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Effectiveness of science learning materials based guided discovery model to improve science process skills

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Abstract. The curriculum 2013is developed with the refinement of teacher centered learning into student centered learning.The learning design in thecurriculum 2013 is emphasized on the application of science process skills. Based on premilinary study in junior high school, the science process skills of the students is weak. Therefore, teacher must practice science process skills to students with suitable learning model. One of learning model that suitable to practice science process skills is guided discovery model. The purposes of this research is to describe the effectiveness science learning materials based guided discovery model to improve science process skills. The effectiveness of learning materials is reviewed from science process skills of the students and student response. The development research method using 4D model. The process of developing science learning material starts from defining step, the process of designing the learning material developed based on information obtained from the step of early analysis, learners, materials, tasks that support then done the design step or design, then the last step is the development step. Based on the result of the research, it is found that science process skills of the students are improved and the students gived a positive response after learning with the learning material based guided discovery model. It is conclude that, science learning materials based guided discovery model is effective to improve science process skills.

1. Introduction

Science is a systematic study about natural objects and phenomenon as a result of thought and investigation carried out by scientists with experiment skills and scientific methods. Science is related to ways of figuring out about nature systematically, thus it is not merely mastery of knowledge collection in the forms of facts, concepts or principles, but also a process of invention [1].

Science is basically composed of three components: scientific attitude, scientific process, and scientific product. Scientific attitude will make students possess positive attitudes such as rising curiosity, and being able to work together with others. Science, as process covers process skills and scientific attitudes that are needed to gain and elaborate knowledge, on the other hand, as product comprises information, ideas, facts, theories, concepts, science laws that are recorded and noted as scientific knowledge [2]. Science learning at schools is taught in reference to the valid curriculum in Indonesia.

Curriculum is a set of plans and regulation concerning purposes, content, and lesson materials as well as ways that are used as a guide of learning activity implementation to achieve certain education goals [3]. The curriculum used in Indonesia has been improved from year to year. This is strived for by the government in order to increase the education quality in Indonesia. The curriculum used in Indonesia today is the 2013 Curriculum. It is the feedback of KTSP (Education Institution Level Curriculum) and KBK (Competence Oriented Curriculum) that had already been tested before. The

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2013 Curriculum was developed with improvement from teacher centered-learning model to student centered-learning. From the passive learning model to the active one which is more supported with scientific approach learning model. From the individual-study system to group (team oriented) system and the passive to critical learning. Such learning model in the 2013 Curriculum is emphasized on the implementation of science process skills.

Science process skills classified into two: basic and integrated process skills. The basic process skill is needed to support the integrated process skill. The basic science process skill is composed of six skills including observation, measurement, classification, communication, questioning skill and interpretation/prediction. The integrated process skill is the highest process skill and involves various basic process skills. The integrated process skill covers seven skills such as building statement of the problems, identifying variables, formulating hypothesis, formulating variable operational definition, designing experiment, conducting experiment, drawing conclusion. Science process skills are really important to be learned and mastered by everyone; when someone has mastered process skills, it means the person has mastered the skills needed in the high level of study, i.e. conducting research and solving problems [4]. In conjunction to this statement, in a learning process, student should not only become listener, but also be active to master the concept so that the learning process is gained more meaningfully.

Based on the pre-research questionnaire result through the science process skills on the Natural Science materials applied on students of grade VIIID SMPN 5 Pamekasan shows that student skills in observing is 70%, formulating research questions 10%, measuring (comparing) 2%, classifying 5%, communicating 60%, and drawing conclusion 54%, with classical completeness of student science process skill 5% and incompleteness 95%. This shows that the student science process skills are necessary to be practiced so that they can be active learners.

Based on this problem, an effort of solving it is needed. One of the ways is by applying the learning model which can involve students in an active way so that the learning is student centered and the science process skills can be experienced. One of the learning models that possibly involves student totally in the learning process is the guided discovery model. Guided discovery is one of the learning models where teacher provides students with specific topic samples and guide students to understand the topics. This model is effective in encouraging involvement and motivation as well as facilitating students to get deep comprehension about clear topics [5]. Learning that can involve students actively can facilitate student to build his own knowledge through scientific investigation to solve problems in daily life. Therefore, the guided discovery model is suitable if used to train science process skills. Learning materials is also necessary to support the teaching and learning activities. Such learning materials can be oriented to a learning model which makes the learning be student centered, one of them is the one oriented to guided discovery.

Based on the study on expectations and facts of obstacle in the reality, it leads to a thought of developing learning materials which is oriented to guided discovery learning model on the topic of additive substance on food. This development hopefully can train student science process skills. There are some previous researches that support this development on learning materials which is oriented to guided discovery. In this article, shows that the guided discovery model is the most effective model in the process of transferring knowledge in physical subject [6]. While this research shows that the implementation of the guided discovery model can train student science process skills [7].

