



CRITICAL THINKING SKILLS OF SENIOR HIGH SCHOOL STUDENTS ON THE ECOLOGICAL LEARNING THROUGH ENVIRONMENTAL EDUCATION – A DEVELOPMENT RESEARCH

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Abstract:

The learning with an environmental approach could become a solution to train critical thinking skill by the student worksheet that correspondence with the surrounding environment can develop the students' critical thinking skill. The research aims was describe the students' critical thinking skill on Ecological learning through environmental education. Development of research use Tessmer Evaluation Formative folowed self-evaluation step; expert review step; one-to-one step; small group step, and field test step. The research was executed from September to December 2018 in SMA Negeri 9 Banjarmasin. The critical thinking skill data was received on the field test which was done by calculating the students' worksheet scores. The data analysis is using descriptive. The results show the students' critical thinking is very high categorized on the interpretation indicator; the analysis, evaluation, and inference indicators are high categorized.

Keywords: critical thinking skill, environmental education, students' worksheet

1. Introduction

The success of students' academic achievement and thinking potential, one of them, is supported by the quality of the learning process (Suma, 2013). One of the 21st-century skills that have to be mastered by the students is critical thinking which always has to be trained (Fisher, 2009). The teachers are expected to teach the students advanced thinking system. Thus, the thinking process has to be supported by a learning plan which facilitates the students' critical thinking skill training (Mardiah et al., 2018).

Thinking critically is thinking rationally in assessing the problems before taking decisions or actions. Thus, it is preceded by information gathering as many as possible

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about the problem (Karim, 2015). The aim of critical thinking is to be able to analyze a number of issues that will be faced in everyday life (Samsudin, 2009). This becomes a challenge for teachers to plan the learning that can train critical thinking ability. One of the alternative ways that can be implemented is the environmental approach.

Environmental approach is using the environment to become the source of learning in order to understand materials regarding everyday life (Mulyasa, 2005). The environment can be utilized as a tool to develop students' skill in the learning process to solve the problems in their physical environment. Learning is not only knowledge transfer but also to find out nature systematically (Komalasari, 2013; Saidah, 2014). Rosmalah (2002) explained that the environmental approach is a learning strategy that utilizes the environmental as the aim, source, and tool of learning.

Learning materials on biology subject are very close to the environment so it can be the source, media, and tool of learning. Biology learning relates to finding out and understanding nature systematically. So, it is not only mastering knowledge about facts, concepts, or principles but also emphasizes the finding out process. The learning on nature using environmental approach plays an important role to learn a biological concept since it could motivate the students to teach biological concepts and critical thinking ability (Zaini, 2015).

The use of environment approach means connecting the environment in a learning process. The use of the environment as the source, media, or even learning tool is very rare to be used. Teachers tend to teach in a room and seldom lead the students to outside the classroom. This is caused by some factors including the material portion which is too much, limited time, and limitation of teachers in developing learning innovation, while the source of learning is mostly found on the students' environment, including the school's surrounding. If this is implemented, it could bring the students to more contextual materials in everyday life.

The education paradigm today is directed to student-centered learning, so the students are expected to actively be involved in the learning activities. On its implementation in the school, student-centered learning can be supported by the student worksheet that facilitates the students to gain learning experience, process skills, and help them to think critically. The learning using student worksheet gives the chances to students to develop concepts within their own knowledge, with completing the founded problems (Istitharah et al., 2017). The student worksheet can be used by teachers as a tool to optimize the achievement of learning result and increase the students' involvement or activities on the learning process, so to develop high-level thinking skill (Azizah, 2015).

According to the early observation done by the researchers in a high school, it can be concluded that the current learning process was not very effective. This is proven by the rapport of odd semester on the biology subject of tenth grade students that showed there are students who couldn't achieve the minimum completeness criteria that have been determined by the school before the students take remedial. 35% of the students of ten grader did not pass the minimum completeness criteria, which was 36 out of 106 students. This can be caused by lack of planning and mastering to the

learning strategies that were implemented by the teacher. The students tended to be quiet listening to the explanation, did not want to ask, and sometimes did things which were not related to the subject. The students were not involved maximally in the learning process, where the students were not given any chances to think their ability on the learning process. The students' result was categorized as low is caused by some factors that included students, teachers, or even the learning process that less activating the students while learning (Fauzi et al., 2015).

Other problems that gathered from the conversation and observation with some biology teachers in other school are not all teachers use the student worksheet that fulfill the demand and condition of the school. Teachers tended to use the student worksheet that is obtained directly from the publisher, where the contents are not compatible with the surrounding school environment and more dominated by multiple choices and essay, so it was less facilitating and not guiding on the observation and critical thinking process.

Every individual critical thinking ability' is different. That's why it is necessary to identify the individual critical thinking ability in a forum (Santi et al., 2017). The research about critical thinking ability had been done before (Lesman et al., 2018; Mardiah et al., 2018; Ripani et al., 2018, Zaini, 2016; Zaini dan Rusmini, 2016; Zaini et al., 2017). The research aims to train the critical thinking ability with the development of learning tools or part of learning to like contextual learning source.

