



## THE EFFECTIVENESS OF GUIDED INQUIRY LEARNING OF INTEGRATED SCIENCE TO IMPROVE STUDENT'S COMPETENCE

Usmeldi<sup>1,✉</sup>, Risda Amini<sup>2</sup>, Agus Suyatna<sup>3</sup>

<sup>1</sup>Electrical Engineering Education Department, 25131, Universitas Negeri Padang, Hamka Street, Air Tawar, Padang, Indonesia

<sup>2</sup>Elementary Education Department, 25131, Universitas Negeri Padang, Hamka Street, Air Tawar, Padang, Indonesia

<sup>3</sup>Faculty of Education and Teaching, 25131, Universitas Lampung, Indonesia

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### Abstract

Natural Science is one of the subjects in Junior High School (SMP). Preliminary survey shows that many (65%) of students who have not finished learning science. The subject matter of science is not yet integrated. Teacher centered learning. Therefore, it is carried out an integrated science learning based on guided inquiry. The study aims to determine the effectiveness of integrated IPA learning based on guided inquiry to improve the competence of learners. This research uses quasi experiment method with pretest-posttest group control design. The subjects of the study were students of eight grades at SMP Negeri 24 Padang. Data were collected using observation sheets, learning outcome test, skill assessment sheets, and attitude questionnaires. The result of the research indicates that the learning of integrated science based on guided inquiry is effectively to improve the student's competence, based on: (1) Mastery learning of has been achieved by most (87.5%) students on knowledge competence, 96.9% on skills and 100% on attitude competence. (2) The improvement of student's competency on experiment class including high category on knowledge domain, (3) Average competence of experiment class is higher than control class. (4) The effect of the implementation of integrated science based on guided inquiry to the student's competence including large categories. (5) Student response to the implementation of learning is very good category.

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✉Correspondence author:

**Usmeldi**

Electrical Engineering Education Department

Universitas Negeri Padang

Email: [usmeldy@yahoo.co.id](mailto:usmeldy@yahoo.co.id)

## INTRODUCTION

Natural science is an important subject which has important role in education. The subject contributes vital development of global knowledge. In natural science, students are encouraged to find the materials themselves and to be able to deliver those materials in a complex way. They are demanded to check new information according to the old formulas and to revise the information if it is no longer applied. Students should be supported to construct knowledge in their mind, to be motivated to solve problems, to find things for themselves, and to do many things based on their ideas (Kemendikbud, 2013).

As the effort to achieve the goal of natural science education, the government has already released a regulation regarding the standard of natural science teacher's competence. The regulation of Ministry of National Education number 16 year 2007 affirms that natural science teacher should possess the concept and thinking mindset regarding natural process. Besides, science teacher should have the competence regarding the learning of science education and apply it in the learning process. In relation to the curriculum of teacher's standard competence, teacher of natural science education should be able to master the concept of science and centralize the learning method for the students. One of the learning methods for that is inquiry model. In 2013 curriculum, every stage of education should conduct the learning process in interactive, inspirative, joyful, challenging, and motivating for students to make them actively participate in classroom activity. Hence, they will be able to develop their creation, creativity, and independence based on their interest, talent, psychological, and physical development. Therefore, in each stage of education stage, there should be a planning for the lesson, activities, and scoring to improve the efficiency and effectiveness of graduate's competence (Regulation of Ministry of Education and Culture No 65 Year 2013).

The learning of science is generally conventional. Students listen to teacher's lecture and take notes in their notebook. The lecture and notes make the students passive; they start to

think that science is a difficult thing to learn actively. Besides understanding the formulas for physics, student are supposed to understand scientific concept. Apart of that, in the class discussion, there are only some active students participate. Thus, the student's learning outcome become bad.

Based on the learning results of students in SMPN 24 Padang, 65.6% students did not pass the passing grade. Later, the learning process is considered unsuccessful, since many students did not completely comprehend the learning materials. The problem happens due to several factors, which come from the students, teachers, or the learning resources. In learning, students tend to choose teachers or students they like to motivate them in learning.

Teachers are also the determining factors for the success of the students in learning. Thus, the learning process will run in a joyful way. In order to achieve that, the teachers should be able to completely and systematically plan the lesson. The objective of teachers' lesson plan is to make the learning process inspirative, interactive, interesting, challenging, and motivating (Depdiknas, 2008).

