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The Impact of Guided Inquiry Learning on Student Performance in Electrolyte and Nonelectrolyte Materials: A Case Study at SMA Negeri 1 Batang Onang

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Abstract
This study aims to see the effect of the Guided Inquiry Learning Model on Student Learning Outcomes on the Material of Electrolyte and Non-Electrolyte Solutions of Class X Students at SMA Negeri 1 Batang Onang. The learning outcomes of high school students in chemistry are still relatively low, one of which is caused by the dominance of teachers in a less innovative learning process that makes students passive. The research was conducted at SMA N 1 Batang Onang with a research sample of two classes: class X MIA-2 (control class) with 16 male students and 12 female students, and class X MIA-3 (experimental class) with 14 male students and 13 female students. This research method is an experiment with a non-randomized group pre-test post-test design. The instrument used was an essay test of 5 questions. The results showed a significant increase in student learning outcomes after the application of the guided inquiry learning model. In conclusion, the guided inquiry learning model is effective in improving student learning outcomes in chemistry learning. The results of hypothesis testing using T Test (Independent Sample t Test). This is evidenced based on the calculation of hypothesis testing with an average test taken from the pretest and posttest scores that the results of the posttest independent sample t test with a significant level value (α = 0.05) obtained a significant value (2-tailed) of 0.008. The significant value (2-tailed) obtained is smaller than 0.05, so H0 is rejected and Ha is accepted. This shows that there is an effect of guided inquiry learning model on student learning outcomes in the material of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang.

1. Introduction

Education is one of the factors that determine whether a country will progress or not. Education also means a conscious and planned effort to create an atmosphere of teaching and

learning processes so that students can actively develop their potential to have the mental strength, intelligence, noble character, and abilities needed for themselves, society, nation, and state.

Education, especially in the field of science, is largely determined by the quality of the learning process in schools. The success of the learning process is strongly influenced by the willingness of educators as facilitators in the teaching and learning process. Educators are expected to be able to increase their potential as teachers, both in their knowledge of handling students and in managing their learning (Nur Fauziah Siregar, 2021). One of the scientific fields taught at school is chemistry. Chemistry is part of education in the scientific field that can be applied in everyday life because of the importance of chemistry (N.A. Sakinah and K. Dwiningsih, 2018).

Chemistry is a subject that studies calculations, formulas, theories, and reactions that are difficult for students to understand, thus reducing the attractiveness of chemistry for students. In the education system, especially in chemistry subjects, many students have difficulty understanding the material due to a lack of interest and understanding obtained from the teacher, and the learning process is less interesting. This causes learning to be monotonous and does not spark students' interest in exploring chemistry concepts. Less innovative teachers tend to use monotonous learning models and are unable to meet the diverse learning needs of their students. Chemistry materials are often presented theoretically, without a practical approach to help students understand the concepts more deeply.

The impact of students' inability to understand chemistry concepts will affect students' low learning outcomes. It can also be seen from the low ability of Mathematics and Science (Chemistry, Physics, Biology) seen from the PISA ranking in the field of science in 2018 from 78 countries; Indonesia received a rank of 70, which is a low rank (Lelya Hilda, 2020). The right teaching model is needed so that learning objectives can be achieved effectively and efficiently and improve student learning outcomes (Fitri Anisa and Eko Yuliyanto, 2017).

One of the materials taught in chemistry is electrolyte and non-electrolyte solutions. Electrolyte and non-electrolyte solutions are one of the chemistry materials taught in class X SMA. The material includes knowledge of concepts, practices, and procedures. One of the characteristics of electrolytic and non-electrolytic solutions is that the scope of the concepts created is built using macro, micro and symbolic graphic images (Fitriyani et al., 2019). An electrolyte solution is a solution that can conduct electric current. Based on the strength and weakness of electrical conductivity, electrolyte solutions can be divided into two groups, namely strong electrolyte solutions and weak electrolyte solutions. A strong electrolyte solution is a solution in which the solute is completely decomposed to form positive and negative ions that can produce electric current electrical conductivity properties of a strong electrolyte solution that cause the light bulb to burn brightly and bubbles to appear around the electrode. Weak electrolyte solutions have weak electrical conductivity with an ionization

value of 0 <α>1. Weak electrolyte solutions contain substances, but only a fraction become ions when dissolved in water. No symptoms occur when the light is turned on, but gas is produced. The solution contains a free solution, the electrolyte-free solution is a solution that cannot conduct electric current. This happens because the substance cannot form ions and move freely in the solvent (Gunawan, et al., 2019).