Based on the above description, the writer would like to develop Natural Science learning materials which is guided discovery learning model oriented to train student science process skills. And the title of this article is “Effectiveness of science learning materials based guided discovery model to improve science process skills”. The purposes of this study is to describe the effectiveness of natural science learning materials which is guided discovery learning model oriented to train student science process skill.

2. Method

The method of this research development is used 4D models (four D models) consisting of define, design, develop, and disseminate, which in this case the steps are only until develop. The subject of this research is students of Grade VIII D SMPN 5 Pamekasan on even semester of 2017/2018

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Academic Year. The research instrument is in the form of science process skill test sheets consisting of pretest-posttest, as well as student response sheet. The data analysis of the research results includes the analysis of science process skill assessment that comprises of pretest and posttest result analysis, and also student response analysis. This research is composed of two main stages i.e. learning materials development stage and learning materials trial stage. The design of the development starts from analyzing student initial condition which then analyzing concept that will be generated into learning indicators specification. Next, the researcher compiles first draft of the learning materials that will be validated and tested to students.

3. Result and Discussion

3.1. Student Science Process Skill

The research result is the student science process skill before and after the learning using guided discovery model. The science process skills trained and measured to students are the basic process skills such as formulating research questions, observing, comparing, classifying, concluding, and communicating. The student science process skill is considered complete if 75% of the students have classically completed. From the pretest and posttest results, it will be measured how much the science process skills of student improved after using the guided discovery learning model. The assessment result of student pretest and posttest can be seen in table 1 below.

Table1. Assessment Result of Student Science Process Skills (pretest and posttest)

Student name	*Pretest* Result	Category	*Posttest* Result	Category	N Gain	Category
Student 1	20	Poor	85	Good	0.81	High
Student 2	15	Poor	75	Fair	0.70	High
Student 3	18	Poor	75	Fair	0.69	Sedang
Student 4	23	Poor	90	Excellent	0.87	High
Student 5	25	Poor	93	Excellent	0.90	High
Student 6	30	Poor	85	Good	0.78	High
Student 7	53	Poor	100	Excellent	1.00	High
Student 8	18	Poor	80	Good	0.75	High
Student 9	10	Poor	90	Good	0.88	High
Student 10	10	Poor	95	Excellent	0.94	High
Student 11	25	Poor	85	Good	0.80	High
Student 12	45	Poor	75	Fair	0.54	Medium
Student 13	35	Poor	70	Poor	0.53	Medium
Student 14	55	Poor	85	Good	0.66	Medium
Student 15	55	Poor	80	Fair	0.55	Medium
AVERAGE	**29**	**Poor**	**84**	**Good**	**0.76**	**High**

Table 1 shows that student pretest result is totally incomplete with average score 29 and poor category. While the posttest result shows 93% students completed with average score 84 and high categorized. From the pretest and posttest results, it can be found that the student study result has gained 0.76 increases with high category.The increases of posttest score of students science process skill with guided discovery model is supported by research that indicates the application of guided discovery model can improve the students science process skill from the average of pretest result shows students completeness is 1.54 then on the posttest result increased to 2.76[7].

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3.2. Student Response

It is student response to the learning process using the developed learning which is guided discovery learning model oriented in the topic of food additives substance. The data of student response is gained from the student response questionnaire which is distributed to students in the end of the learning. The questionnaire consists of 15 questions about student response to the learning they have just done. The result of student response from 15 students can be seen in the following table 2.

Table 2.Student Response Questionnaire Result

No.	Questions	Answer	
		Yes	**No**
1.	The learning activity is something new for students	93%	7%
2.	The learning activity can be attractive and fun	100%	0%
3.	The learning activity can coach students to make questions	100%	0%
4.	The learning activity gave students chance to identify problems that are suitable with learning materials and to formulate research questions	100%	0%
5.	The learning materials in this activity is related to daily life	100%	0%
6.	This learning material is useful for daily life	100%	0%
7.	The discussion and experiment activities can give new knowledge and experience	100%	0%
8.	From the experiment activity, studentscan make conclusion based on the experiment result.	100%	0%
9.	Students can practice communicating	80%	20%
10.	Through discussion activity, studentscan make opinions with group mates to find problem solution	100%	0%
11.	The steps in completing the worksheet are understandable	100%	0%
12.	This experiment learning activity can help students understand the concept	100%	0%
13.	Studentsmore motivated to join the learning activity in the class	100%	0%
14.	Joining the learning activity makes students have responsibility in the given task	100%	0%
15.	Joining the learning activity makes students always be thankful to God's gift and grace that have been given in this life	100%	0%
	AVERAGE	**98%**	**2%**

Table 2 shows that 98% students give positive response to the learning with guided discovery learning model. The positive response of the students is also supported by the research that indicates students give a positive respon after learning with guided discovery model [7].

4. Conclusion

Based on the result of the conducted research, the researcher can draw a conclusion that science learning materials that oriented to guided discovery models can be regarded effective to train student science process skils. This is proven with the test result of student science process skill which increases from pretest to posttest with score of N gain 0.76, high category, as well as 98% students giving positive response to the learning process.

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