The low ability of students in understanding the concept of science is due to their lack of knowledge regarding scientific concepts, such as: problem solving, scientific processing skills, thinking skills, and rational thinking. The lack of preparation can be seen from the learning process which is mostly presented in a lecture to explain theories and assignment. Reif (1995) states that an informative learning method causes the learning process to become less effective for students to obtain functional knowledge.

In order to improve student's understanding of scientific concept, there should be a learning process which can give the students capital of mastering and implementing scientific concept. A learning model which can be used for the learning process is guided inquiry approach. Inquiry is a method for teaching science which refers to the way of asking, finding knowledge or information, and to understand natural phenomenon. Inquiry is a method which can train students to become active and creative in learning. This learning method emphasizes the learning process in the laboratory by using

inquiry method, demonstration, and experiment. The learning process of science in the laboratory allows the students to obtain theoretical and applicative knowledge through hands-on activities. The learning of science has a direction on the learning process which actively involving students in the formation of scientific concept through practicum. In the learning process of inquiry, concept is found by doing experiment based on the fact discovered in the laboratory. Guided inquiry learning method means the investigation of learning problems by providing questions and materials supported by the teacher. The problems raised by the teacher is expected to support the students in conducting investigation to know answers of certain problems (Mercer, 2004; Bao, 2009).

Guided inquiry learning model has problems if the students do not have the creativity of inventing ideas (Fellenz, 2004; Krischner 2006; Belland, 2012). The model aims to give students chances to find facts, concept, and principle through direct experiment, the improvement of science literacy, and training the students in solving problems or questions. The learning process of guided inquiry has the characteristics as said by Ashiq (2011) and Sadeh (2009) as: (1) Students are conditioned to investigate problems to obtain knowledge. (2) Students are motivated to actively and reflectively learn something. (3) Students learn based on their experiences. (4) Students develop ideas of learning through guidance. (5) Students develop in staged level. (6) Students have different learning way. (7) Students are educated through social interaction with other people.

Sanjaya (2011) explains that guided inquiry is a set of learning activities which emphasizes on critical and analytical thinking to find and discover answers from a raised problem. Inquiry learning is a process of learning which is oriented to students. In this approach, students have dominant role in the learning process. The learning steps using inquiry method are in the sequences of: orientation, problem solving, hypothesis, data collection, hypothesis, and conclusion (Majid, 2014). Based on Sanjaya (2011), guided inquiry will be effective if: (1) Teachers expect the students to find answers from the raised problems themselves. (2) The

learning process are not in the form of cognitive or conceptual building, but it is packed in an evident conclusion. (3) Learning process starts from student's curiosity. (4) Teachers have enough time. (5) There are not many students in one class.

Based on the previous condition of science learning, guided inquiry learning of science is required to improve Junior High School student's competencies. The model is expected to improve student's ability in mastering the concept of science, the skills of conducting experiment and having scientific behavior. Thus, this research comes with the research question of: How is the effectiveness of guided inquiry science learning process to improve student's competences?

## METHODS

This research uses quasi-experimental method with the design of pretest-posttest control group (Creswell, 2008). Pre-test and post-test is given to students in the experiment and control class with the same test items. This research was done to 32 students of the grade VIII in SMP Negeri 24 Padang in science. The steps of the research are: (1) conducting initial survey, (2) framing the lesson plan based on guided inquiry approach (lesson plan, student's worksheet, and assessment), (3) validating lesson plan, (4) planning research instrument, (5) conducting experiment of lesson plan and research instrument, (6) analyzing try out test, (7) giving pre-test, (8) giving action with conducting guided inquiry learning approach for science in the experiment class, while the control class has the conventional learning, (9) giving post-test, and (10) analyzing data and interpreting the learning result.

The instruments of the research are: observation sheets, learning result test, and the questionnaire of student's responses to the learning process. The observation is used to do initial survey. The data of the test was analyzed quantitatively to know student's competence in learning. The effectiveness of the learning process is reviewed from the competence and student's opinion regarding the learning process. The improvement of student's competences are analyzed by counting the average normalized-

gain scores from pre-test and posttest. The average difference of student's competence in the experiment and control class is analyzed using t-test and continued with effect size to know the impact of learning method to student's learning result. The responses of the students to the learning process was analyzed by comparing the average score with the categorized score.

