International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Enhancing Students' Cognitive Outcome in Chemistry by Guided Inquiry Learning Models

Ryzal Perdana[a]*, Ratu Beta Rudibyani[b]

[a]*Faculty of science and technology, Nahdlatul Ulama University of Lampung, Indonesia*

[b]*Faculty of teacher training and education, University of Lampung, Indonesia*

[a]*Email: Ryzalperdana2009@gmail.com*

[b]*Email: Ratu.betta.r@gmail.com*

Abstract

This study aims to determine the effectiveness of guided inquiry learning models on salt hydrolysis material to students' cognitive learning outcomes. Quasi experimental research uses pre-test and post-test control group design. The research was conducted in senior height school in East Lampung, Indonesia. The subjects of this study consisted of 36 students of XI IPA 1 as experimental class using guided inquiry learning model and 36 students of XI IPA 4 as control class using lecture method. The data were collected using the test technique in the form of 30 multiple choice questions. Data were analyzed by t-test using SPSS. The results showed that the t-test in the experimental class was obtained by probability (p) -6,347 ($p < 0.05$), so H0 was rejected. The results showed that there was a significant difference between the pretest and posttest score of the students using guided inquiry model with N-gain of 0.900. The learning outcomes in the control class also increased but not as large as in the N-gain experimental class of 0.414. It can be concluded that guided inquiry learning model enhancing students' cognitive learning outcomes.

Keywords: Learning Models; Guided Inquiry; Student's Cognitive; Learning Outcomes.

1. Introduction

A formal education program is the process of training and developing people in knowledge, skills, thoughts, and characters in a structured and certified program. Teaching refers to learning in order to prepare learners with specific knowledge, skills or abilities applied in one learning process [6].

---

* Corresponding author.

Learning is an activity or psychic, which takes place in an active interaction with the environment that produces a number of changes in the knowledge, skills, values, and attitudes that are constant and permanent [13]. Similar opinion also states that learning is a process of business that a person undertakes to obtain a whole new behavior change, as a result of his own experience in interaction with his environment [10]. Learning objectives are a number of learning outcomes that indicate that the student has performed a learning act that indicates that the student has performed a learning act, which generally includes new knowledge, skills and attitudes, which students are expected to achieve. The goal of learning is a description of the behavior that is expected to be achieved by students after the learning process and is an accurate way to determine learning outcomes [9]. Implementation of Curriculum 2013 is done by trained students' skills reflected in the learning activities to improve learning outcomes [5].

Science or Natural Science (IPA) is one of the requirements in the mastery of science and technology. Chemistry as one of the basic science in science has a big share in the progress of science and technology. This is marked by the development of technology in all fields that apply chemical concepts. However, in fact the students' cognitive learning outcomes nationally are still considered low and less than optimal. Pursuant to result of questionnaire of student requirement analysis can be known that salt hydrolysis material is one of material that is difficult to be understood because in this material value of national exam (UN) student year 2013 and 2014 still low.

One way to enhancing student learning outcomes is to use an inquiry learning models. One of the learning oriented skills of developing the process of science is inquiry learning. The inquiry based learning approach (inquiry) is supported on the knowledge of the learning process that has emerged from the research [1].

The guided inquiry method is the inquiry approach by the teacher guiding the students to do the activity by giving the initial question and directing to a discussion. The teacher has an active role in determining the problem and the stages of the solution. With this approach students learn more oriented to the guidance and instruction of the teacher until students can understand the concepts of the lesson. In this approach students will be exposed to relevant tasks to be solved either through group discussions or individually to be able to solve problems and draw conclusions independently.

Based on the questionnaire of the teacher's needs, it is found that teachers rarely use inquiry method in chemistry learning, so the researcher decided to apply guided inquiry method. The results showed that students who were taught using guided inquiry methods had better achievement scores than students who were learning by using conventional learning methods [8]. This is in line with research that mentions cognitive learning outcomes of students increased by using guided inquiry inquiry model[12]. Based on the above explanation then conducted a study with the title "Enhancing student’s cognitive outcome in chemistry by guided inquiry learning models”

2. Review of Literature

Learning is a process traversed by students to gain from the purpose of learning itself is a form of competence

that must be possessed by students through students through learning activities. This is in line with the implementation of Curriculum 2013 in Indonesia, conducted by trained the skills on students that are reflected in learning activities to improve learning outcomes [5]. One way to improve student learning outcomes is to use an inquiry-based learning model. Guided inquiry is a model that can improve students' cognitive learning outcomes. Guided inquiry has a syntax of learning: observation, formulating problems, designing experiments, conducting experiments, collecting experimental data, analyzing experimental data, drawing conclusions, and making conclusions [4,7].

The results of cognitive learning is the level of achievement mastery of the material that must be achieved students. Bloom further explained that "Cognitive domain consists of six categories" namely: knowledge, comprehension, application, analysis, synthesis, and evaluation.

