Guided Inquiry Learning With Sea Water Battery Project

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Abstract. Science learning process is expected to produce valuable product, innovative and real learning environment, and provide memorable learning experience. That orientation can be contained in Inquiry Based Learning. SMP N 4 Juwana is located close to the beach. That's why, Sea Water Battery Project is very suitable to be applied in learning activity as an effort to fulfill the renewable energy based on local wisdom. This study aims to increase interest, activity and achievement of students. Learning implementation stage, namely : Constructing Sea Water Battery project, observation, group presentations, and feedback. Sea Water Battery is renewable energy battery from materials easily found around the learner. The materials used are copper plate as the anode, zinc plate as the cathode and sea water as the electrolyte. Average score of students Interest on the first cycle 76, while on the second cycle 85. Average score of students Activity on the first cycle 76 and on the second cycle 86. Average score of students achievement on the first cycle 75, while on the second cycle 84. This learning process gave nurturant effect for students to keep innovating and construct engineering technology for the future.

1. Introduction

National Education System Law has mandated that the National Education aims to educate the nation and develop students' potency to become a noble man. Science as one of the national curriculum in national education that has an important role in achieving the goals of the National Education. Garbet (2011) states that Science relevant to find out about a systematic nature, so that the Science is not only knowledge mastery, such as : facts, concepts, or principles, but also a discovery process.

Indonesian education implements four approaches, namely 1) life skills -oriented education, 2) competency-based curriculum and learning, 3) production-based learning and 4) broad-based education. Life skills-oriented education, competency-based curriculum and learning process are expected to produce valuable products, demand real and innovative learning environment, and provide an integrative learning experience. The orientation can be contained in Project Based Learning.

Energy needed in Indonesia in particular and the world, increases generally because of population growth, economic growth and energy consumption patterns are constantly increased. Fossil energy, which has been the main source of energy, is very limited and continue to diminish. Alternative of energy is needed to overcome energy needs.

Maritime Ministry Data shows that Indonesia's land area is 1,910,931.32 km^2 and Indonesia's sea area is 3.544.743,9 km2 or 64.97% of Indonesia territory, so the Indonesian marine water resource is very abundant and can be used as an renewable alternative energy. SMP N 4 Juwana is located at 9 km from the Java Sea and 3 km from the River Juwana. Local wisdom on the abundance of marine water resource can be included in learning activity of electric current source chapter through Sea Water Battery Project Based Learning.

SMP N 4 Juwana students have problem to master electric current source chapter. It can be seen from their achievement, which down. Data from the last two years were as follows, (1) in the academic year 2013/2014, learning mastery is 75%. (2) in the academic year 2014/2015, learning mastery is 75%

Students' Interest and activity in learning were still low. It was marked from 36 students, only 7 who were active. Learning innovation is needed to improve the understanding of the concept, interest and activity of students on this chapter.

Observation and reflection from author and observer in the learning process of electric current source chapter, can be concluded that the factors that led to the lack of students understanding were as follows: 1) The learning method used was one direction, no feedback from students. 2) The learning process did not arouse interest and activity of students. 3) Students did not understand the basic competency. 4) Teachers did not optimize media around the students into educational media in the learning process.

The problem in this classroom action research are as follows, 1) How does the Sea Water Battery project design? 2) Can the Sea Water Battery Project Based Learning increase the students' interest? 3) Can Sea Water Battery Project Based Learning enhance the activity of students? 4) Can Sea Water Battery Project Based Learning improve mastery learning on the electric current source chapter?

The goals in this classroom action research are as follows, 1) Finding Out Sea Water Battery project design. 2) Finding Out whether the Sea Water Battery Project Based Learning can increase the interest of. 3) Finding Out whether Sea Water Battery Project Based Learning can enhance the activity of students. 4) Finding Out whether the Sea Water Battery Project Based Learning can improve learning mastery on on the electric current source chapter.

Bell (2010) states Project Based Learning is a learning model that involves a project in the learning process. Definition of Project Based Learning has been described above is in line with the exposure by Savery (2006) is as follows. 1) Project Based Learning is fueled and standards-based curriculum. 2) Project Based Learning Asks a question or poses a problem that each student can answer. 3) Project Based Learning Asks students to Investigate issues and topics addressing real-world problems while integrating subjects across the curriculum. 4) Project Based Learning is a model that fosters abstract, intellectual tasks to explore complex issues.