Electrolytic and non-electrolytic solution materials are often difficult for students to understand because the concepts are abstract and require a deep understanding of the properties of particles in solution. This material has special characteristics related to everyday life. Therefore, it requires the right learning model to understand the concept well and involve students actively. The appropriate learning for this material is to use a guided inquiry learning model supported by exercises taught by the teacher to increase student absorption and understanding of the material. Learning through the guided inquiry learning model is a reading and listening phase plus hands-on practicum support (Paralita et al., 2015).

The guided inquiry learning model is a study for students to conduct experiments, ask their questions and look for answers, connect discoveries with other discoveries, and learn for themselves with guidance from the teacher. The guided inquiry learning model is very suitable for use when practicum is carried out either in the laboratory or classroom, the teacher guides students properly and directs them. By using the guided inquiry learning model to develop a learning model from conventional learning to learner-centred learning (Tiurlina Siregar, and Desry Natalia, 2019). In the guided inquiry learning model, the teacher acts as a facilitator, meaning that the teacher helps students actively find ideas, concepts, or ideas and solve problems based on data and material provided by the teacher.

Guided Inquiry Learning Model is a model that guides students in developing thinking skills and emphasizing scientific attitudes. The results of research conducted by Sri Indriyani show that there is a significant effect of the guided inquiry learning model on the material of electrolyte and non-electrolyte solutions on the learning outcomes of high school class X students with a significance value of less than 0.05 ($p = 0.036 < 0.05$) and an increase in student learning outcomes in cognitive aspects with an average of 0.50 including in the moderate category (Sri Indriyani Van Gobel, et al, 2019). Based on the results of other studies, it is concluded that there is an effect of the guided inquiry learning model on students' cognitive learning outcomes (Asrul, et al, 2020).

The guided inquiry learning model can increase students' interest in the learning process as shown through their activities. The Guided Inquiry Learning Model is a teaching and learning activity that discovers concepts under the guidance of the teacher through questions that guide student thinking. This model focuses on the process and skills for conducting research, including exploration, discovery and understanding activities. The sequence of activities begins with planning research, carrying out research, collecting research data, and drawing conclusions under the direction of the teacher (Arlianty, 2015). You will be

able to increase students' curiosity and stimulate their thinking activities can effectively improve student learning outcomes, especially in the subject of electrolyte and non-electrolyte solutions. Based on the above background, the author is interested in conducting a study entitled "The Effect of Guided Inquiry Learning Model on Student Learning Outcomes on the Material of Electrolyte and Non-Electrolyte Solutions for Class X Students in High School".

2. Research Methodology

This research will be conducted at SMA Negeri 1 Batang Onang school, which is located in Pintu Padang village, Batang Onang District, North Padanglawas Regency. The reason the researchers chose this location is because in this school there are problems that researchers want to examine. This research was conducted in the even semester of the 2023/2024 school year. The teaching and learning process of SMA N 1 Batang Onang students takes place in May - June 2024.

The type of research to be carried out is quantitative research. Quantitative research is research that uses measurements, calculations, formulas, and certainty of numerical data in planning, processes, hypothesis formation, methods, data analysis, and conclusion drawing (Marinu Waruwu, 2023). The characteristics of quantitative research are influenced by positivist concepts that can be measured and verified empirically. The type of method used in this research is the experimental method. The experimental method was chosen because it has the ability to identify the cause-and-effect relationship directly between the independent variable and the dependent variable. In experiments, the researcher has full control over the research conditions, thus allowing manipulation of the independent variable to observe its impact on the dependent variable. This makes experimentation a very reliable method for testing hypotheses.

