

The Effectiveness of Using Student Worksheet Based on Guided Inquiry toward the Student Learning Outcomes in Buffer Solution Material

Fitra Handa Yani, Mawardi Mawardi*, Aisyah Fitri Rusiani Js

Chemistry Department, Universitas Negeri Padang,
Indonesia



Abstract- Learning outcomes have an important role in seeing the success of the learning process. Therefore improving learning outcomes is something important to consider. This study will see the success of using student worksheets based on guided inquiry on learning outcomes in buffer solution materials. The sample consisted of 36 students divided into two classes namely the experimental class and the control class. The learning experimental class uses guided inquiry-based student worksheets while the control class learns with textbooks that are not guided inquiry based. The study was conducted with type of non equivalent control group design. Data collected from the results of pre and post-test consisted of multiple choice tests given by the researcher. Tests for normality and homogeneity of the data possessed by this data are normally distributed and have a homogeneous variance. Based on the results of the study obtained N-Gain in the experimental class is 0.86 higher than the control class which is 0.76. Hypothesis testing is done with the help of SPSS software. Based on the results of the analysis obtained significance 0,000 at the 0.05 (α) significance level and 95% confidence level. The significance value obtained is smaller than α . Therefore it can be concluded that learning using student worksheets based on guided inquiry can improve student learning outcomes in buffer solution material.

Keywords - Guided Inquiry, Student Worksheets, Learning Outcomes, Buffer Solutions.

I. INTRODUCTION

Education is a process in order to influence students so that they are able to adjust as well as possible with their environment. Speaking of processes, it is certainly inseparable from all efforts made to develop quality human resources. Some efforts can take the form of guidance, which in essence is the provision of assistance, direction, motivation, advice and counseling so that students are able to overcome, solve problems and overcome their own difficulties. In order for the implementation of learning to run effectively and efficiently, a systematic planning is needed[1]

Effective and efficient learning can occur through the communication process. Communicating is not only a

process of delivering messages but also involves several interrelated components that must be created by the teacher so that the learning process takes place optimally. In this case a skill is needed for a teacher to be able to convey a message to his students, so that the message can be received as expected. The skills referred to here are the skills of a teacher in choosing methods, media and the right approach in delivering lessons according to his role as facilitator [2].

The role of the teacher in the learning process must be able to create learning conditions that are expected to encourage students to find out from various sources through observation, and not just being told [3]. The learning model that can guide students to find out their own information is inquiry learning. Inquiry learning model is a series of

learning activities that emphasize the independence of students to find and find [4].

This learning model is divided into four levels namely confirmation inquiry, structured inquiry, guided inquiry and open inquiry. One of the most effective inquiry learning models is guided inquiry [5].

Guided inquiry learning process is student-centered learning, students work in small groups with individual roles to ensure that all students are fully involved in the learning process [6]. In the guided inquiry learning model students are required to learn in acquiring knowledge by finding themselves [7]. The inquiry in learning process consists of five stages namely orientation, exploration, concept formation, application, and closing [8]. Through the five stages of the guided inquiry learning process, it will direct students to acquire knowledge by finding themselves.

Guided inquiry learning will be effective if it is supported by a teaching material. One teaching material that facilitates students to be more active in the teaching and learning process is student worksheets [9]. Based on the results of research conducted by Bilgin (2009) and Myers (2012), it was concluded that students who learn by using guided inquiry strategies more easily understand and understand the concept of lessons and increase the effectiveness of interaction, team building, learning, and interest through group work, highly structured [10] [11]. In this study it was conducted to examine the effectiveness of student worksheets on buffer solution material.

II. METODHS

2.1 Sample Of research

This study uses 72 students registered in class XI IPA SMAN 3 Kota Padang in the academic year 2018/2019. These students are divided into two groups, namely experiment and control class.

