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The Effectiveness of Guided Inquiry-Based Learning to Train Critical Thinking Skills in High School Level

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***Abstract*—This study aimed to describe the effectiveness of guided inquiry based learning to train critical thinking skills on ecosystem topic in the high school level. The trial test in this study involved 10th graders of SMA Negeri 1 Sumenep in the second semester of academic year 2017/2018 by implementing the modified guided inquiry based learning devices. The research design was that used in this study was One-Group Pretest-Posttest Design. Data of students' critical thinking skills were obtained from students' answers to the six critical thinking skills instruments. The results obtained from this study is in the form of critical thinking skills data of students viewed from the gain score and students' mastery learning outcomes. The gain score obtained by the students has an average of 0.74 which categorized as high. Moreover, the percentages of students' mastery learning data showed that 100% of students succeeded after being given the treatment. Based on these data, it can be concluded that guided inquiry based learning enables students to practice their critical thinking skills on ecosystem topic.**

Keywords—guided inquiry, critical thinking skills, lerning devices development, ecosystem, high school

I. INTRODUCTION

There have been real shifts in the way we live and work as well as in how we get and evaluate information in the 21st century. These changes encourage us to critically look at critical thinking itself and determine what approaches are most effective to meet the challenges and opportunities we face [1]. Educators have long been aware of the importance of critical thinking skills as an outcome of student learning. More recently, the Partnership for 21st Century Skills has identified critical thinking as one of several learning and innovation skills necessary to prepare students for post-secondary education and the workforce [2].

The Partnership for 21st Century Skills defined critical thinking as a process that involves "effective reasoning, using systems thinking (i.e. analyzing how the parts and the whole work together), making judgments and decisions, and solving problems" [3]. Critical thinking is a mental activity that involves the brain works at the complex level and use the analysis and evaluation process. Therefore, critical thinking ability are indispensable in solving problems or finding solutions [4]. In the presentation of Kemendikbud [5], the learning process in the 2013 curriculum emphasizes on the scientific (scientific) approach. The scientific criteria are intended to encourage learners to think critically, analytically and appropriately in identifying, understanding, solving problems, and applying learning materials. In order to be called scientific, the learning activities are directed to learning based on scientific inquiry activities. A scientific approach should also encourage active educative interaction of teachers with learners [6].

Active learning is an important learning process to provide learners to use their critical thinking frequently. McCarthy et al [7] stated that the implementation of active learning in the classroom is more emphasized on providing the learning situation that allow students to do more activities in terms of knowledge building. In the process of construct the concept, students can practice their thinking skills. In addition, critical thinking learners are required to actively and skillfully conceptualize, apply, analyze, synthesize, and or evaluate the information that was gathered or resulting from observation, experience, reflection, communication reasoning, or as a guide to beliefs and actions [8].

The learning process should enable students to actively think by implementing the learning model that develops their critical thinking skills, since the concept of activeness is a very important pattern in constructing learners' thinking and is one of the foundations of constructivist learning that learners are actively construct their knowledge and not just absorbing the informations from the teacher [9]. According to Mitrevski and Zajkov [10], critical thinking is a thinking process that involved the learners actively in solving problems, formulating the conclusions, predicting, and making decisions. According to Duron et al [11], when teachers think about what should happen

in a lesson, it is important to consider the type of active learning that can drive critical thinking skills.

Critical thinking skills can be developed both directly and indirectly in biology learning. Biology learning directed at the constructivism learning that emphazises on the meaningful learning will not work well without any process that allows students to think critically. Inquiry based learning is the approach that is in line with the demands of Curriculum 2013 and supports in teaching students critical thinking skills is inquiry based learning.

Inquiry based learning is the learning model that provides a great opportunity for learners to be actively involved in the learning process. Inquiry can also be interpreted as a question or investigation [12]. Because investigation involves inquiry, inquiry is sometimes referred to as a scientific inquiry, defined by Eggen and Kauchak [13] as a teaching model designed to provide learners with the experience of the scientific method. For instance, the pattern of thought that emphasizes the questioning, formulating the hypotheses for answering questions and test the hypothesis with the data. Furthermore, Eggen & Kauchak [13] explained that the inquiry model is designed to help learners gain an in-depth understanding of the scientific method while developing their critical thinking, self-regulation, and understanding of specific topics. One type of inquiry study used in this study was guided inqury.

Guided Inquiry learning is a learning model with the guidance of teacher in the impelentation process. The teacher guides students in constructing their knowledge and understanding the subject matter, through carefully planned and carefully supervised inquiry, but still equips and directs students in free learning [14]. The guided inquiry model is an inquiry learning model that presents the problem, questions and materials or supporting materials determined by the lecturer. The problem posed by the lecturer in teaching-learning activities gives encouragement to the student to conduct an investigation in determining the answer [15].