3. Method

Place of study conducted in senior height school at East Lampung, Indonesia. The subjects of this study consisted of 36 students XI IPA 1 as the experimental class using the guided inquiry learning model and 36 students XI IPA 4 as the control class using lecture method. The research design used was pre-test and post-test nonequivalent control group design. The test design uses two classes: control class (using lecture method) and and treatment class (using guided inquiry model). Both classes get pre-test first before receiving treatment and then proceed with post-test in both classes [11]. The research design can be seen in Table 1.

Table 1: Research Design

Group	Pretest	Treatment	Posttest
Control	O_1	X_1	O_2
Experiment	O_3	X_2	O_4

Note:

X_1 : control class (lecture method)

X_2 : treatment class (using guided inquiry learning model)

O_1 : Pretest given to control class

O_2 : Posttest given to control class

O_3 : Pretest given to treatment class

O_4 : Posttest given to treatment class

The research used in the experimental class is to use guided inquiry learning model to know the improvement of

the students' cognitive learning outcomes. The syntax of the guided inquiry learning model is presented in Table 2

Table 2: Learning Guided Inquiry Syntax

The syntax of learning		Stages of learning
1)	Introduction of the area of investigation to students	Observation
2)	Finding and looking for trouble	Formulate the problem
3)	Identify the problem under study	Designing an experiment Hypothesis design Conducting an experiment
4)	Determining strategies to solve the problems based on facts found	Collect experiment result data Analyze experiment data Make a conclusion Communicate the results of the experiment

(Source: [4,7])

In this research, the students' cognitive learning result data is collected using the test technique in the form of 30 multiple choice questions.

The data were analyzed descriptively, the data were known to be normal and homogeneous, the further test used was parametric test, the t-test test using SPSS and the increase of students' cognitive learning result can be seen on the sketch gain in the pretest and posttest of the students.

The guided inquiry model is said to be effective in improving students' cognitive learning outcomes if there is a difference between the pretest and posttest results between the t-test and the gain-score calculation.

Normalized gain score by [3]. can be calculated by the formula:

$$\text{N-Gain} = \frac{S_{post} \quad S_{pre}}{S_{max} \quad S_{pre}}$$

Note:

S_{post}: Posttest score

S_{pre}: Pretest score

S_{max}: The ideal score maximum

Table 3: N-Gain Score Criteria

Gain Score Scala	Criteria
$g \geq 0,7$	Height
$0,7 > g > 0,3$	Medium
$g \leq 0,3$	Low

(*Source*: [3])

4. Result and Discussion

Posttest is given to the experimental class after being treated in guided inquiry learning model and lecture method in the control class.

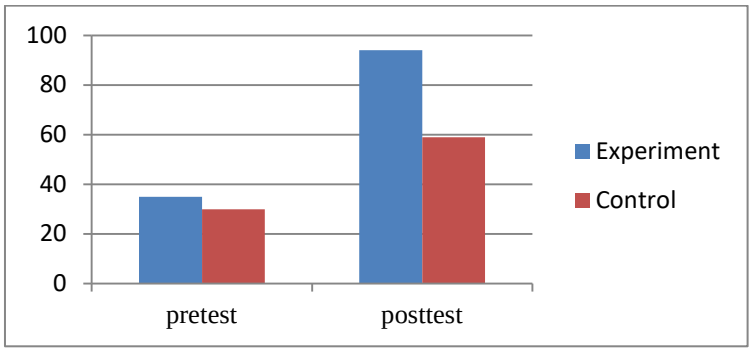

Figure 1: Pretest-Posttest Value Control and Experiment Class

Based on the above graph it is known that the posttest result of the experimental class is higher than the control class posttest.

This can be seen from the mean value of posttest 94 for the experimental class and 59 for the mean posttest grade of the control class. Normal Gain Test of Experimental Class After getting the result of pretest and posttest value, then the N-gain test is done to know the cognitive value of the student. After doing the calculation of N-gain value in the experimental class enter in the high category that is 0.9.

Normal Test of Class Gain The N-gain control for the control class enters into the medium category of 0.414. In drawing the conclusions from the results of the study, conducted the analysis through statistical hypothesis test for the cognitive domain.

The steps taken in this hypothesis test is to test the normality and homogeneity test of both classes of samples first, then tested the similarity of two average - average. From the normality and homogeneity test the two sample classes came from normally distributed populations and homogeneous variance, to conclude the t test was used.

