Improvement of Science Process Skills Through Development of Worksheets Integrated by Terrarium Media Global Warming Materials

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ABSTRACT

Science process skill is used as basic skill in learning of science, according to the real science include the aspects of attitude, process, product, and application as a whole skill. The purpose of this research is to know increase of students' science process skill after used worksheet which is developed. The kind of this research is development research adopt development model of Dick and Carey, with using descriptive research methods. The subject of this research is the VII grade students at SMPN 2 Sumenep academic year 2017/2018. The result of data testing shows that students' science process skill increase with N-gain average 0,7 high criteria. Worksheet was chosen to be developed as learning material in this research, because worksheet can support the effectivity of learning based science process skill. Worksheet that had been developed can be used as learning material to increase students' science process skill through observation by using media of terrarium.

Keyword: Process Skill, Worksheet, Global Warming

INTRODUCTION

Education must be able to direct students compete in the era of globalization. Students not only required to master science, but also required to have adequate skill to achieve learning success in accordance with the planned competencies. The knowledge dimension that must be possessed by middle school students in the science learning process, including the dimension that of factual and conceptual knowledge oriented to cognitive aspect, while the dimensions of procedural knowledge oriented to cognitive and psychomotor aspects in developing science process skills (Sani, 2015).

Science process skills are expertise on cognitive and psycomotor aspects obtained from directed training, to be used in finding, developing, and denying discovery as verification of existing concepts (Trianto, 2012). Preliminary data on observation of students process skills at SMPN 2 Sumenep, obtained 3 indicators include the measurements (67%) and predictions (60%) that occupy medium criteria, while indicators communicate 53% with less criteria, thus the 3 indicators need to be trained (Arikunto, 2012). Based on PISA data in 2015 showed that Indonesia was ranked 69th out of 76 countries.

Worksheet are several sheets contain assignment in the form of instructions or steps that have been systematically arranged to improve the optimization of student's science process domain (Prastowo, 2011). Refers to the characteristics of science learning, it is necessary to develop a worksheet that can combine theory and practice in presenting global warming material to improve indicators of student science process skills that have not reached the good category.

This is because, the worksheet can provide instructions for making observations related to global warming material which has been an abstract material for students. Concidering the material is difficult to be presented simply. Thus, this will have an effect on improving students' science process skills after observations. Corresponding with the results of Widowati's research, the worksheet support exploration activities in developing the thinking skills and scientific attitudes of junior high school students based on the 2013 curriculum (Widowati and Anjarsari, 2013).

Presenting the material of global warming concretely to students requires structured presentation, include conceptually, learning media, assignments, and observation activities that must be a whole unit. The purpose of this study was to determine the improvement of student's science process skills on the material of global warming after using the worksheet developed by integrating observation activities using a terrarium.

Terrarium is defined as a miniature artificial biosphere by creating certain moisture through the water cycle pattern (Gladbach, 2014). Terrarium can be used as an of analogy the greenhouse effect to help students find concepts related to global warming material to support the effectiveness of the worksheet developed. Refers to the characteristics of science learning, it's necessary to develop worksheet that can combine theory and practice in presenting global warming material to improve science process skills of students have not reached the good category.

RESEARCH METHODS

The kind of this research is development research refers the development model of Dick and Carey by using procedural flow to produce products in the form of worksheet to improve student's science process skills. The procedure for conducting research can be described, as follows:

1. *Assess Needs to Identify Goal,* identification of problems to be able to analyze learning solutions.
2. *Conduct Instructional Analysis,* insttructional analysis to determine the prerequisite competencies by students in learning.
3. *Analyse Learners and Contexts,* analyze student characteristics with the context of learning.
4. *Write Performance Objectives,* achievement goals can be obtained through learning analysis to identify skills to be learned.
5. *Develop Assessment Instruments,* the assessment instrument that is prepared must have conformity with the research objectives based on certain indicators.
6. *Develop Instructional Strategy,* must be able to clearly describe the process that will be carried out to achieve the goal.
7. *Develop and Select Instructional Materials,* develop and select teaching materials.
8. *Design and Conduct Sumative Evaluation,* teaching material products must first be declared feasible before the implementation stage.
9. *Revise Instruction,* if the teching material product is declared ina dequate, it must go through the revision stage.
10. *Design and Conduct Sumative Evaluation,* the summative evaluation development stage is carried out to obtain an assessment in accordance with the research objectives.