## RESULTS AND DISCUSSION

The effectiveness of integrated science learning based on guided inquiry in improving student's competence is reviewed from: (1) student's grade, (2) student's competence improvement, (3) average difference of student's competence score in the experiment and control class, (4) the impact of learning method to student's learning outcome, and (5) student's responses to the learning process. All aspects are analyzed to know the effectiveness of the learning model.

### Student's Grade

The scoring to student's competence in the experiment class copes the knowledge, skills, and behavior (Table 1). The result of student's scoring is obtained from the analysis of student's learning process in each meeting. Student's classical passing grade are basically achieved. The result of psychomotor scoring was obtained from the observation during the learning activities. The result of the behavior scoring are obtained during the learning process. The observed behaviors are thorough understanding, curiosity, disciplines, cooperation, and responsibility. The average score of behavior of the students in four meeting shows that 10 students have good behavior and the other 20 are very good. The percentage of student's good and very good behavior are 100 %. The fact shows that integrated science learning based on guided inquiry can improve student's behavior.

**Table 1.** Student's Learning Outcome

| No | Student's Learning Scope | The Average Learning Result in the Meetings |      |      |      | Pass (%) |
|----|--------------------------|---|------|------|------|----------|
|    |                          | 1   | 2    | 3    | 4    |          |
| 1  | Knowledge                | 76.3  | 81.6 | 89.0 | 93.0 | 87.5     |
| 2  | Skills                   | 75.0  | 87.7 | 92.9 | 95.2 | 96.9     |
| 3  | Behavior                 | 77.8  | 84.4 | 87.8 | 88.3 | 100      |

### Student's Learning Improvement

The average learning result of the students in the experiment class before the guided inquiry method was 68.3. After the application of the method, the average score raised into 93.0 (fourth meeting). Student's learning outcome is included into a very good category. The improvement of student's outcome can be obtained from counting the average normalized gain score ( $\langle g \rangle$ ) from the average score before and after the learning process. After coming through the process of data analysis, the analysis obtained the score of  $\langle g \rangle = 0,8$ . Based on the categories of normalized gain score, the improvement of student's learning outcome in the classroom is categorized as high.

### The Difference of Learning Result of the Students in the Experiment and Control Class

Before analyzing the data to know the average score of students in the experiment and control class with using t-test, the normality distribution test and data homogeneity test were conducted. The normality distributed test and the homogeneity test is the requirement for analyzing data to determine the formula of t-test in the research. The result of the normality test show that the pretest and posttest of the students in the experiment and control class had normal distribution in the significance level of  $\alpha = 0.05$ . The result of homogeneity test data shows that the pre-test of the students in the experiment and control class is homogeneous ( $\alpha = 0.05$ ). The same thing also happens to the posttest.

Based on the result of the normality test and homogeneity test in both classes, the test for the difference of the student's learning outcome is obtained through t-test (with the formula of normal data and homogeneous data). After conducting the average difference test, the students obtained the average pre-test score in slightly significant differences ( $\alpha = 0.05$ ). Thus, the learning outcome of the students in integrated science learning based on guided inquiry is the same in both classes. The difference of posttest

shows that the students in the experiment and control class has significantly different result ( $\alpha = 0.05$ ). Thus, it can be concluded that the learning result of the students in integrated natural science class is different. The average score of student's learning outcome in the experiment class was higher than the control class. The result of the average difference test in the experiment and control class for the pretest and posttest can be seen in Table 2.

**Table 2.** The Test of Average Difference of Students in the Experiment and Control Class

| Test Group | Action Group | Average Score | SD  | t <sub>score</sub> | Note           |
|------------|--------------|---------------|-----|--------------------|----------------|
| Pre-test   | Experiment   | 68.3          | 6.9 | 0.325              | In significant |
|            | Control      | 67.8          | 5.3 |                    |                |
| Post-test  | Experiment   | 93.0          | 5.8 | 8.303              | Significant    |
|            | Control      | 79.2          | 7.4 |                    |                |

$$t_{\text{table}} = 2.000$$

### The Impact of the Learning Process to Student's Learning Result

The impact of the application of guided inquiry method to student's learning result was counted using effect size with Cohen formula. The measurement shows the effect size of 3.875. The result shows that there is a significant impact of guided inquiry learning in science to student's learning outcome in a high category.

