

The Effectiveness of the Guided Inquiry Learning Module towards Students' Character and Concept Understanding

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Abstract: *This study aims to investigate the effectiveness of learning using the guided inquiry module towards students' character and concept understanding. The study design used is one group pretest-posttest. The data collection methods used are interview, observation, test, and documentation. The data are analyzed by classical completeness and N-gain methods as well as quantitative descriptive by calculating the average score and determining the criteria on certain interval class. Learning by using guided inquiry module is considered effective in increasing students' concept understanding if the classical completeness analysis result of cognitive test at least reaches 85% and N-gain result is more than 0.3. While learning by using guided inquiry module is considered effective in improving students' character when the average affective and psychomotor learning outcomes get predicate of good or very good in every aspect. The data analysis result shows that 87.50% of the students achieve Classical Completeness Criteria (CCC) grade in the cognitive test and N-gain score by 0.73 as well as the average affective and psychomotor learning outcomes of students received the predicate of good and very good at all aspects. Based on the results obtained, it can be concluded that learning by using guided inquiry-based chemistry module is effective in improving students' character and concept understanding.*

Keywords: The effectiveness of learning, Character, Guided Inquiry Module, Concept Understanding, Classical Completeness Criteria

1. Introduction

Chemistry is one of the subjects that is closely related to daily life, so that in understanding the chemical material, students do not just memorize the theory, but they also need to link the chemical material with an example in life. Suharyadi et al. (2013) stated that the learning process that connects a concept with an example in life will survive longer in one's memory. In addition, the sample buffer solution in life can facilitate students in finding the concept of buffer solution material independently. The discovery of concept through self-finding will make student learning more meaningful (meaningful learning), and this significance will have an impact on the improvement of students' learning outcomes (Budiada, 2011). Therefore, the learning process involving students actively in finding the concept of a material by their own is very appropriate to overcome students' difficulties in understanding the buffer solution material.

In the context of chemistry learning, students' understanding of the concept is still relatively low (Adayani, 2009). According to Marsita et al. (2010), one of the factors that lead to students' difficulties in learning chemistry is the concept engrafting of buffer solution material which is less deep. This can be overcome by linking the concepts of buffer solution with everyday life and the need for learning strategies that create such good atmosphere of learning so that students can work together to solve a problem by finding new things (Marsita et al., 2010).

Learning model that involves students to find concept of a material by their own is inquiry learning model. According to Sanjaya (2006: 194), inquiry learning is a series of learning activities that emphasize on analytical and critical

thinking process to seek and find the answer of a problem. In general, the inquiry learning process includes five steps such as formulating the problem, proposing hypotheses, gathering data, testing hypotheses, and drawing conclusions (Bulunuz & Zehra, 2009; wardani, 2013). This is in accordance with the stages in the scientific activities commonly done in the study of natural science; one of them is on the chemistry subject.

Syah (2005: 191) states that inquiry is a process of the use of students' intelligence in acquiring knowledge by finding out and organizing the concepts and principles into an order of importance according to the students. The main purpose of inquiry is to develop intellectual skills, critical thinking and ability to solve problems scientifically (Dimiyati & Mudjiono, 1999:173). Judging from the involvement of teachers in the learning process, there are three kinds of inquiry model; they are guided inquiry, free inquiry, and modified inquiry (Nurhadi et al., 2004:72).

Guided inquiry module is a module that presents the material and problem by using the method of investigation where the students are guided to be able to find the concept of the materials studied by their own (Malihah, 2011: 18). Module is a book written with the intention that the students can learn independently without or with the guidance of a teacher (Novana et al., 2014). A good module is a module that contains at least the learning instructions (instructions for the student / teacher), the competence to be achieved, the content of the material, supporting information, exercises, manual work (can be a worksheet), evaluation, and feedback to the results of evaluation (Direktorat Pembinaan SMA, 2008: 13). This guided inquiry approach is training the students to be more oriented to the guidance and instructions from teachers so that students can understand the concepts of the lesson

(Matthew et al., 2013). In this method, the students will be faced to the tasks that are relevant to be resolved either through group discussion or individually to be able to solve the problem and draw a conclusion independently (Douglas, 2009).

Guided inquiry module used in the learning process contains learning activities which are carried out in accordance with the stages in the guided inquiry learning model. The parts contained in the module include the presentation of the problem, formulation of hypotheses, presentation of data source, drawing conclusions, tasks application, and measurement of the level of understanding through the exercises. The module designed by the researchers consists of 62 pages, which presents buffer solution material which is divided into four activities which represent 4 sub materials.

