain in learning outcomes and the gain in students' science process skills.

These results are supported by research conducted by Said et al., (2017), it is found that the correlation value obtained shows that science process skills and student learning outcomes have a positive correlation with very high interpretations. This shows that science process skills has an effect on student learning outcomes. The guided inquiry learning model is able to provide better qualifications than conventional learning models, but has not achieved maximum results. This optimal lack of achievement is influenced by several factors, namely in the process of understanding concepts, each student has difficulty solving problems, because solving problems is included in higher-order thinking skills, students are less empowered to solve discussions in their groups. In addition, the lack of students ability to dig up information to solve the problems presented. In science process skills, the research results show that the experimental class that learns with the guided inquiry learning model is superior to the control class that learns using the conventional learning model (Setyawati et al, 2019).

▪ CONCLUSION

After conducting research, data analysis and hypothesis testing, it is concluded that there is an influence of guided inquiry learning model on improving learning outcomes in chemical bonding materials with sig. (2-tailed) = 0,010 where sig. (2-tailed) < 0,05 and there is an influence of guided inquiry learning model on improving science process skills on material bond chemical with sig. (2-tailed) = 0,000 where sig. (2-tailed) < 0,05 and there is significant correlation among enhancement results study and enhancement science process skills through the learning model inquiry guided with sig. (2-tailed) = 0,000 where sig. (2-tailed) < 0.05.

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