### The Responses of the Students to the Learning Method

The analysis of student's responses shows that there is an average of 85.7 acceptance which is included as a very good. The score of the category came from the average ideal score and the ideal standard deviation. The result shows that most of the students can do the integrated learning of science based on guided inquiry method.

Based on the analysis of the data, it can be stated that: (1) the passing grade of the students was achieved by most of the students which was 87.5% for the competence of knowledge, 96.9% for the competence of skills, and 100% for the competence of behavior, (2) there is an improvement for students in the experiment class, specifically for the scope of knowledge, (3) there is a significant difference to the average score of competence between students in the experiment class and the control class, (4) the

average competence of students in the experiment class was higher than the control class, (5) the impact of guided inquiry learning to student's competence was high, and (6) the average score of student's responses in the learning process was very good. Therefore, it can be concluded that the learning of science using guided inquiry method was effective to improve student's competence.

### Discussion

The result of the discussion shows that the learning of science using guided inquiry model was effective to improve student's competence. Based on the analysis of student's learning outcome, at the first meeting, there are still many students who got low result. The low result happened because the students were not accustomed to the learning model. They have difficulties in following the learning process of science using guided inquiry process. In learning science, students have a problem which should be solved through experiment. The activity will ignite student's curiosity to learn the material further. Besides, the guided inquiry is also included into the experiment, discussion, presentation, and composing reports.

An investigation to guided inquiry model in teaching science shows that the learning model can improve students' scientific understanding. The model allows the students to build

knowledge independently and help them to understand the concept of science (Pandey, 2011; Lee, 2010; Minner, 2010; Wilson, 2010). The learning process of guided inquiry help the students to improve their learning result or outcome (Lederman, 2013; Fitriani, 2016; Hairida, 2016; Sukma, 2016), to conduct investigation in the laboratory (Gerald, 2011; Brickman, 2009), and to gain scientific ability. The implementation of guided inquiry does not only rely on student's scientific understanding, but also to the scientific process and skills (Ambarsari, 2012; Ariesta & Supartono, 2011; Khan, 2011). Guided inquiry can help the students to develop the skills and ability based on the daily needs (Gerald, 2011; Opara & Oguzor, 2011).

The improvement of scientific conceptual understanding by the students through guided inquiry model is supported by McDermott (1975). He states that students should be able to do something in the laboratory beside mastering essential concept. Students should be able to do practicum, solve problems, and communicate result based on the criteria of ABET (Lattuca, 2006). Inquiry practicum is a good skill to develop. The result of the reserach is also supported by Cox (2002) and Jongdee (2009) that inquiry laboratory activities can help the students in doing practicum. Deters (2005), Weaver (2008), and Widowati (2017) in their researches, show that inquiry laboratory can improve student's ability in logical thinking, problem solving, and making good impression on laboratory activities.

The importance of laboratory activities is also stated by Ivins and Raghubir. Ivins (McComas, 2005) says that laboratory is an effective place to help students understanding the concept of science more than a discussion. Raghubir (McComas, 2005) finds that students show higher cognitive level when they are actually able to obtain knowledge through laboratory actiities for verifying theories they have learned. Practicum inquiry is a challenging activity which helps the stduents in finding the concept of science. Cox (2002) mentions that laboratory inquiry can improve student's skills in conducting practicum. Wahyudin (2010) says that the implementation of guided inquiry

learning with the help of multimedia can improve student's interest and understanding.

## CONCLUSION

The result of the research shows that the learning of science based on guided inquiry is proven effective in developing student's competence, based on: (1) the passing grade of the students was achieved by most of the students which was 87.5% for the competence of knowledge, 96.9% for the competence of skills, and 100% for the competence of behavior, (2) there is an improvement for students in the experiment class, specifically for the scope of knowledge, (3) there is a significant difference to the average score of competence between students in the experiment class and the control class, (4) the average competence of students in the experiment class was higher than the control class, (5) the impact of guided inquiry learning to student's competence was high, and (6) the average score of student's responses in the learning process was very good. The suggestion to the teacher is that the guided inquiry learning should be applied for teaching science.

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