The Application of Discovery Learning With Scientific Approach to Improve The Students’ Science Process Skill

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Abstract

The purpose of this classroom action research is to improve the high school students’ science process skill through the application of discovery learning model with scientific approach. Discovery learning gives the opportunity to the students to develop the science process skill by themselves. Scientific approach used to manage the development of science process skill to be more guided and responsible. The research was conducted in two cycles in which each cycle consists of planning, acting, observing, and reflecting. The assessment technique for students’ science process skill is conducted by using observation sheet. Based on the observation results, it is shown that there is significant improvement of students’ science process skill (SPS) score by 17.44% from the first cycle to the second cycle. The ten science process skill (SPS) indicators that were assessed are observing, grouping or classifying, interpreting, predicting, questioning, formulating hypotheses, planning experiment, using tools and materials, applying concepts, and communicating results. Based on the research results, it can be concluded that applying discovery learning model with scientific approach is able to improve the high school students’ science process skill.

Keywords: discovery learning; scientific approach; the students’ science process skill (SPS)

Introduction

Chemistry is the science that is acquired and developed based on experiments to seek answers to the questions of what, why, and how natural phenomena takes place, particularly relating to substances. Introduction to the science of chemistry began in junior high school level, joining with biology and physics in the natural science subject. The learning of chemistry is then continued at the high school level and become an independent subject that is the chemistry subject.

Based on the observations made, it appears that the learning of chemistry at one high school in Kendal Residence is good enough. The teacher has to associate the material with the things experienced and easy to find by students in everyday life. Furthermore, the researcher also conducted an interview with one of the school chemistry teacher who stated that although the learning process has been associated with things that exist in everyday life, still, students are being passive during the learning process. During the lesson, the teacher presents the chemistry knowledge to the students, then the students only pay attention to the explanations and examples given by the teacher without directly involved in the knowledge discovery and construction. Learning activities are still lacking to develop a process of interaction among the learners, between learners and teachers, and learning resources in an environment. In addition, based on interviews with students and teachers of chemistry subjects, learning in the laboratory rarely implemented due to the limited time available so it is only done on certain materials. The lack of practical activities leads to the low science process skill of the students.

The situation in the school is less in accordance with the curriculum 2013 which mandates the scientific approach in the learning process. Scientific approach is an approach that accentuates the dimensions of observation, reasoning, discovery, validation, and explanation of a truth. Therefore, the learning process with scientific approach should be implemented based on the values, principles, and scientific criteria. The learning model used is also based on constructivist learning theory where students carry out a process that is active in constructing meaning, discourse, dialogue, and physical experience which occurs inside the assimilation process and connect thoughts or information that has been learned (Rifa’i & Anni, 2011). Science process skills (SPS) should also be considered in order to meet the competency standards that include attitudes, knowledge, and skills.
Based on the existing problems, the researchers applied the learning model of discovery learning with scientific approach. Discovery learning model is based on constructivist learning theories (Anyahule, 2013). The model and this approach emphasize the active role of students in learning while the teacher only acts as a facilitator in helping students to discover and construct knowledge. According Roestiyah (2001), discovery learning is a teaching method that engages students in the process of mental activity through brainstorming, discussion, seminars, reading on their own and tries it themselves, so that children can learn on their own. Learning discovery model allows a more meaningful learning process so it is well embedded upon the knowledge obtained by students (De Jong & Joolingen, 1998). This is in accordance with Kolb (1984), that knowledge is continuously acquired from experience and testing by the individual. Through practical activities, students gain experience as well as evidence that are tested by themselves so that they always remember the concept of the activities being carried out. The process of finding their own concept will also provide motivation to students to make other discoveries thus increasing interest in learning. Therefore, discovery learning model is appropriate when applied to build science process skills, because in it there is a process to plan, implement, and report the results.

Therefore, the formulation of the problem of this study is whether the science process skills of students can be increased by the application of the scientific discovery learning model approach. The purpose of this study is to determine the increasing state in science process skills of students with the application of the scientific discovery learning model approach.

Methodology

The study was designed as a classroom action research which was conducted in the XI grade classroom consisting 36 students, which consists of 16 male students and 20 female students. The classroom selection technique used purposive sampling that is based on the consideration of the classroom teacher since the students are less active in the learning process and also have a low science process skill, so they need an improvement. There research design was developed according to the design which was developed by Lewin (in Elfanany, 2013) in which each cycle consists of the planning, acting, observing, and reflecting.

The data collecting techniques used are documentation, observation, and test. The data in this study is the assessment of science process skill using the performance assessment technique. The assessment is conducted when the students are doing practical work since the practical work is an important thing of the performance assessment process in which the practical work is an important thing of the developed science curriculum (Mamlok-Naaman, 2012).

The latticework of the observation sheet was developed according to the ten SPS indicators in the colloid material. This material was chosen since the colloid is widely applied and used for human needs, the use and also the products are often used in the daily life. The ten SPS indicators assessed are observing, grouping or classifying, interpreting, predicting, questioning, formulating hypotheses, planning experiments, using tools and materials, applying concepts, and communicating results (May, 2007).