In each of the activities contained in the module, students are guided to perform learning by using a model of guided inquiry in accordance with the instructions presented in the module. Initially students are guided to read articles that are presented in the module on each activity. The articles presented in the module are articles related to everyday life and completed with an image as background information on the content of the article. There are 4 articles in the module that represent each activity. After reading articles, students are guided to identify problems based on the articles they read and made a hypothesis or provisional estimates of the matter. Then, students are guided to read the material in the module as a source of hypothesis testing that has been formulated. Furthermore, students are guided to verify the hypothesis by writing an explanation and conclusion of the activity.

At the end of each activity, students are guided to evaluate learning by answering some questions as many as 10 questions on each activity and conduct self-assessment in accordance with the instructions contained in the module. If the students' score is in accordance with the standard level of mastery, then they can proceed to the next activity. However, if the students' score is less than the standard level of mastery, then they must repeat the previous activities. At the end part of the module, there is a final evaluation that contains a set of questions about the material covered in activity 1-4 that are arranged in the form of multiple choice questions, a bibliography, an answer key for the exercises in each activity and the final evaluation, the appendices in the form of ionization equilibrium constant of a weak acid and weak alkali, as well as a glossary.

Guided inquiry approach is inquiry approach in which teachers guide students to perform activities by giving the initial question and leading to a discussion (Sanjaya, 2008:202). Teachers have an active role in defining the problem and the stages of its solution. This guided inquiry approach is used for less experienced students to learn with inquiry approach (Villagonzalo, 2014). With this approach, students learn by orienting more to the guidance and instructions from teachers so that they are able to understand the concepts of the lesson (Anderson, 2002). At this approach, the students are faced with tasks that are relevant to be resolved either through group discussion or individually to be able to solve the problem and draw a

conclusion independently so that it can develop the student's character.

Students' characters that can be developed through learning in the classroom by using guided inquiry module include accuracy, self-reliance, curiosity, responsibility, and cooperation. While the character of students that can be developed through learning in the practicum can be seen from the activities such as preparing the tools and materials, skill in using the tools, mastery of practicum procedures, teamwork, observing experimental results, drawing conclusions and communicating the results of the experiment. Those students' characters maybe grouped on the assessment of affective (attitude) and assessment of psychomotor (skills) (Sudaryono, 2012:43).

Basically, students get necessary guidance during the learning process (Villagonzalo, 2014). In the early stages, teachers provide much guidance, and then at subsequent stages, the guidance is reduced, so that the students are able to conduct the inquiry process independently (Furtak, 2006). The guidance given can be in form of questions and multidirectional discussion that can lead students to understand the concept of a lesson (Barrow, 2006). During the learning process, the teacher should monitor the discussion groups of students, so teachers can know and give instructions needed by the students.

Guided inquiry learning model is a good model of inquiry learning used for students and teachers who have not been accustomed to using the inquiry model in learning activities. According to Villagonzalo (2014), guided inquiry learning model emphasizes on the learning process involving students actively in learning activities with the guidance of a teacher if necessary. Active student involvement can make the learning process more meaningful so it can improve the understanding of the concept of the material being learned and is able to improve the character of the students.

The problems to be solved in this study are: 1) whether the guided inquiry learning module implementation is effective in improving students' understanding of concepts, and 2) whether the guided inquiry learning module implementation is effective in improving students' character.

2. Method

This study is an experimental study using pretest-posttest control design (Sugiyono, 2013). The material used in this study is buffer solution. The population of this study is all students of class XI Mathematic and Natural Sciences 2 of State Senior High School. Sampling is conducted by using purposive sampling technique. The data are collected by the methods of documentation, testing, and observation. The research instruments used a cognitive assessment sheet, psychomotor assessment sheet, and affective assessment sheet.

The researchers conduct chemistry learning on the material of buffer solution in class XI Mathematics and Natural Sciences 2 assisted with guided inquiry module based on the learning plans that had been developed and validated before. Before the learning process begins, the researchers

conducted a pretest to measure the initial condition before the learning activity assisted with guided inquiry module. After that, each student is given a guided inquiry chemistry module as a handbook in the learning process conducted by the researchers. In the learning process, the researchers guide the student to conduct inquiry activity based on the instructions contained in the module. At the end of the meeting, the researchers held a post test to measure students' understanding of the concept after learning by using guided inquiry module.

At each meeting, the students have a discussion related to the issues contained in the module based on the inquiry method. Each group presents the results of the discussions and conclusions of the discussion in front of the class. This activity is performed to measure the student's character based on an assessment of affective. Students also do a practicum in the laboratory with the instructions contained in the guided inquiry module. The researchers conduct practicum activities in the laboratory to measure the student's character based on the student's skills in conducting experiments in the laboratory.

3. Result and Discussion

Students' understanding of the concept of the buffer solution material is measured by using cognitive tests performed before (pretest) and after (posttest) the learning with the guided inquiry module. The cognitive questions used to measure students' understanding of concepts are multiple choice questions with reasons. The student's cognitive test results described in Table 1.