2.2. Research Design

This research is a quasi experiment research with a type of non-equivalent control group design. This type of research is used to see the effect of a treatment by conducting a pre-test and post-test. Two sample classes consisted of the experimental class and the control class were given different treatments. The experimental class learns buffer solutions using worksheets based on guided inquiry and control class learning using textbooks that are not guided inquiry based. The tests and treatments given to each class of samples are illustrated in the following table

Table .Non Equivalent Control Group Design

Group	Steps		
Eksperimen class	O ₁	X	O ₂
Control Clas	O ₃		O ₄

O1 = Pre-test experimental group

O2 = post-test experimental group

O3 = Pre-test control group

O4 = Post-test control group

X = Learning using student worksheets based guided inquiry [12]

2.3. Data Collection

To test the effectiveness of a guided inquiry based student worksheets on student learning outcomes used learning outcomes test instruments in the form of multiple choice questions. The value of student learning outcomes is obtained based on the following equation.

$$Value = \frac{score\ obtained}{total\ score} \times 100$$

The value of student learning outcomes is calculated using normalized Gain values using the N-Gain formula as follows [13]

$$\langle g \rangle = \frac{\% \langle post\ test \rangle - \% \langle pre\ test \rangle}{100 - \% \langle pre\ test \rangle}$$

Information :

% <post test> = average grade post test class

% <pre test> = average grade pre test

The magnitude of the gain average <g> is interpreted based on the criteria in Table 1.

Table 1. Criteria for gain score averages [13]

Limitation	Criteria
$g \geq 0,7$	High
$0,3 \leq g < 0,7$	Medium
$g < 0,3$	Low

III. RESULTS

3.1 Data description

Assessment of the effectiveness of guided inquiry-based student worksheets was carried out by holding pretest and posttest for both sample classes. This question consists of 20 items with C1-C6 cognitive level. The average value of student learning outcomes in each sample class can be seen in the following table.

Table 2. Student Learning Outcomes

Class	N	Pretest	Posttest	Pretest-posttest
Eksperimen	36	16,94	87,78	70,83
Kontrol	36	15,97	79,17	63,19

In the table above it can be seen that the average initial ability in the sample class in each school has almost the same value. The value at the end of learning after learning the value of the experimental class is higher than the control class. To do N-Gain analysis, normality, homogeneity, and hypothesis testing on this data used the pretest and posttest value difference.

3.2 Data analysis

3.2.1 N-Gain

The N-gain test was conducted to see whether effective student worksheet based guided inquiry used by students to improve student learning outcomes. The average value of N-Gain learning outcomes for each sample class can be seen in Table 3 below.

Table 3. N-Gain Value of Student Learning Outcomes

Class	N-Gain	Criteria
Experiment	0,86	High
Control	0,76	High

Based on Table 3, it is known that the average value of N-Gain for all classes is high. Although equally high, the N-Gain value for the experimental class is higher than the control class.

3.2.2 Test for normality

Data normality test was carried out with SPSS statistical application. This normality test is carried out in order to find out whether or not the distribution of data groups is normal. The normality test used is kolmogorov-smirnov.

Table 4. Normality Test Results Pretest Value Difference and Posttest Learning Outcomes of Students

Class	α	Sig.	Distribution
Experiment	0,05	0,739	Normal
Control		0,184	Normal

Based on Table 4, both classes have significance > 0.05 (α). Thus, the data on the difference between the pretest and posttest results of learning in each class is normally distributed.

3.2.3 Test for homogeneity

Data homogeneity test was performed with SPSS statistical application. This homogeneity test is carried out with the aim of knowing whether the data group has a homogeneous variance or not. The homogeneity test used is the Levene test. The results of the homogeneity test of the difference between pretest and posttest of learning outcomes can be seen in Table 5.

Table 5. Homogeneity Test Results of Pretest Value Difference and Posttest of Learning Outcomes

Class	α	Sig.	Variance
Eksperimen Kontrol	0,05	0,241	Homogen

Based on Table 5 each class has significance > 0.05 (α). Thus, the difference between the pretest and posttest values of the learning outcomes of each class has a homogeneous variance

3.2.4 Test the hypothesis

This hypothesis test uses independent sample t-test with the help of the SPSS statistical application. The results of hypothesis testing can be seen in Table 6 below.

Table 6. Hypotheses for learning outcomes

Class	α	Sig
Experiment Control	0,05	0,000

Based on the table above shows that the significance value of the difference between the pretest and posttest learning outcomes is small from 0.05. This means that the learning outcomes of students learning with student worksheet based on guided inquiry increase significantly with students who learn without using student worksheet based on guided inquiry.

