Application of guided inquiry learning model in biological learning: it’s the influence to science process skills and students' scientific knowledge in class XI MIPA high school

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Abstract. This study aims to determine the effect of the application of guided inquiry learning model to the skills of the students' science process because in the implementation of the Science Process Skills of the less developed students in class XI MIPA Senior High School. The research data was obtained by giving scientific knowledge test in the form of posttest and non test in the form of observation skill of students science process during the practicum activity (as main data) and interview with teacher of biology study (as supporting data). After all activities carried out, the data were analyzed quantitatively by hypothesis test. Based on the data analysis there is influence of guided inquiry learning model to the science process skill and students' scientific knowledge. It can be seen that the average score of the students' Science Process Skills in the experimental class is 70.34% and the control class is 63.30%. From hypothesis test th = 7.536 and ttable value = 1.664, this means th > ttable so hypothesis accepted. Average scientific knowledge of experimental class students 64.78 and control class 55.23. From hypothesis test for th = 3.075 and ttable value = 1.664, this means th > ttable so hypothesis accepted. From the results of this study can be concluded that the application of guided inquiry model influences the students scientific process skills and students scientific knowledge on the material of human excretion system of class XI MIPA Senior High School 8 Jambi City. The skills of students scientific processes and scientific knowledge can be well channeled with the help of guided inquiry learning models that involve active students during the learning activities. From the results of this study suggested that teachers can apply guided inquiry learning model in learning activities, especially practical activities that make students become enthusiastic in learning. This model makes students like a scientist so that raises the spirit in students to perform the whole procedure of practice to be implemented.

1. Introduction
Education has a very important role in advancing a nation, this progress depends on the results of education implemented by the nation itself. Education that has been started from human birth has a fungi and a very important role in life because from education, humans can develop abilities and help the character and civilization of a dignified nation. Education is essentially the process of maturing the quality of life, through this process it is expected that humans can understand the meaning and nature of life, as well as for what and how to carry out the tasks of life and life properly (Mulyasana, 2011: 2). In practice, current learning places more emphasis on cognitive abilities than psychomotor abilities,
while psychomotor skills or skills are very important for students, because of these skills knowledge and attitudes will be well formed. In essence, biology learning as part of science cannot be separated from minds on, hands on, and in on activities, namely students or students must be able to do activities that are able to hone noble thinking, practice, and character skills. These three skills, students are expected to be active in thinking and processing activities to hone science skills so that students can find new concepts from learning activities so that they have strong character in their social life (Aji, 2014: 23-24)

Biology subjects as part of the field of science, have a very important role to improve the quality of education, especially in producing quality students. This can happen because biology learning is part of the foundation of science and technology which has brought major changes in various aspects of life on earth. Biology learning has differences with other subjects. Biology learning not only prioritizes knowledge, but also emphasizes process skills. The same thing was stated by Muandar (2016: 5) the goal of the IPA-Biology practicum in schools was: 1) to train the skills needed by students, 2) to provide opportunities to apply and integrate their knowledge and skills in practice, 3) prove something scientifically (scientific inquiry), and 4) appreciate the knowledge and skills possessed.

Science Process Skills are skills derived from fundamental abilities which in principle already exist in students who include observing, classifying, predicting, hypothesizing, measuring, planning, controlling variables, interpreting, applying, concluding and communicating (Ambarsari, 2013: 82). Based on the results of preliminary studies through observation and interviews conducted by researchers to biology teachers of Senior High School8 Jambi City, it is known that there are still many students having difficulties in understanding biological materials, especially the excretory system material. Besides the problems that occur and are faced in learning activities in the excretory system material, among others are: (1) Presentation of material is mostly done with conventional models but there are several learning models used such as Discovery learning, problem based learning, whose implementation has not run optimally, (2) Laboratories at Senior High School8 Jambi City are undergoing repairs to the room so that practicum activities are held in class, students are less active in carrying out the practice because they are not in the laboratory atmosphere. While in addition to the cognitive and affective aspects, psychomotor aspects or skills are needed to strengthen understanding of science concepts or science, this has an impact on students' lack of distribution of ideas and process skills in learning activities.