Table 4: Test Results Pretest-posttest Predecessors of Cognitive Classes of Experiment and Control

Data	Test	Type of test	Result	Decisions	Conclusion
Pretest experiment	Normality	*Kolmogorov-smirnov*	*pretest*=0.23	H_o is supported	Data is normal
Pretest control			*pretest* =0.36	H_o is supported	Data is normal
	Homogeneity	*Leven statistic*	=0.112	H_o is supported	Data is Homogeneous
Posttest experiment	Normality	*Kolmogorov-smirnov*	*posttest* = 0.47	H_o is supported	Data is normal
Posttest control			*posttest*=0.21	H_o is supported	Data is normal
	Homogeneity	*Leven statistic*	=0.273	H_o is supported	Data is Homogeneous

Based on Table 4 shows the results of the normality test in the experimental class, the pretest significant value of 0.23 (<0.05), so Ho supported. The pretest data is normally distributed. In the control class normality test, with a significant pretest of 0.036 (<0.05), so Ho is supported. The pretest data is normally distributed. The pretest homogeneity test in the experimental and control classes showed a significant value of 0.112 (<0.05), so Ho supported, homogeneous data. In the test of normality significant posttest experimental class is 0.005 (<0.05), so Ho is rejected. Posttest data is not normally distributed. In the control class normality test the significant value of posttest is 0.47 (<0.05), so Ho is supported. Posttest data is normally distributed. The experimental and control class homogeneity test results showed significant values of 0.273 (> 0.05), so Ho supported, homogeneous data. Based on the normality test indicating normal and homogeneous data then t test is presented in Table 5.

Table 5: Test Results of Experiment Class and Control

Type of test	Result	Decisions	Conclusion
t-test	$-t_{statistic} = -7, 285$ P=0.000	H_o is not supported	The result is not same (there is a difference)

Based on Table 5 shows the t test on the experimental class and control class. The result of t test in the experimental class is obtained by -t statistic = -7,208 with probability value (P) = 0.000 (P <0.005), so Ho is rejected. These results indicate that there is a significant difference in student learning outcomes in the experimental class and control class. It can be concluded that a class using guided inquiry learning model is more effective in improving students' cognitive learning outcomes.

5. Conclusion

Value of the average of the experimental class learning outcomes is higher than the control class. This can be seen from the mean value of posttest 94 for the experimental class and 59 for the mean posttest grade of the control class. Based on the results of t-test, it can be concluded that there is a significant difference between the experimental class learning result and the control, which means the guided inquiry learning model effectively improves students' cognitive learning outcomes with the experimental N-gain grade of 0.9 with the high category while in the control class with N -gain 0.414 with medium category.

Acknowledgments

This research is supported by the “Ministry of Finance Indonesian” and “Ministry of Research and Technology of higher education Indonesian” through LPDP scholarship program.

Reference

[1] Ali,A. The Effect of Inquiry-based Learning Method on Students’ Academic Achievement in Science Course. Universal Journal of Educational Research. 2(1): 37-41. 2014.

[2] Gengarelly, L. M., and Abrams, E. D. Closing the Gap: Inquiry in Research and the Secondary Science Classroom. Journal of SciEduc Technol. 18:74-84. USA: University of New Hampshire. 2008.

[3] Hake, R, R. 1999. Analyzing Change/Gain Scores. diakses di http://www.phisycs.indiana.edu/~sdi/Analyzing Change-Gain.pdf pada 25 februari 2017.

[4] Joyce, B., and Weil, M. Model of Teaching(edisi kedelapan).Yogyakarta: Pustaka Pelajar. 2011.

[5] Kemendikbud. Pengembangan Kurikulum 2013. Jakarta: Kementerian Pendidikan dan Kebudayaan. 2013.

[6] Khaliqa, N., Azizb, A., Hussainc, J., and Malikd, N. Sociological Study of Parents Orientation towards Selection of School for their Children Education. International Journal of Sciences: Basic and Applied Research. Volume 37, No 1, pp 253-263. 2018.

[7] Martin, R.. Teaching Science for All Children:an Inquiry Approach (with “Video Explorations” Video Workshop CD-ROM). USA: Alyyn and Bacon 75 Arlington St Sulte 300 Boston. 2005.

[8] Matthew, B. M. and Kenneth, I.O. A Study on The Effects of Guided Inquiry Teaching Method on Students Achievement in Logic. International Research. 2(1): 134-140. 2013.

[9] Oemar Hamalik. Kurikulum dan Pembelajaran. Bumi Aksara, Jakarta. 2008.

[10] Slameto. Belajar dan Faktor-Faktor yang Mempengaruhi. PT Rineka Cipta, Jakarta. 2010.

[11] Sugiyono. Memahami Penelitian Kualitatif. Bandung: Alfabeta. 2012.

[12] Udiani Ketut, A.A.I.N., Marhaeni, I.B., and Arnyana, P. Pengaruh Model Pembelajaran Inkuiri Terbimbing terhadap Hasil Belajar IPA dengan Mengendalikan Keterampilan Proses Sains Siswa. e-Journal Program Pascasarjana Universitas Pendidikan Ganesha. Vol 7, No 1 Tahun 2017.

[13] W.S. Winkel. Psikologi Pengajaran. Media Abadi, Yogyakarta. 2009.

[14] Wahyuni, R., Hikmawati., and Taufik, M. Pengaruh Model Pembelajaran Inkuiri Terbimbing dengan Metode Eksperimen terhadap Hasil Belajar Fisika Siswa Kelas XI IPA. Jurnal Pendidikan Fisika dan Teknologi. Volume II No 4, October 2016.