The success indicator in this study is achieved if 70% of the students get the SPS score in the minimum category of ‘good’.

Results and Discussion

The result of the study is the science process skill score of chemistry of the students which was assessed by three observers by using the tested observation sheet instrument. The observation sheet had been validated by the expert and had also been declared proper to be used in the study. The reliability of the instrument used had been tested according to the interrater reliability.

The assessment of science process skill was conducted when the students were doing colloid practical work. The data obtained from the assessment of each cycle showed that the students’ SPS score of cycle I and cycle II had normal distribution. In the cycle I, the average of students’ SPS score was 62.89. This shows that the number of students who got the SPS score in the minimum category of ‘good’ is less than 70% and the success indicator of the study has not been achieved yet. The average score of each SPS point in the cycle I can be seen in the Figure 1.

![Figure 1. The average score data of each indicator of SPS assessment in the cycle I](image)

According to Figure 1, the average score of each point is generally good enough since two of the ten indicators got good average score (75 ≤ x < 85), three indicators got enough average score (65 ≤ x < 75), and five indicators got less average score. The five indicators which got less average score are: (1) planning experiments, (2) formulating hypotheses,
(3) observing, (4) communicating results, and (5) questioning, hence it needs a remedial.

After doing the reflection and discussion with the teacher, then the designs for cycle II to trigger the SPS improvement are by: (1) giving extra assignment to the students to draw the working plot on a manila paper so the working plot made is clear, (2) exploring the literature about formulating hypotheses and the criterium of a good hypotheses so the hypotheses made next is better, (3) the teacher gave motivation to the students to take upon to say their opinions while the class discussion was going on, so they got more knowledge.

The steps planned to be done in the cycle II are according to Roestiyah (2001), who states that in the discovery learning, the students are allowed to discover themselves or experiencing the mental process themselves, while the teacher only guides and gives the instruction. This is also appropriate with what had been stated by Akta&mis&Er&in (2008), that the objective of the science learning is to make someone use the science process skill.

Before the learning process in cycle II, the lesson plan was revised then the learning process was done as what had been done in the cycle I by emphasizing on the three indicators which still have low score. The average score change of each SPS point happened in the cycle II can be seen in the Figure 2.

**Figure 2.** The average score data of each SPS assessment indicator in cycle II

Figure 2 shows that the average score of the ten indicators are already good, except on the indicator of questioning. The SPS average score of the students in the cycle II is 76.17. from those data, 72.22% or about 26 of 36 students got the score of 75 or more. This means that the success indicator in the study has been achieved and the classroom action research cycle can be stopped in the cycle II.

The improvement of each SPS indicator from cycle I to cycle II can be seen in the Figure 3. Figure 3 shows that the high improvement happened on the indicators of planning the experiment, predicting, and hypothesizing. These indicators improved since the students are accustomed to do literature exploration and understand the working plot diagram making. In addition, the students also know a good hypotheses formulation after getting some suggestions from the teacher to seek for information about formulating hypotheses.

**Figure 3.** The score improvement of each SPS indicator from cycle I to cycle II

The indicators of using tools and materials, observing, grouping, and applying concepts did not improve too high since the teacher thinks that those indicators are the indicators assessed in the implementation stage of the practical work that needs a habit to improve. However, this improvement is appreciated as good since the success indicator can be achieved in two cycles only.

The total SPS score of each student is then tabulated and converted into the score of 0 up to 100. According to the improvement test using T test with the deliberacy degree of 5%, there is a significant improvement of the SPS score in the cycle I to cycle II amount 17.44%. This is appropriate with the statement of difuccia (2012), that the practical work which is done continuously in which the science curriculum development is developed based on the practical work activity and the assessment is based on the process, this can definitely improve the students’ practical work skill. The SPS score improvement is also in line with the study result done by Oloyede (2010) and Balim (2010), who state that guided discovery can improve the students’ skill in chemistry.

The SPS score indicators generally show that the application of the learning model of discovery learning with scientific approach is effective to improve the students’ science process skill. The explanation about success of the previous study based on the learning pyramid by Dale in Ambarjaya (2012), that in the learning process of discovery learning with scientific approach the students use some activities at once which are available at the learning pyramid. The activity of literature exploration is an activity in verbal form, the group discussion activity as a learning in the participation form, and doing the experiment as the implementation form. Those activities can improve the achievement in learning. In addition, science is developed on the basis of proof and the most principal is that the proof is obtained through the experiment which is done carefully (Reid, 2008).

**Conclusion**
The action process done in the two cycles proves that the learning model application of discovery learning with scientific approach can improve the students’ science process skill significantly. The appropriate strategy by identifying the score of each SPS indicator can overcome the learning lack in the cycle I, so the success indicator of the study which has been determined can be achieved in the cycle II.

References