A learning model is needed that is seen as being able to help improve students' Science Process Skills. One learning model that can be applied is a guided inquiry learning model that influences Science Process Skills. Science is related to how to systematically find out about nature, so that science is not only a mastery of a collection of knowledge in the form of facts and principles but also a process of discovery related to everyday life. Learning science with guided inquiry learning models involves active students in laboratory activities so that students gain a deep understanding of the facts and concepts of the material being studied (Budiyono, 2016: 141). Trianto (2010: 166) states that inquiry is a learning activity that involves maximally all the ability of students to search and investigate systematically, critically, logically, analytically, so that they can formulate their own findings. Inquiry learning is designed to invite students directly into the scientific process in a relatively short time.

The same thing was stated by Novitasari (2017: 97) Learning by using guided inquiry models can enrich experiences, develop scientific attitudes, and learning outcomes will last a long time in students' memories so that learning becomes more meaningful. Learning in scientific research becomes more meaningful if students find their own knowledge. Previous research that has been done by Hariyadi and Ibrohim (2016). Stating that there are differences in process skills and mastery of the science concept of students between students who are taught by guided inquiry models with students who are taught with conventional learning. Research that has also been conducted by Wahyudi and Imam (2013) states that the application of inquiry learning models is guided by practicing Process Skills Science can
improve learning outcomes. Ozdemir (2017:52) related Scientific Process Skill and Scientific Creativity. Saido (2015) studied about high order thinking skill in science learning, and then Kustijono (2018:82) using peer models to know scientific attitude, Science Process Skills in Basic Physics Practicum.

Based on the description, it is important to do research with the title "The Effect of the Application of the Guided Inquiry Learning Model on Students' Science Process Skills in the Material of the Human Excretion System in Class XI MIPA Senior High School 8 Jambi City". This study aims to determine 1. The effect of the application of Guided Inquiry learning model on Science Process Skills of students in learning biology class XI MIPA Senior High School Jambi City and. 2. knowing the effect of the application of the Guided Inquiry learning model on students' scientific knowledge in learning biology class XI MIPA Senior High School Jambi City.

2. Methods
The method used in this study is True experiment with the Posttest Only Control Design design. According to Sukmadinata, et al. (2012: 58) in this method besides the experimental group there is a control group which is also characteristic in the variables equal to the experimental group. The difference in the experimental group was given special treatment while the control group was given another treatment, or treatment that could be done, which compared the results with the experimental treatment.

| Table 1 Research Design of Post-Test Only Control Design |
|-----------------|-----------------|-----------------|
| Class           | Treatment       | Post-test       |
| Experiment      | X               | T₁              |
| Control         |                 | T₂              |

Information:
X: Application of the Guided Inquiry learning model
T₁: Post-test in the Experiment class
T₂: Post-test on the control class

Subjects in this study were all class XI MIPA Senior High School 8 Jambi City taken as many as two classes that will be used as a sample class, namely the experimental class and the control class.

2.1. Data collection technique
Data collection techniques in this study used tests and observation sheets. The test is carried out by giving post-test questions after completing the learning process in the experimental class and control class. Observation sheets were carried out during the lab work and were observed by eight observers.

2.2. Research Instruments
In this study, the instrument used to collect data in the form of test and non-test instruments.

2.3. Test
In this study, the instrument used to collect data on the results of the second class knowledge of the sample class is a multiple choice objective test. How to process multiple choice test scores is by formula (Arikunto, 2014: 193):

\[
skor = \frac{\text{correct total sample}}{\text{total of all samples}} \times 100\%
\]  

(1)

2.4. Observation
The assessment of psychomotor aspects in the form of students' Science Process Skills observation sheets can be analyzed using the Scale rating model. According to (Sugiyono, 2014: 141) Scale rating
is the raw data obtained in the form of numbers then interpreted in a qualitative sense which is then quantified. Scalainers are arranged in statements and rating scales are made in a range from 1 to 4 items.

\[
Psychomotor\ value = \frac{\text{the number of scores obtained}}{\text{maximum score amount}} \times 100
\]  

(2)

After that a further test is carried out to test the hypothesis.