Based on the statement that has been disclosed, the researchers aim to examine the effectiveness of guided inquiry based learning to trained the critical thinking skills on ecosystem materials in the high school level.

II. METHOD

The design of this study used One-Group Pretest-Posttest Design (Tuckman 1978 in [16]). Described with the pattern as follows:

$$O_1 \rightarrow X \rightarrow O2$$

Note:

O_1 = Pretest, to record students' critical thinking skills before being given treatment.

X = Treatment to students, that is implementing the learning based on the guided inquiry model

O_2 = Posttest, to know students' critical thinking skills after being given treatment.

The initial test (O_1) measured the student's critical thinking skills before the treatment. Treatment on the subject (X), i.e. learning by using biological learning devices based on guided inquiry model conducted during four meetings. The final test (O_2), for measuring critical thinking skills after subject is treated. The final activity is to compare the results of O_1 to O_2 to determine the effectiveness of learning devices in the form of improving students' critical thinking skills. Moreover, the subjects of this research are 1st grade of senior high school of SMA Negeri 1 Sumenep in the second semester of academic year 2017/2018.

III. RESULTS AND DISCUSSION

Research subject in this study was biology learning device based guided inquiry model to train students' critical thinking skills, and in a trial test involved 15 students of SMA Negeri 1 Sumenep Class X School Year 2017-2018. The results of this study indicate that there is an increase in posttest score after the students were given the treatment with guided inquiry based learning. The students'critical thinking skills based on pretest and posttest results were increased from the average score of 20 to the average score of 77 (scale 0-100) with the normalized gain score between pretest and posttest showed the score of 0.74 with the category " high " in Table I. Students' critical thinking skills improve after being given inquiry-based learning treatment. The students' critical thinking skills were categorized as "high" category if students have a gain score > 0.70 and the "moderate" category if students get < 0.30 gain score > 0.70.

TABLE 1. PRE-TEST AND POST-TEST SCORE OF CRITICAL THINKING SKILLS

Student	Pretest Score (0-100)	Posttest Score (0-100)	Gain Score	Criteria
1	10	70	0.67	Moderate
2	15	78	0.74	High
3	10	75	0.72	High
4	65	85	0.57	Moderate
5	20	73	0.66	Moderate
6	10	70	0.67	Moderate
7	15	85	0.82	High
8	20	78	0.72	High
9	35	73	0.58	Moderate
10	15	85	0.82	High
11	5	75	0.62	Moderate
12	10	75	0.72	High
13	50	78	0.56	Moderate
14	15	75	0.71	High
15	0	80	0.80	High
Average	20	77	0,74	High

The result of pretest on trial I showed that the obtained score by students under minimum standard value of Biology Subject is 70 with the number of 15 students, which results in 0% completion percentage. After implemented the learning by using inquiry-based learning devices, posttest results showed that the mastery of classical was 100%.

The results of knowledge learning at the time of pretest and posttest can be seen in the Table 2.

TABLE 2. THE RESULTS OF STUDENTS' MASTERY LEARNING OUTCOMES

Student	Pretest		Posttest		% Mastery Outcomes	
	Score	*Mastery*	*Score*	*Mastery*	P_1	P_2
1	10	NP	70	P	0%	100%
2	15	NP	78	P		
3	10	NP	75	P		
4	65	NP	85	P		
5	20	NP	73	P		
6	10	NP	70	P		
7	15	NP	85	P		
8	20	NP	78	P		
9	35	NP	73	P		
10	15	NP	85	P		
11	5	NP	75	P		
12	10	NP	75	P		
13	50	NP	78	P		
14	15	NP	75	P		
15	0	NP	80	P		

Note: P= Pass, NP= Not Pass, P_1 = Pretest, P_2 = Posttest

Based on these results, it could be indicated that the inquiry learning model could aid students in practicing their critical thinking skills. The students' critical thinking skills were improved because students followed the learning activities that made them think critically to solve problems that were given by the teacher.

These results are similar to the other research by Maitoh [17], that there is a significant influence of guided inquiry learning models on students' critical thinking skills. According to the research that was done by Duran [18], science and technology learning supported by guided activities develop in accordance to the IBL (Inquiry Based Learning) approach can improve the students' critical thinking skills. Moreover, the results in this research support the finding in Yunita's study [19]. Furthermore, students' critical thinking skills reach 88.93%, which is categorized as excellent after being treatment with guided inquiry based learning. Tuju et al [20] also stated that the students' understanding of student biology can be enhanced through the implementation of the inquiry learning strategies.

IV. CONCLUSION

Based on the results and discussions that obtained from this study, it can be concluded that learning based on guided inquiry model aids students to practice their critical thinking skills in high school level. This was proven by the score gain that was categorized as high, with the score of 0.74. Moreover, the results of students' mastery learning showed that 100% of students who follow the learning process could understand the topic very well.

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