Project-Based Learning has five main steps, namely: (1) setting the theme of the project, (2) establishing the context of learning, (3) planning activity, (4) processing activity, and (5) implementing activity. Silver (2004).

Tobias (1994) says that the interest is more like a taste and sense of belonging to something or activity, without being told. Interest is basically the acceptance of a relationship between yourself with something outside of yourself. The stronger or close the relationship, the greater the interest.

According to Indonesian Dictionary (2005), Active means enterprising. Prince (2004) argues that the activity here is both physically and mentally. In learning activity, both activities must be interrelated. The link between the both will produce optimal learning activity

2. Model, Analysis, Design and Implementation

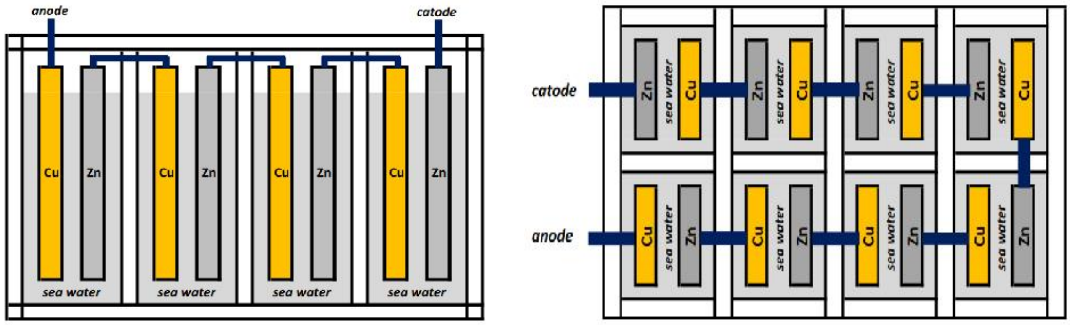
This Classroom Action Research was conducted in odd semester of 2015/2016 academic year, namely October to December 2015 at SMP N 4 Juwana at Tluwah street Juwana, Pati. The research subject is class IX A by the number of 34 students, boys were 18 students, while girls were 16 students. Class IX A was choosen as research subjects, because: (1) learning interest with good category is only 65%. (2) Students activity with good category is only 16 from 34. (3) learning mastery is only 57%.

There are two data sources in this Classroom Action Research, namely primary and secondary data sources. The primary data consists of 1) qualitative data (observation result of students' interest, observation result of students' activity , video documentation). 2) quantitative data is the achievement of students on the electric current source chapter. While the secondary data is the advice from the observer.

Data were collected by using an instrument as follows, 1) Interest of students data were collected

by questionnaire. 2) Learning activity was collected by observation sheet. 3) Students' achievement were collcted by written test in narrative form.\
Success indicator in this Classroom Action Research, namely: 1) Learning interest with a good category reaches 85% 2) Learning activity with a good category reaches 85%. 3) Learning mastery reaches 85%.

The materials needed in Sea Water Battery project such as: a) a copper plate as the anode, b) zinc plate as the cathode, c) sea water as an electrolyte, and d) a plastic tube. The materials used are very commonly found in the environment around the students. It proves that the materials around us can be used as a medium of education. Design Sea Water Battery as shown in Figure 1.



(a) (b)

Figure 1. Sea water battery project design (a) side view, (b) top view

2.1. Research Procedure

2.1.1. First Cycle Plan, namely : 1) arranging Syllabus Development and Learning Device of Basic Competency 3.3 Describing the element work principle and generated electric current well as its application in everyday life by learning indicators : a) Describing the composition and the electric element work. b) Developing the research instrument. c) Discussing learning device, research instrument used by the observer is Widyastuti Trirahayu, S.Si, M.Pd.

Implementation, namely : Teacher carried out learning based on the plan of Cycle I with the following main stages. 1) Preparimg the Sea Water Battery Project. 2) Group Presentation. 3) Feedback.4) Learning Evaluation.

Observation, peer teacher observed the learning process with the observation instrument of students' activity and teacher learning process observation. On this stage, researcher collected data in the learning process by using the instrument. (1) questionnaire to measure the interest of students. (2) Observation sheet to measure the activity of students. (3) Evaluation test to measure concept understanding of students on the electric current source chapter.