2.5. Difficulty Level
The magnitude of the problem difficulty index is determined by the formula:

\[ P = \frac{B}{JS} \]

Description:

- \( P \) = Index of difficulty
- \( B \) = Many students answer the question correctly
- \( JS \) = The number of all students of the test participants

2.6. Difference Power
Determine the different power items used by the following formula:

\[ D = \frac{BA}{JA} - \frac{BB}{JB} = P_A - P_B \]  

(3)

2.7. Validity
The validity of the test (validity of the test) relates to whether the test used can measure exactly what will be measured. Arikunto (2014: 317) the technique used to determine the validity of an item is to use the product momentandperson formula with a rough number formula as follows:

\[
r_{xy} = \frac{\sum NXY - (\sum X)(\sum Y)}{\sqrt{[\sum X^2 - (\sum X)^2] \cdot [\sum Y^2 - (\sum Y)^2]}}
\]  

(4)

2.8. Reliability
Reliability is the regularity of a test if it is tested on the same subject, at different times or to the same subject at the same time. According to Arikunto (2014: 223) to determine the reliability of all tests used the Spearman-Brown formula as follows:

\[
r_{11} = \frac{2r_{1/21}}{1 + r_{1/21}}
\]  

(5)

2.9. Data analysis technique
The data analyzed were the results of the observation sheet in the experimental class and control class. According to Sudjana (2010: 466) for the normality test used by the Lilliefors test with the formula:

\[
Z_l = \frac{\bar{X} - \mu}{\sigma}
\]  

(6)

If \( L_o < L_{table} \) means the table is normally distributed while if \( L_o > L_{table} \) means the results of the observation sheet are not normally distributed. After testing for normality, the next step is to do a homogeneity test. To determine the homogeneity used the formula:

\[
F^* = \frac{S_1^2}{S_2^2}
\]  

(7)

Both data groups have a homogeneous variant if \( F_{count} < F_{table} \) obtained from the F distribution list using the real 0.05 level of freedom instead the two data groups have a homogeneous variant if \( F_{count} > F_{table} \). Hypothesis testing is used t test. In this study the hypothesis used is the similarity of two averages. The formulas that will be used are:

\[
S_{gab}^2 = \frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1 + n_2 - 2}
\]  

With
\[ t_{\text{count}} = \frac{X_1 - X_2}{S_{gab} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \]  

(8)

3. Results And Discussion

3.1. Results

3.1.1. a. Students Science Process Skills

| Class       | Number of participants | Average |
|-------------|------------------------|---------|
| Experiment  | 42                     | 74.19   |
| Control     | 38                     | 50.23   |

![Figure 1. Science Process Skills Percentage Graph](image)

3.1.2. Student Scientific Knowledge

| Class       | Number of participants | Average |
|-------------|------------------------|---------|
| Experiment  | 42                     | 64.78   |
| Control     | 38                     | 55.23   |

Analysis of Science Process Skills Results

Based on Table 2 it can be seen that there is a difference in the average value of students' scientific knowledge in the experimental class with the control class after being given treatment. T-test is then conducted to find out the research hypothesis. Based on the calculation of the t-test, the calculation results obtained are \( t_{\text{count}} = 7.536 \) and \( t_{\text{table}} = 1.664 \). From these data it is clearly seen that \( t_{\text{count}} > t_{\text{table}} \) is accepted. So, it can be seen that the guided inquiry learning model influences the Science Process Skills of class XI MIPA Senior High School 8 Jambi City.

Analysis of Student Scientific Knowledge Results

Based on Table 3 it can be seen that there is a difference in the average value of students' scientific knowledge in the experimental class with the control class after being given treatment. T-test is then conducted to find out the research hypothesis. Based on the calculation of the t-test at the 0.05 level, the calculation results obtained are \( t_{\text{count}} = 3.075 \) and \( t_{\text{table}} = 1.664 \). From these data it is clearly seen that \( t_{\text{count}} > t_{\text{table}} \)
It is accepted. So, it can be seen that the guided inquiry learning model influences the scientific knowledge of class XI MIPA students of Senior High School 8 Jambi City.