The research design used is a non-randomized group pre-test post-test design (Hastjarjo, 2019). In this design, a group of research subjects from a certain population is used and then grouped non-randomly into two groups. Namely the experimental group and the control group (Rangkuti, 2016). The reason is that the method used is an experiment that compares one or more comparison groups that do not receive treatment. In this study researchers used tests. The test conducted before the experiment is called the pre-test (t1) and the test conducted after the experiment is called the post-test (t2).

Population is the whole symptom/unit to be studied (Rangkuti, 2016). Thus, the object of this research is all X-grade students of SMA Negeri 1 BATANG ONANG as many as 108 people. The sample is part or as representative of the population to be studied. According to Sudjana and Ibrahim, the sample is a part of the population that can be reached and has the same characteristics as the population being sampled (Arikunto, 2013). In this study, researchers used cluster sampling techniques. Cluster random sample selection is the selection of groups of subjects. Selection in this way is more time efficient and can be used

when it is impossible to select individuals, but there is a possibility that the selected sample is not representative. Then, the selected classes are class X MIA 2 and X MIA 3, each class totalling 27, so the sample taken is 54 students, where class X MIA 2 is the control class and X MIA 3 is the experimental class.

In this case, the research instrument used by researchers is a test. Tests are divided into two groups, namely description tests and objective tests. Descriptive tests are questions that students answer in the form of descriptions, explanations, comparisons, reasons and other types that match the demands using their language (Darwin et al., 2021). In this study, the test that will be used by researchers is an essay test. In this study, the test that will be used by researchers is an essay test. The reason is so that the value of student learning outcomes can be seen easily and can give students an idea to answer questions that are already available in essay form so that students can give answers according to their abilities. The number of tests was 5 essay tests. This test was given at the beginning of the study (pretest) and the end of the study (posttest).

Data collection techniques are methods used to obtain empirical data used to achieve research objectives. Analysis of instrument elements consists of a validity test, reliability test, difficulty and discrimination. Validity is a measuring tool that shows the levels of validity and reliability of an instrument. Testing content validity is carried out for instruments in the form of tests, and then testing content validity can be done by comparing the content of the instrument with the learning material that has been taught. In this study, researchers used construct validity for test instruments and the learning device used was the learning process plan (RPP). If r-count> r-table then the test is said to be valid and if r-count < r-table then the test is invalid. By using the following formula:

$$r_{XY} = \frac{\mathrm{N}\sum XY - (\sum X)\,(Y)}{\sqrt{N(X^2} - (\sum X)^2\ (N\sum Y^2 - (\sum Y)^2)}$$

After obtaining the r_xy price, validity testing is carried out by comparing the r_xy price with the r_table. The price of r_table. can be obtained by first determining the degree of freedom using the formula df = n - 2 at a significant level $\alpha = 0.05$. Test Description:

If r_xy≥r_table, then the question is valid

If r_xy≤r_table, then the question is invalid.

In giving an interpretation to r11, it is consulted to the table of r-product moment values at a significant level of 5% if r11> r-table, it is declared reliable and vice versa if r11 < r-table, it is not reliable (Sudijono, 2011). In this case, the reliability test uses the help of SPSS software version 24.0. The Pretest question obtained the value of r11 is 0.665, and r-tabel is 0.396 then r-count> r-tabel, which means the pre-test question is reliable so it is categorised as high reliability. The Pretest question obtained the value of r11 is 0.672 and r-tabel is 0.396 then r-count> r-tabel which means the pre-test question is reliable so it is categorized as high reliability.