Reflection stage that is the result of observation was collected and analyzed. From the observation, teacher conducted reflection to determine deficiencies, obstacles and constraints during the learning process. The data obtained was used as a basis and reference for researcher to evaluate teacher and learners during the learning process. The result of the analysis was used to plan further action on the second cycle.

2.1.2. Second Cycle Plan, namely: 1) developing Syllabus Development and Learning device at basic competency 3.3 Describing the element work principle and the generated electric current as well as its application in everyday life. Learning indicator measures the voltage between the poles of the voltage source and clamp voltage (applied voltage).

Implementation, namely 1) Students were divided into several groups to construct materials that have been prepared to be a Sea Water Battery project. Teacher facilitates students in compiling Sea Water Battery. Students measure the voltage between the poles of the voltage source and clamp

voltage (applied voltage) corresponding student activity sheet. 2) The results of each group were presented. 3) From the group presentations were given feedback from other groups. Teacher gave scantlings from the feedback of students. 4) Learning Evaluation.

Observation, peer teacher observed the learning process with the observation instrument of students' activity and teacher learning process observation. On this stage, researcher collected data in the learning process by using the instrument. (1) questionnaire to measure the interest of students. (2) Observation sheet to measure the activity of students. (3) Evaluation test to measure concept understanding of students in the indicator measuring the voltage between the poles of the voltage source and clamp voltage (applied voltage).

Reflection, the result of observation was collected and analyzed from the observation, the teacher hold a reflection to determine deficiencies, obstacles and constraints during the learning process. The data obtained was used as a basis and reference for researcher to evaluate subsequent learning.

3. Result and Discussion

Description of the initial condition of class IX A shows that (1) Learning interest with good category only 65%. (2) Students' activity with good category only 16 from 34 students. (3) Mastery learning is 57%.

3.1. Description First Cycle

Plan, researcher sets Syllabus Development and Learning Device of Basic Competencies 3.3 Describing the element work principle and the generated electric current as well as its application in everyday life by learning indicators : a) Describing the composition and the electric element work. b) Developing the research instrument. c) Discussing learning device, research instrument used by the observer.

Implementation : teacher carries out learning according the plan of first cycle with the following main stages.1) Preparing the Sea Water Battery Project. 2) Group Presentation. 3) Feedback. 4) Learning Evaluation first cycle. Figure execution of the first cycle is shown in Figure 2.

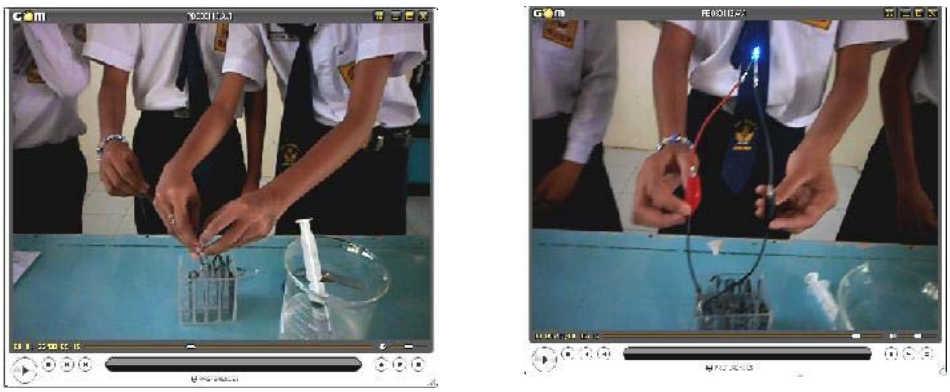


Figure 2. Video compilation of sea water battery project

Observation of first cycle was carried out during the activity. Observer followed the entire process of the actions performed in class IX A. The observation result of the implementation of learning on the first cycle can be seen as follows 1) The teacher had facilitated the students in the group to work together to design the Sea Water Battery Project. 2) Teacher had facilitated students in groups to communicate Sea Water Battery Project. 3) The teacher had guided the students to make inferences about the concept of an electric current source to train independence of thought. 4) Teacher had identified the students' problem to understand the material based on the debriefing and discussion in the classroom. 5) The teacher had guided the students to reflect on the learning

difficulties to understand the material honestly and seriously.