3.2. Discussion

3.2.1. Student Science Process Skills Results

In this study there are 5 aspects of Science Process Skills in learning activities that are assessed using observation sheets, namely observing, grouping, predicting, communicating, using tools and measuring. A summary of the average value of each aspect of the Science Process Skills in the experimental and control classes is presented in Table 4.

| No | Component                  | Rating Score (%) |
|----|----------------------------|------------------|
|    |                            | Experiment       | Control         |
| 1. | Observe                    | 69.57            | 64.8            |
| 2. | Grouping                   | 71.67            | 62.5            |
| 3. | Predict                    | 71.94            | 67.76           |
| 4. | Communicate                | 67.35            | 60.93           |
| 5. | Use of tools and measurements | 71.36           | 65.12           |

Aspect:

Observe

In the aspect of observing, the indicator observes every change that occurs in each experiment and reads the measuring instrument, the average student score is 69.57% with a fairly skilled category in the experimental class and the average student score is 64.8% in the control class. Can be seen in Figure 2.

Figure 2. Average Observing Aspect Value Graph

The picture explains that at this stage students have begun to understand how to identify changes that occur in the experiment and can read the measuring instrument well enough. Changes in the two
classes are not too different because they are both in the category of skilled enough, but the class given the guided inquiry learning model still has a higher value than the control class with conventional learning (discussion method). This is supported by Novitasari’s (2017: 103) statement that there is an influence of differences in Science Process Skills of students in learning using guided inquiry learning models and those who learn using the lecture method.

**Grouping**

In the grouping aspect, the indicator makes an observation table according to the observation procedure. The experimental class obtained an average score of 71.67% with the skilled category and the control class 62.5% with the category of skilled enough. Can be seen in Figure 3.

![Figure 3. Graphs of Grouping Aspects](image)

The picture explains that the ability of students in terms of making a good and complete observation table is good in the experimental class and quite good in the control class. This is because in the experimental class students are more focused on working on all the procedures that have been given because the inquiry learning model makes students actively involved in all learning activities. this is supported by the statement of Budiyono (2016: 127) that guided inquiry involves students to be active in learning, especially Science Process Skills.

**Predict**

In the aspect of forecasting with indicators, designing experiments practicum activities. The experimental class obtained an average score of 71.94% in the skilled category and 67.76% in the category of skilled enough in the control class. Can be seen in Figure 4.
Figure 4. Average Value of Aspect Predicts

The picture explains that the ability of students to design experiments in this practicum activity looks better in the experiment class than the control class. The experimental class is getting used to making experimental designs according to procedures while in the control class students are still not used to making experimental designs so there are still many students who ask questions during practicum activities. This is supported by the statement of Aji (2014: 29) that at the stage of designing the experiment students are guided by the teacher to make an experimental design in accordance with the instructions in the LKS, students gain experience in designing experiments and learn how to determine the next steps to process data so that later conclusions can be drawn.

Communicate

In the aspect of communicating, with indicators making written reports, connecting data from observations with theory, presenting the results of the experiment and drawing conclusions based on the results of class discussions. The experimental class obtained an average score of 67.35% with the category of quite skilled and control class 60.93% with the category of quite skilled. Can be seen in Figure 5 below.

Figure 5. Graph of Communicating Aspects

The picture explains that both the experimental class and the control class are not used to drawing conclusions from class discussions and tend to be less serious in presenting the results of the discussion.
Use of Tools and Measurements

In the aspect of the use of tools and measurements, with indicators of accuracy in the use of tools and measurements, reading measuring instruments, determining measuring instruments, and experimenting practicum activities. The experimental class obtained an average score of 71.17% with the skilled category and the average control class score 63.95% with the category of skilled enough. It can be seen in Figure 6 below.