Table 1: Students' cognitive test result

Component	Result
Maximum Score	4.00
Average of pretest	0.35
Average of posttest	3.02
N-gain (g)	0.73
Category	High
Number of students	32
Number of students that meet KKM	28
% Classical Completeness	87.5

Based on the results of the posttest, 28 of 32 students get score ≥ 2.85 , or meet the minimum completeness criteria set by the school. The percentage of completeness acquired 87.5% of the students declared complete individually, so that it can be stated that the students meet the classical completeness. N-gain test analysis also shows an increase in cognitive learning outcomes of students with high category 0.73. The results obtained in this study show an increase in cognitive learning outcomes before and after using the guided inquiry module. This shows that the use of the guided inquiry module can improve students' understanding of the concept. These results are consistent with the study conducted by Aulia (2014) which concluded that the inquiry-based learning media used in the learning process can improve students' learning outcomes. In addition, the study conducted by Yuniyanti, et al, (2012) showed that chemistry learning with the inquiry effects on the improvement of students' learning outcomes. The guided inquiry activities

presented in this module can lead students to understand the concept of a lesson (Barrow, 2006).

In addition to the concept understanding, this study also aims to investigate the effectiveness of learning by using guided inquiry module towards the students' characters. The characters assessed are divided into 2; they are affective and psychomotor assessment. Affective assessment is measured with five different characters; those five characters expressed attitudes of the students during the learning process in the classroom. The improvement of affective learning outcome is determined by comparing the scores before and after using guided inquiry learning module. The improvement of learning outcomes of each character is shown in Figure 1.

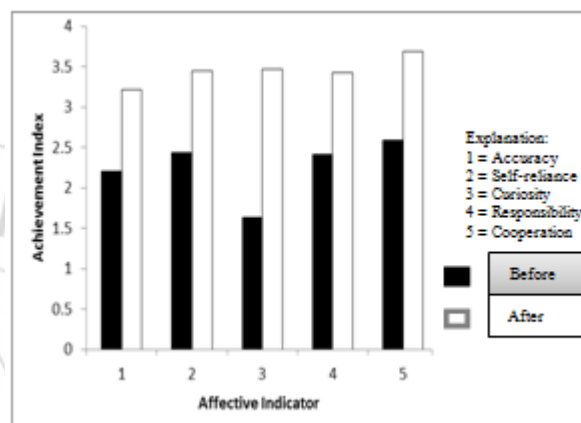


Figure 1: The analysis result of students' affective assessment

The measurement results of the students' characters are measured based on the observation towards the attitude or behavior of students during the learning takes place in the classroom either individually or in groups. The character development result is measured by 5 characters namely accuracy, self-reliance, curiosity, responsibility, and cooperation.

Based on Figure 1, the highest increase of the score of character is on the aspect of curiosity that is 1.84. It is very visible during the process of guided inquiry activities take place. Most of the students have their own opinion about the article they read and they always look for information on the questions raised in the article in the module either through the chemistry handbook they have as well as from the Internet. It can encourage a sense of curiosity of the students to learn the material, especially in learning buffer solution. This result is supported by the opinion of Andriani (2011) that the application of guided inquiry learning model can improve students' enthusiasm in learning activities. In the study conducted by Akhyani (2008) also showed that the inquiry learning can improve students' critical thinking skills.

Aspect which has the second highest average score is the aspect of cooperation with an increase of 1.10. This is evident from the discussions with the inquiry method. The more often students conduct group discussions, the more improvement of good teamwork seen in each group. An increase in the character average score which is high enough is also seen in the aspect of accuracy that is equal to 1.02. Aspect of accuracy is measured based on the accuracy of the

students in completing tasks according to the instructions given in the inquiry activities. Based on the observations, most students are able to understand the instructions and orders given so that they are able to finish the task appropriately.

Aspects of self-reliance and responsibility are the aspects with the highest average score increase after accuracy, that is 1.01. The final average score of the self-reliance aspect is classified in the category of excellent. This is due to the use of inquiry method for learning. Students are accustomed to be faced with tasks that are relevant to be resolved either through group discussion or individually to be able to solve the problem and draw a conclusion independently (Douglas, 2009). The final average score of the responsibility aspect also includes in the aspects with excellent score criteria. This aspect is assessed based on the student's ability to fulfill the tasks during the learning activity; they are conducting discussion of inquiry, always following the learning activity well, and completing tasks according to the instructions in the module.

Based on the results of the study, it can be concluded that the guided inquiry based high school chemistry module developed effectively improves the affective learning outcomes of students on the buffer solution material. These results are consistent with study conducted by Novanaeta. (2014) that the use of inquiry-based module has positive influence on the development of student's character. According to Wiyanto (2005), a model of learning that can build logical, analytical, and systematic thinking ability, and establish a scientific attitude, which many experts recommend is inquiry learning model which gives learners the opportunity to learn to find and not just to accept.