Figure 1. Dick and Carey's Research and Development
Source: (Setyosari, 2015)
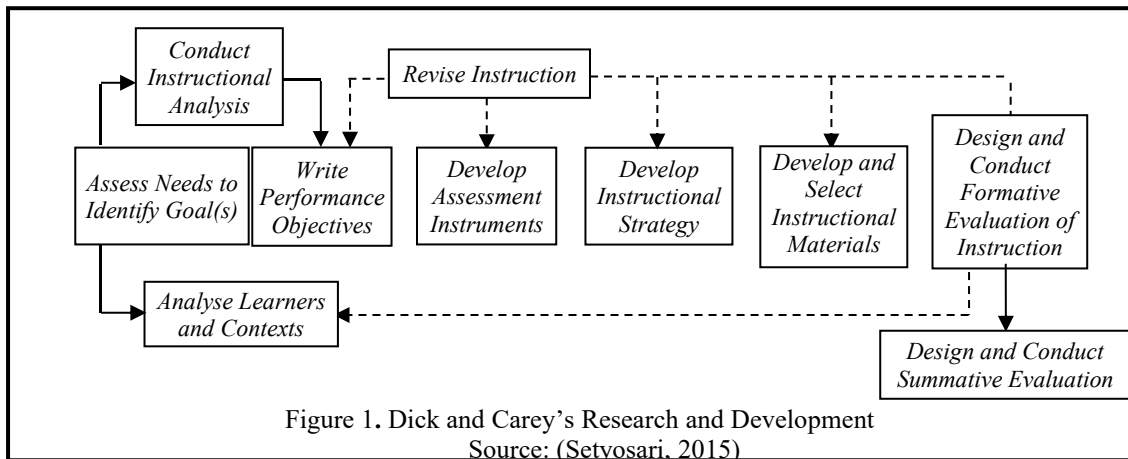
Product trials were carried out using the pretest-posttest research design. The subject is the VII grade student's at SMPN 2 Sumenep academic year 2017/2018 to the worksheet developed. Data collection instruments using observation sheets of science process skills by being analyzed using a formula (1):

$$Science\ Process\ (\%) = \frac{Score\ Obtained}{Score\ Max} \times 100 (1)$$

Table 1.Category of Assesment of Science Process Skills

Presentage Interval	Criteria
≥85%	Very Good
70% - 85%	Good
55% - 70%	Medium
40% - 55%	Less
<40%	Very Less

Source: (Arikunto, 2012)

Improvement of science process skills achieved by students, analyzed using gain (N-gain) a formula (2):

$$N - gain = \frac{posttest - pretest}{scoremax - pretest} \qquad (2)$$

Table 2.Average N-gain Interpretation

N-gain Interval	Improvement Criteria
<g>≥0,7	High
0,3 <<g>< 0,7	Medium
<g>< 0,3	Low

Source: (Anisa, Supardi and Sedyawati, 2014)

RESULTS AND DISCUSSION

This development research prodeces teaching materials in the form of worksheet to improve students' science process skills. The data obtained uses a procedural flow in accordance with the development model by Dick and Carey in developing the resulting worksheet.

1. *Assess Needs to Identify Goal,* analyze the learning difficulty factor to determine the expected competencies.
2. *Conduct Instructional Analysis,* analyze the competencies that exist in the content standard in the 2013 curriculum applicable at the school.
3. *Analyse Learners and Contexts,* analyze student characteristics combined with the learning context.
4. *Write Performance Objectives,* achievement goals are obtained through learning analysis to identify skills that will be learned by students.
5. *Develop Assessment Instruments,* development of research validation instruments.
6. *Develop Instructional Strategy,* development of terrarium media as an analogy observationmedium in supporting the effectiveness of the developed worksheet.
7. *Develop and Select Instructional Materials, the worksheet* was developed because increase the effectiveness of science process skills based learning.
8. *Design and Conduct Sumative Evaluation,* validation stage by experts to determine the feasibility lvel of the worksheet asa benchmark for product improvement..

9. *Revise Instruction,* the revision stage is carried out, if there is a mismatch between the development objectives and the process or the results obtained during the validation stage.

10. *Design and Conduct Sumative Evaluation,* Observation activities on students' science process skills were carried out by two previously appointed observers.

Characteristics of science subjects at the junior high scool level are used to provide a complete picture of knowledge in cluding dimensions of factual, conceptual, and procedural knowledge (Sani, 2015). Worksheet developed to improve students' science process skill in accordance with the essence of science learning. The essence of science includes aspects of attitudes, processed, products, and applications, expected to be reflected in concept verification through scientific activities by using students curiosity.

The results of the Rahayu study state by using worksheet in learning can improve the optimization of the science process domain (Rahayu, Sriyono and Ngazizah, 2012).Students can feel attracted to the stages of procedural learning, witout coercion to achieve learning objectives in supporting the science process skills students have. Observation activities that have been designed include aspects of doing, observing, and analyzing (Prastowo, 2011).

The results of the data analysis outlined a comparison of improvement in science process skills obtained by students, analyzed using the N-gain formula described in table 3.