IV. DISCUSSION

The guided inquiry learning model was equally used in both sample classes, both the experimental class and the control class. The difference between the two samples lies in the teaching material used. In the experimental class using student worksheet based on guided inquiry that is valid and practical. Whereas in the control class using a text book provided by the school.

Effectiveness testing aims to determine the level or degree of application of the theory, or model in a particular situation [14]. In this study the effectiveness of student worksheets assessed is the learning outcomes of students. To

see this effectiveness, 20 learning outcomes tests were used at the cognitive levels C1 to C6. This test is given before the learning (pretest) to see the students' initial abilities and after learning (posttest) to see the comparison of the results of different treatments.

Based on the calculation of the pretest value of the experimental class and the control class, the values obtained were 16.94 and 15.97 respectively. This value indicates that the initial abilities of the two classes are not much different. In this case the control class had a slightly higher initial reliability than the experimental class. But it will be different for the posttest value or value after learning. The experimental class scored 87.78 and the control class 79.17. This value indicates an increase in the value of the experimental class from pretest to posttest higher than the control class. This proves the statement that student learning outcomes before and after using guided inquiry-based student worksheets are seen to increase during initial tests and final tests. In addition, the value also shows that in the posttest the value of the experimental class is above the value 80 (the minimum completeness criteria value). Previous research shows that 70% of students have values above the minimum completeness criteria for students learning with guided inquiry [15]. If in a learning more than 60% of student learning outcomes above minimum completeness then the learning has been effective [16]

The difference in the value of the pretest and posttest was calculated to be carried out by N-Gain analysis and hypothetical test. The N-gain test was conducted to see whether guided inquiry-based student worksheets were effectively used to improve student learning outcomes. The results of the N-Gain analysis show that the experimental class scored 0.86 while the control class scored 0.76. The data has high criteria [13]. Even though it is equally high, the experimental class scores higher. This value shows that guided inquiry-based student worksheets are effective in improving student learning outcomes. This is because learning with guided inkuir models and understanding concepts easily so as to provide meaningful learning [10] [11].

This result is in line with the hypothesis test. Before testing hypotheses, the data obtained is first tested for normality and homogeneity. Based on the results of the analysis of normality and homogeneity using the SPSS statistical application it is known that the data is normally distributed and has a homogeneous variance. Therefore in this hypothesis test using independent sample t-test with the help of SPSS statistical applications. Based on the results of

the analysis that has been carried out obtained a significance value of 0,000. This means that the learning outcomes of students who learn with student worksheet based on guided inquiry increase significantly with students who learn without student worksheet based on guided inquiry.

The effectiveness of the worksheets based on guided guild is because in the experimental class each concept is explored with one or more models and guided by key questions. These key questions can guide students to learn independently, be active in group discussions and find concepts according to the steps on the student worksheet. This key question will guide students in finding concepts by observing the model [17]. Besides learning with a guided inquiry model is student-centered learning, students work in a small group, but the role of the individual is also fully involved when the learning process takes place [6]. So that students who learn by using guided inquiry strategies are easier to understand and understand the concept of lessons and increase the effectiveness of interactions, team building, learning, and interest through highly structured group work [10]

Therefore the exploration and formation stage of the concept takes place well. Whereas in the control class the teaching materials used are less equipped with models that can be analyzed by students. At the concept formation stage the key questions are conveyed by the teacher without being presented in the teaching materials used so that students find it difficult to find concepts independently and group discussions do not go well. Thus, it is evident that one of the effective models of learning incuri is learning guided inkuri (5). This study shows the same results as previous studies that showed guided inquiry learning was effective in improving learning [18] [19] [20] [21].

V. CONCLUSION

The effectiveness of guided inquiry-based student worksheets to improve learning outcomes in buffer solution material is seen from the comparison of student learning outcomes in the experimental class and the control class. The experimental class N-Gain test results showed a higher value than the control class. In addition to the hypothesis test the significance value obtained is smaller than the significance level. It can be concluded that guided inquiry-based student worksheets effectively improve student learning outcomes.

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