![Graph of Aspects of Use of Tools and Measurement](image)

**Figure 6.** Graph of Aspects of Use of Tools and Measurement

The picture explains that the class given the guided inquiry learning model has a higher value than the control class with conventional learning (discussion method). This shows that the use of guided inquiry learning models makes students' Process Skills begin to develop. Students begin to get used to activities such as a scientist, by finding their own solutions to problems given so that students follow them actively. This is supported by Novitasari's statement (2017: 97) that learning using guided inquiry learning models can enrich experiences, develop scientific attitudes, and learning outcomes will last a long time in students' memories so that learning becomes more meaningful.

Based on the explanation above, it can be seen that the highest value of the Science Process Skills aspect in the experimental class is the predicted aspect (71.94). The experimental class is higher than the control class. This is supported during learning activities, the experimental class students carry out activities according to the procedure because it is assisted by a guided inquiry learning model. Students are required to always be active when doing practical activities. The process of predicting the experimental group is seen when students make experimental designs in accordance with the observation procedure, the use of guided inquiry learning models makes students accustomed to designing experiments like a scientist. The average value of Science Process Skills in the highest control class is the forecasting aspect (67.76). The process of predicting in the control class is higher than other aspects because students are directly involved in practicum activities, so students are interested in predicting activities.

Aspects of Science Process Skills that has the lowest average value in the experimental class is an communicating aspect (67.35). This is because during the practicum activities students still have difficulty making class conclusions, because students are used to just making group conclusions. But still can follow the learning calmly so that some groups can do it well, so the value of communicating the experimental class is higher than the control class. The average value of ScienceProcessSkillsin the lowest control class is the communicating aspect (60.93). This is because when there are still many practical activities for students who have difficulty making class conclusions, the use of conventional learning models (discussion) makes students less serious about learning.
Based on the results of the analysis of research that has been carried out, shows that in biology learning using guided inquiry learning models can train students in developing Science Process Skills so that the nature of biology as a science can be implemented optimally. In this regard, Sheba in Hariyadi (2016) states that Science Process Skills are the intellectual skills needed in carrying out scientific investigations obtained as a result of natural science learning. The guided inquiry learning model that is applied in the experimental class trains students' Science Process Skills because in the ongoing learning activities students are accustomed to the activities and questions that present students' Science Process Skills.

Activities carried out according to the procedures set by the teacher, so that learning becomes more conducive and students can do practical work. A clean learning atmosphere and adequate infrastructure increase students' enthusiasm in learning, this has a positive influence on students' Science Process Skills. The use of guided inquiry learning models in addition to Science Process Skills students who can be channeled well, students' scientific knowledge can also develop well, this can be seen from the results of students' scientific knowledge experimental class is higher than the control class (can be seen in table 3). The use of guided inquiry learning models makes learning long lasting in students 'memories so that it influences students' scientific knowledge. Putra (2015: 104) states that guided inquiry learning models are learning models that emphasize the development of cognitive, affective and psychomotor aspects in a balanced manner, so that learning through this model is considered more meaningful. It is also stated by Wahyudi (2013: 65) that student learning outcomes by applying guided inquiry learning models by practicing Science Process Skills students can improve learning outcomes.

4. Conclusion
Based on the results of data analysis and hypothesis testing, it can be concluded that the guided inquiry learning model influences students' Science Process Skills in biology learning in the XI MIPA class of Senior High School 8 Jambi City. This can be seen from the results of the $t_{\text{test}}$ obtained by $t_{\text{count}}$ greater than $t_{\text{table}}$, namely 7.536 $> 1.664$. And the implementation of guided inquiry learning model influences the scientific knowledge of students in the biology class XI MIPA Senior High School 8 Jambi City. This can be seen from the results of the $t_{\text{test}}$ obtained by $t_{\text{count}}$ greater than $t_{\text{table}}$, which is 2.032 $> 1.664$.

5. Suggestion
- Teachers are expected to be able to apply guided inquiry learning models in the learning process of biology. This is because the inquiry model can make students active in learning activities, understanding the concept in students can last a long time so that the learning outcomes obtained are as expected.
- Classroom mastery is very necessary in this study, so that it is expected that researchers can prepare themselves optimally.
- This researcher is only carried out on learning biological material. Researchers hope that there will be further research on guided inquiry learning models in other materials.

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