Table3.Data on Improving Science Process Skills Based on Observations

Indicator	O_1	O_2	Score Increase	
			N-gain	Criteria
A	67%	98%	0,9	High
B	53%	96%	0,9	High
C	60%	93%	0,8	High

Source: (Primary Data, 2018)

Information:
A : Measurement (The students can measure the difference in termperature on the terrarium media using a thermometer).
B : Communicate (The students can explain the cause and effects of differences in observation data on terrarium media).
C : Prediction (The students can predict the occurrence of temperature differences in terrarium media).
O_1 : Initial Observation
O_2 : Final Observation

Worksheet tials on improving science process skills can be proven from the increase in N-gain score with class selection tecniques based on the significance value of the homogeneity test. Science process skills are prioritized in science learning, related to fact gathering activities, connecting between concepts and scientific attitudes, expected to have a significant effect on the learning process carried out. The process skills indicators in this study are only focused on indicators Measurement (The students can measure the difference in termperature on the terrarium media using a thermometer), Communicate (The students can explain the cause and effects of differences in observation data on terrarium media), and Prediction (The students can predict the occurrence of temperature differences in terrarium media).

The measurement indicators obtained reach the highest precentage with N-gain achieved at 0,9 the high criteria. Measurement activities that have been carried out by students can run correctly, this can be proven based on students' ability to use thermometers correctly in accordance with the procedures listed on the process skills observation sheet. Students are trained to solve problems using existing procedures, thus students are expected to get used solving procedural problems (Bloom, 2001). In accordance with the Dimyati's statement, which states the main factor in improving science process skills is active student involvement as student are required to find concepts through direct experience, not only based

on concepts from the teacher (Dimyati and Mudjiono, 2013).Global warming material is integrated using terrarium media making it easier for teachers to associate concepts with students real situations, thus students can understand the global warming material in real terms.

Accuracy of the data in measurement is needed for students to be able to prove the increase the average temperature of the earth is caused by an increase greenhouse gases. Improvement of student process skills, used as a driving force for concept discovery and development towards attitudes or values obtained by students (Trianto, 2010). According to the results, it turns out students are able to find and develop concepts through scientific attitudes in improving the science process skills possessed in accordance with the learning experience will be achieved.

The indicator communicates the results of observations reaching 0,9 N-gain in high criteria. Field facts, proving students can cummunicate the results of observations made through group discussions. Djamarah stated the indicator communicate can be done through discussion to express and report the results of observations that have been made orally or in writing (Djamarah, 2010).

The results of observations on the indicator predict, reaching N-gain of 0,8 with high criteria. Predicting is an indicator that cannot be achiaved simultaneously by students associated with differences the speed of cognitive development in different individuals in reaching the formal operational stage. A student can be considered to have reached the formal operational stage, if it can interpent new experiences obtained through the existing scheme (Slavin, 2011). According to the results of Putra's research stating predictions are made on the basis of a pre-existing scheme, and then tested as a proof stage through observations involving measurement skills (Putra, Widoretno and Prayitno, 2015). Oviana's research results state a person can be considered able to

predict if one can predict a situation based on existing facts (Oviana, 2013).

Science process skills are used as important basic skills to be improved in science learning. The results of Sedyawati's research state science based process skill learning, role in building students' independence with optimizing the psychomotor domain, and effective through experimental activies carried out by students (Anisa, Supardi and Sedyawati, 2014). In accordance with the results of Riswanto's research, stating that learning by integrating the improvement of science process skills can make it easier for students to construct their knowledge independently (Riswanto and Dewi, 2017).

One of the causes of increasing concentrations of greenhouse gases is CO_2 gas in the stroposphere of the earth. Observations using terrarium are made to make it easier for students to understand the importance of plant vegetation against global warming. The teacher can design a simple observation to explain how plant vegetation can reduce the everage temperature of the earth (Kusminingrum, 2008). Terrarium media consisting of Samanea saman seeds, is considered to be the largest O_2 producer with CO_2 absorption capacity of28.448,39 kg/tree/year (Rivai, Patana and Latifah, 2014). The availability of oxygen will affect the normal level of temperature in the air. One of the factors that can effect the respiration rate of the organism is body weight, temperature, and activities carried out. The greater size of an organism's body, the greater it's movement activity will affect the rate of respiration (Anfa *et al.*, 2016).

Data on process skills that have been analyzed, increase after the product implementation phase reached 96% with N-gain of 0,7 very good categories (Suharsimi, 2012). According to the results of the research Sedyawati stated one of the factors that influence the high and low level of science process skills, influenced by optimizing the active role of students

participating in learning (Anisa, Supardi and Sedyawati, 2014).

CONCLUSION

The results of the analysis of the data, can be concluded students' science process skills have increased after using worksheets on the material of global warming that has been developed. This can be seen from the increase in N-gain achieved on the measurement indicator of 0,9 on the high criteria; the communicating indicator reaches an N-gain of 0,9 on the high criteria; and the indicator predicts reaching an N-gain of 0,8 on the high criteria, with the average N-gain obtained of 0,7 with high criteria

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