3.2. Description Second Cycle

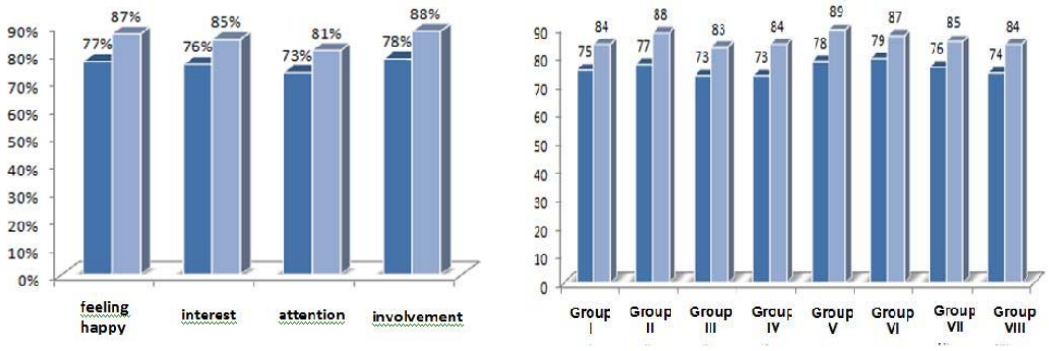
Plan: 1) developing Syllabus Development and Learning device at basic competency 3.3 Describing the element work principle and the generated electric current as well as its application in everyday life. Learning indicator measures the voltage between the poles of the voltage source and clamp voltage (applied voltage).

Implementation, namely : 1) Students were divided into several groups stringing materials that have been prepared to be a Sea Water Battery project. Teacher facilitated students in compiling Sea Water Battery. Students measured the voltage between the poles of the voltage source and clamp voltage (applied voltage) corresponding student activity sheet. 2) The results of each group were presented. 3) From the group presentations were given feedback from other groups. Teacher gave scantlings from the feedback of students. 4) Learning Evaluation in the second cycle. Video presentation of the group is shown in Figure 3.

Figure 3. Video presentation of second cycle

3.3. Results

Learning Interest was measured using a questionnaire. The comparison results of the first cycle and second is shown in Figure 4.



(a) (b)

Figure 4. (a) Interest comparison of first cycle and second cycle; (b) The learning activity comparison of first cycle and second cycle

Students activity during Sea Water Battery Project Based Learning for each cycle can be seen in Figure 4b. The students activity is seen based on sheet format of students' process skills observation by observer. From the observation sheet is obtained students' activity through Sea Water Battery

Project Based Learning increased.

Knowing the learning achievement of the of electric current source concept, post test was performed using a briefing test. The comparison of learning achievement in the first cycle and the second cycle can be seen in Figure 5.

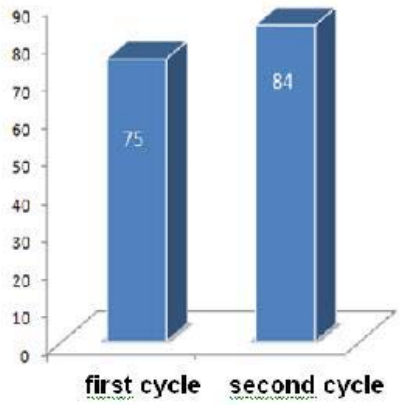


Figure 5. The average value of first and second cycle

4. Conclusion

Sea Water Battery is a renewable energy battery from materials easily found around the students The materials used are copper plate as the anode and zinc plate as the cathode as well as sea water as the electrolyte. Students Interest in Sea Water Battery project-based learning has increased, the first cycle has an average score of 76%, while the second cycle has an average score of 85%. Students activity on the first cycle has an average score of 76 and the second cycle has an average score of 86. The learning achievement of students has increased, the first cycle has an average value of 75, while the second cycle has an average value of 84. Suggestions for future research are the development of Sea Water Battery products more varied and Improve control of students in implementing the project to obtain a more optimal result.

5. References

[1] Bell S 2010 *A Journal of Educational Strategies, Issues and Ideas* **83** (2) 39-43
[2] Garbett D 2011 *Australian Journal of Teacher Education* **36** (6) 36-49
[3] Prince M 2004 *Journal of Engineering Education* **93** (3) 223-31
[4] Savery J R 2006 *Interdisciplinary Journal of Problem - Based Learning,* **1** (10 1-13
[5] Silver C E 2004 *Educational Psychology Review* **16** (3) 235-56.
[2] Tobias S 1994 *Review of Educational Research* **64** (1) 37-54