The difficulty level of the question can be seen as the ability of students to answer the question, not in terms of the teacher's ability to design the question. To find the level of difficulty of the question, researchers used the formula (Darwin, et al., 2021):

$$I = \frac{B}{N}$$

Differentiability analysis examines the items of the question to know the ability of the question to distinguish students who are classified as capable (high achievement) from students who are classified as less or weak achievement. The usual way to analyze differentiating power (Syamsudin, 2012):

$$DB = \frac{S_A - S_B}{J_A}$$

The discrimination index ranges from 0.00 to 1.00. On this index, there is the possibility of a negative sign when a reverse test shows the quality of the test, namely smart children are called stupid and stupid children are called smart. Thus there are three points of discriminating power, namely:

Tabel 1. Classifying and interpreting

DP Value	Interpretation
$\mathbf{D_P \leq 0{,}00}$	Very bad
$\mathbf{0{,}00 < D_P \leq 0{,}20}$	Bad
$\mathbf{0{,}20 < D_P \leq 0{,}40}$	Fair
$\mathbf{0{,}40 < D_P \leq 0{,}70}$	Good
$\mathbf{0{,}70 < D_P \leq 1{,}00}$	Very Good

Data analysis techniques are carried out to process the data that has been obtained from the results of the research conducted. After the sample was given treatment, a test was conducted to determine student learning outcomes. From these results, data were obtained which were used as a basis for testing the research hypothesis. The test results obtained by students are converted into scores based on absolute criteria such as the initial stage. The tests carried out in the final data analysis are almost the same as the initial data analysis. Test for normality, homogeneity, and mean difference.

To find out the test results of students before treatment which is referred to as the pretest score, it can be seen in the following Table 2:

Tabel 2. Frequency Distribution of Experiment Pretest Class

Interval Class	Frequency	Persentage (%)
25-30	3	11 %
31-36	7	26%
37-42	6	22 %
43-48	7	26%
49-54	2	7 %
55-60	2	7 %
Amount	27	100%

The Table above shows that only 7% of students are close to the KKM score. Visually, the distribution of respondents' scores above is depicted in the following histogram.

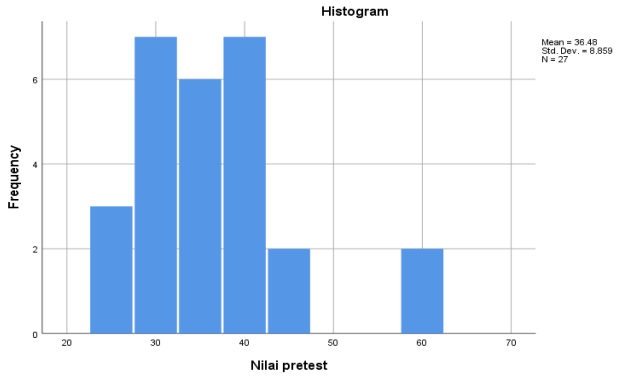

Figure 1. Pretest Score of Experimental Class Students

From the histogram above, it can be seen that the horizontal line is the student learning outcomes, and the vertical line is the frequency of scores. Where students who are worth 25-30 are three people, 35-40 are 13 people, 45-50 are seven people, and 55-60 are two people.

Table 3. Experimental Class Pretest Data Values

No.	Data Value	Amount
1	Mean	40
2	Median	38
3	Mode	33
4	Range	35
5	Standard variance	68,54
6	Standard deviation	8,27
7	Highest score	60
8	Lowest score	25
9	Number of Interval Classes	5,732
10	Class Length	6
11	Total	985

Based on the table above, it can be concluded that the total score on the pretest is 985, mean 40, meaning that the average score of students is still in the low category. The highest score is 60 not yet able to reach the kkm value limit. The lowest score is 25 far below the Minimum Completeness Criteria.

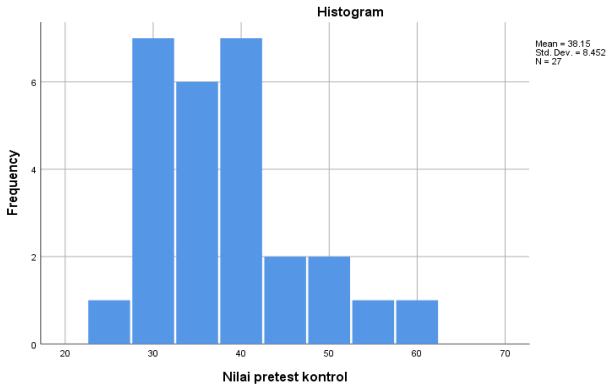

Figure 2. Pretest Score of Control Class Students

From the histogram above, it can be seen that the horizontal line is the student learning outcomes, and the vertical line is the frequency of scores. Where students who scored 25-30 were eight people, 35-40 were 13 people, 45-50 were four people, and 55-60 were two people.