The increase of psychomotor learning outcomes is measured when doing experiments using practicum procedures contained in the guided inquiry based high school chemistry module. Psychomotor learning outcomes measured include 6aspectsas shown in Figure2.

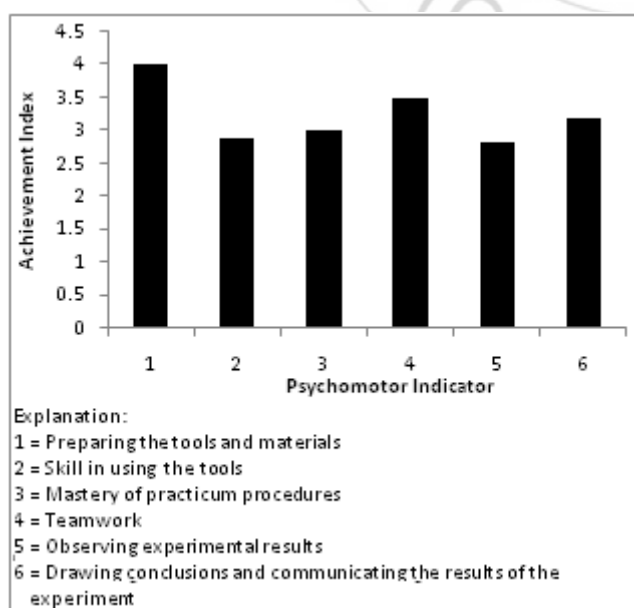


Figure 2: The Analysis of Students' Psychomotor Assessment

Based on the diagram in Figure2, the highest psychomotor average score is on the aspect of preparing tools and materials. Based on the observation, most of the students are able to prepare the tools and materials that should be prepared before the practicum begins. This is because the students are fairly familiar with the situation in the laboratory. Based on information obtained from a chemistry teacher of State Senior High School 2SlawiTegal, the XI class students are accustomed to doing chemistry learning in the classroom and laboratory by rotation every week. It aims to familiarize students not to feel strange when they are in the laboratory.

Aspect with the next highest average score is teamwork. Based on the observation during the practicum, teamwork in each group is excellent; even some students help other groups and exchange information on the observations that have been made. The teamwork is also seen when students clean up the practicum after the completion of the practicum. Although there are still some students who seem less able to work together but this should not be an obstacle during the practicum take place. Even the students look happy and excited when carrying out the practicum.

The next aspect is drawing conclusions and communicating the results of the experiment. Assessment on this aspect is measured with the ability to make conclusions from practicum correctly and completely, and confidently communicate the results of observation to the class. Of 8 groups, there are 3 groups that dare to present their observation results to the class. Students also use some sources from books and the internet as well as a photograph of the observation in the practicum report. Therefore, the practicum reports made by each student are mostly correct and complete.

Aspects with the next highest average score is the mastery of practicum procedures. The practicum was done in the learning practice of buffer solution material is distinguishing buffer solution and non-buffer solution based on the changes in color of the solution when acid or alkali is added with the aid of phenolphthalein indicator as a guide to changes in solution pH. This practicum procedures contained in the guided inquiry based high school chemistry modules. Before carrying out the practicum, students have been told to study the illustration of practicum activities in the module, so that when it comes to the practicum implementation, they have prepared and mastered the practicum procedures although there is a solution that is not identical with those contained in the module because it is not available in the school laboratory. However, the solution does not reduce the functionality of the previous solution, namely a solution of strong acid HCl that is replaced with HNO₃ solution that also includes strong acids.

Aspects of skill in using the tools and observing the results of the experiment are the last aspects assessed by the observers in the buffer solution practicum. The average score of each of these aspects are in good category, namely 2.88 and 2.81. Based on the observation, some students have mastered the tools used during the practicum, but there are still some students who do not know the name or function of

the tools. In addition, when observing the results of the experiment carried out, there are still some students who hesitated and asked the teacher about the experimental results obtained. However, some students also feel confident with the results obtained and are able to explain the reason of the observation results that occur during the experiment.

Based on the result of descriptive analysis, it shows that the average score of each aspect of students' psychomotor belong to good category. This result is also supported by the study conducted by Andayani (2009) which shows that the application of guided inquiry learning model can improve students' scientific work ability. Results of another study conducted by Praptiwietal. (2012); Wardani (2013) also state that guided inquiry learning is effective to improve the mastery of concepts, performance and cooperation of students.

4. Conclusion

According to the study on the effectiveness of guided inquiry learning model towards students' character and concept understanding, it can be concluded that: 1) Implementation of guided inquiry learning module is effective in improving students' concept understanding; 2) Implementation of guided inquiry learning module is effective in improving students' character.

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