Tabel 12 Nilai Data Kelas Pretest Kontrol

No	Value Amount	T
1	Mean	37
2	Median	30
3	Modus	30
4	Range	35
5	Standar varian	83,06
6	Standar deviasi	9,11
7	Skor tertinggi	60
8	Skor terendah	25
9	Banyak Kelas Interval	5,732
10	Panjang Kelas	6
11	Total	1030

Based on the table above, it can be concluded that the total score on the pretest is 10, 30, mean is 37, meaning that the average score of students is still in the low category. The highest score is 60 not yet able to reach the KKM score limit. The lowest score is 25 far below the KKM.

To find out the results of student tests after treatment which is referred to as the posttest score, can be seen in the following table:

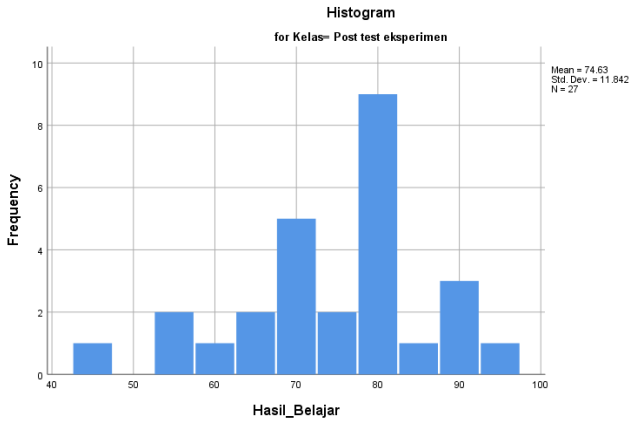

Figure 3. Posttest scores of control class students

From the histogram above, it can be seen that the horizontal line is the student learning outcomes and the vertical line is the frequency of scores. Where students who are worth 45-50 are 1 person, 55-60 are 3 people, 65-70 are 7 people, 75-80 are 11 people and 85-95 are 5 people.

Table 14 Data Value of Experiment Post-Test Class

No	Data	Value Number
1	Mean	70
2	Median	65
3	Mode	75
4	Range	50
5	Standard variance	590,34
6	Standard deviation	24,29
7	Highest score	95
8	Lowest score	45
9	Number of Class Intervals	6
10	Class Length	8
11	Total	1920

Based on the table above, it can be concluded that the total score on the posttest is 1,920, the mean is 70, meaning that the average score of students has increased. The highest score of 95 can already pass the KKM value.

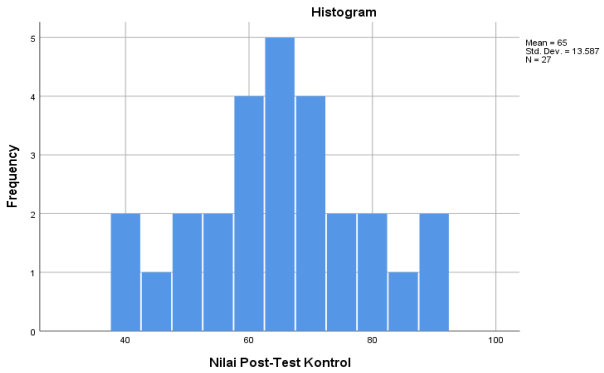

Figure 3. Posttest scores of experimental class students

From the histogram above, it can be seen that the horizontal line is the student learning outcomes and the vertical line is the frequency of scores. Where students who are worth 40-45 are 3 people, 50-55 are 4 people, 60-65 are 9 people, 70-75 are 6 people and 80-90 are 3 people.

Table 16 Data Values of Control Post-Test Class

No	Data	Value Number
1	Mean	65
2	Median	60
3	Mode	65
4	Range	50
5	Standard variance	166,59
6	Standard deviation	12,90
7	Highest score	90
8	Lowest score	40
9	Number of Class Intervals	6
10	Class Length	8
11	Total	1755

Based on the table above, it can be concluded that the total score on the post-test is 1,755, a mean of 65, meaning that the average value of students has increased. The highest score of 90 can already pass the KKM value.

3. Result

After being given treatment in the experimental class, a requirement test was first carried out on the research variables to test the research hypothesis. Testing the normality of this distribution is done using the chi-squared test.

X^2=∑▒(f_0-f_e)^2/f_e with testing criteria if X2count < X2table with degrees of freedom dk = k - 3 and a significance level of 5% or 0.05, it can be concluded that the data is normally distributed.

From the tests carried out on the pretest, the x2 table value was obtained with degrees of freedom dk = (k - 3) = (6 - 3) = 3 and a significant level of 5% or 0.05, so the X^2 table was 7.815. On the pretest obtained X^2 count 6.14. So that X^2 count < X^2 table or 6.14 < 7.815.

On the posttest obtained X^2 count 2.16 so that X^2 count < X^2 table or 2.167 < 7.815. Based on these results, the data is normally distributed.

Homogeneity Test

The next test is the homogeneity test on the pretest and posttest results of student learning outcomes in the control and experimental classes. A homogeneity test is conducted to determine whether the variants of each pretest and posttest data from the two groups are identical.

Table 17 Pretest and Posttest Homogeneity Test Results

Data	Sig	α	Conclution
Pretest	0,585	0,05	sig. > α (data homogen)
Posttest	0,794	0,05	sig. > α (data homogen)

Based on the table of homogeneity test results of pretest scores of student learning outcomes in control and experimental classes, a significant value of 0.585 is obtained, which is greater than the significant level (α) 0.05. The results of the homogeneity test of the post-test value of student learning outcomes in the control and experimental classes obtained a significant value of 0.794 which is greater than the significant level (α) 0.05. Thus it can be concluded that the pretest and posttest data of student learning outcomes of control and experimental classes have homogeneous variants.

Hypothesis Test

After the data is described, then to test whether there is a significant influence in using the guided inquiry learning model on student learning outcomes on the subject of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang can be carried out with the following steps:

a. If X^2 count> X^2 table guided inquiry learning model on student learning outcomes on the subject of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang. Ho is rejected and Ha accepted

b. If X^2 count < X^2 table then the guided inquiry learning model on student learning outcomes on the subject of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang. Ho is accepted and H is rejected.

Furthermore, hypothesis testing was carried out using the Independent Sample T Test test with a significant level (α) of 0.05. The following is presented the results of the pretest data hypothesis test in Table 18 below:

Table 18 Independent Sample T Test Results

Test data	Signifikasi (α)	Sig.(2-tailed)	Conclution
Posttest	0,05	0,008	Sig. (2-tailed) < α H0 is rejected and Ha is accepted. There is a difference in the average posttest value of student learning outcomes

Based on table 18, the results of the posttest independent sample t test with a significant level value (α = 0.05) obtained a significant value (2-tailed) of 0.008. The significant value (2-tailed) obtained is smaller than 0.05, so H0 is rejected and Ha is accepted. This shows that there is a significant difference in the average posttest value of the learning outcomes of control class and experimental class students.

Thus, it can be concluded that there is a significant influence between the guided inquiry learning model on student learning outcomes on the subject of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang.

4. **Pembahasan**

This study was conducted to determine the effect of guided inquiry learning model on student learning outcomes on the subject of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang. Before treatment, a pretest was given to the sample to find out before treatment. Based on the research results obtained from the pretest data, it can be seen that for the pretest the average value obtained is 30.01, it can be concluded from the average value obtained that the students' learning outcomes are still insufficient, then after the normality test is carried out on the pretest, the x table value is obtained with degrees of freedom dk (k-3) (6-3) = 3 and a significant level of 5%, the X^2 table is 7.815. In the pretest, it was obtained X^2 count = 6.14 so that Xcount < X^2 table or 6.14 < 7.815. Based on these results, it shows that the initial data (pretest) is normally distributed.

After the initial data (pretest) was analysed, then treatment was given using the guided inquiry learning model. The learning process is that the teacher conveys the objectives of the subject matter to be studied, then the teacher forms the group into 5 groups and conducts a practicum. After the learning process is complete, then a posttest is given to students. Then the final data (posttest) is analysed, based on the results of the study obtained

an average value of 80.27 from the average value obtained after treatment it can be concluded that the treatment given has an effect as evidenced by the increase in student learning outcomes so that it reaches a good category.

Then the initial data value (pretest) and the final value (posttest) were analysed by conducting hypothesis testing and conducting a two mean difference test. By using the Independent Sample T Test test, the results of the posttest independent sample t test with a significant level value ($\alpha = 0.05$) obtained a significant value (2-tailed) of 0.008. The significant value (2-tailed) obtained is smaller than 0.05, so H0 is rejected and Ha is accepted. This shows that there is a significant difference in the average posttest scores of the learning outcomes of control class and experimental class students.

From the description and calculation results above, it can be concluded that the group discussion method is better than not using this learning method. From the results of the study it can be concluded that there is a significant influence between the guided inquiry learning model on student learning outcomes on the subject of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang.

In accordance with previous research conducted by Yuli Angraini, Muhammad, and Resti (2020), it shows that the guided inquiry learning model on electrolyte solution material has a significant effect on learning outcomes. The treatment given to the experimental class used the guided inquiry learning model, while the control class used a conventional learning model. Data collection techniques using tests in the form of multiple choice questions and interviews. The data analysis technique used was the t test assisted by SPSS Version 24.0. The data analysis techniques used in this study were descriptive and inferential analyses.

Quantitative descriptive analysis carried out is the analysis of describing the chemical learning outcomes obtained by converting the results of students' raw scores into standard scores to determine the absorption of students, then prerequisite tests are carried out by conducting normality and homogeneity tests after that hypothesis testing is carried out to see the effect of guided inquiry learning models on learning outcomes.

Furthermore, the N-Gain test was conducted to see the difference in pretest and posttest scores or the increase in student outcomes after being given the learning model treatment. Normality tests were also carried out in this study, the significance value of the experimental class posttests was 0.20 and the control class was 0.144. Because the significance value of the experimental and control class posttests> 0.05 or 0.20 and 0.144> 0.05.

Thus it can be stated that the posttest data on the learning outcomes of experimental and control class students are normally distributed. the value of the significant level ($\alpha = 0.05$) obtained a significant value (2-tailed) of 0.008. The results showed that there was an effect of the guided inquiry learning model on the material of electrolyte and non-electrolyte solutions on the learning outcomes of class X SMA students with a significance value of less than 0.05

(p = 0.036 <0.05) and an increase in student learning outcomes on cognitive aspects with an average of 0.50 included in the moderate category.

4. Conclusion

Based on the results of the research and the results of data analysis in Chapter IV, the researchers concluded that there is a significant influence between the guided inquiry learning model on student chemistry learning outcomes on the subject of electrolyte and non-electrolyte solutions in class X SMA N 1 Batang Onang. This is evidenced based on the calculation of hypothesis testing with an average test taken from the pretest and posttest scores that the results of the independent sample t test p osttest with a significant level value (α = 0.05) obtained a significant value (2-tailed) of 0.008. The significant value (2-tailed) obtained is smaller than 0.05, so H0 is rejected and Ha is accepted.

If a study has been conducted in an educational environment, the implications that can be taken certainly have implications in the field of education and also further research, in connection with these results, the implications are as follows:

Based on the results of the above research that, there needs to be an effort to apply the guided inquiry learning model consistently both in electrolyte and non-electrolyte solution materials and other subject matter. This aims to improve student learning outcomes. In addition, based on the theory that has been tested by researchers, it can be seen that the guided inquiry learning model can accelerate students' understanding of learning materials. In realising this, teachers need to apply the model following existing procedures.

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