Some research on the use of student worksheet to critical thinking was conducted by Fransisca (2016). She concluded that the student worksheet with scientific approach bases could improve critical thinking ability on the material of plantae on the tenth grade. Hairunnisa (2017) reported that student worksheet with guided inquiry based could improve critical thinking ability. Another finding by Firdani and Pudjiastuti (2015) concluded that the development of student worksheet with guided discovery orientation could train the critical thinking ability of the students on the material of acid base on tenth grade.

One of the materials that can be taught with the environmental approach is the ecology material. The learning of ecology will be more meaningful with the use of an environmental approach and supported by student worksheet that is in line with the surrounding condition of the students. Regarding with this reason, it can be proposed the research question of "how is the critical thinking ability of senior high school students in the ecological material with the school's environment approach?"

2. Material and Methods

The type of this research is development research, which is research using Tessmer model, that is conducted in four steps: self-evaluation; expert review and one-to-one; small group; and field test. This research is focusing on a field test.

The research was conducted for four months (September – December 2018) in SMA Negeri 9 Banjarmasin. The subject of the research is 82 students.

The effectiveness data were gathered from the critical thinking ability on the field test. The analysis was conducted by calculating the score towards the answer in completing the student worksheet. The result was analyzed descriptively. The score given towards the student worksheet answers is according to the scoring criteria on the score table modified from Sukroni (2014) as follows.

Table 1: The Scoring Guidance of Critical Thinking Skills

Indicator	Information	Score
Interpretation	The Answer Rating of Critical Thinking Skill (Interpretation)	
	Achieving the maximum standard (100% of descriptor), the students are able to explain, give correct meaning from data or information	4
	Achieving the standard (75% of descriptor), the students are able to explain, give correct meaning from data or information	3
	Achieving the minimum standard (50% of descriptor), the students are able to explain, give correct meaning from data or information	2
	Not achieving the minimum standard (25% of descriptor), the students are not able to explain, give correct meaning from data or information	
Analysis	The Answer Rating of Critical Thinking Skill (Analysis)	
	Achieving the maximum standard (100% of descriptor), the students are able to identify and analyze the meaning and connecting the facts of investigation	4
	Achieving the standard (75% of descriptor), the students are able to identify and analyze the meaning and connecting the facts of investigation	3
	Achieving the minimum standard (50% of descriptor), the students are able to identify and analyze the meaning and connecting the facts of investigation	2
	Not achieving the minimum standard (25% of descriptor), the students are not able to identify and analyze the meaning and connecting the facts of investigation	1
Evaluation	The Answer Rating of Critical Thinking Skill (Evaluation)	
	Achieving the maximum standard (100% of descriptor), the students are able to verify the rightness of analysis result which is in line and reasonable according to the facts of investigation	4
	Achieving the standard (75% of descriptor), the students are able to verify the rightness of analysis result which is in line and reasonable according to the facts of investigation	3
	Achieving the minimum standard (50% of descriptor), the students are able to verify the rightness of analysis result which is in line and reasonable according to the facts of investigation	2
	Not achieving the minimum standard (25% of descriptor), the students are not able to verify the rightness of analysis result which is in line and reasonable according to the facts of investigation	1
Inference	The Answer Rating of Critical Thinking Skill (Inference)	
	Achieving the maximum standard (100% of descriptor), the students are able to identify, think and obtain the needed elements to make a reasonable conclusion	4
	Achieving the standard (75% of descriptor), the students are able to identify, think and obtain the needed elements to make a reasonable conclusion	3
	Achieving the minimum standard (50% of descriptor), the students are able to identify, think and obtain the needed elements to make a reasonable conclusion	2
	Not achieving the minimum standard (25% of descriptor), the students are not able to identify, think and obtain the needed elements to make a reasonable conclusion	1

The calculation of the percentage is as follows:

$$\text{Percentage Score} = (\text{achieved score}) / (\text{maximum score}) \times 100\%$$

The percentage score then categorized according to the table 2:

Table 2: The Percentage Category of Critical Thinking Skill

Percentage (%)	Category
$81,25 < X \leq 100$	Very High
$71,5 < X \leq 81,25$	High
$62,5 < X \leq 71,5$	Medium
$43,75 < X \leq 62,5$	Low
$0 < X \leq 43,75$	Very Low

Adapted from Karim & Normaya (2015).

3. Results

The data of students' critical thinking skill can be seen from table 3 as follows:

Table 3: The Result of Critical Thinking Skill

Student	Student Worksheet			
	Interpretation	Analysis	Evaluation	Inference
1	100.0	83.3	75.0	75.0
2	83.3	75.0	75.0	75.0
3	83.3	91.7	91.7	91.7
4	83.3	75.0	75.0	58.3
5	75.0	66.7	83.3	75.0
6	83.3	75.0	83.3	83.3
7	100.0	75.0	75.0	75.0
8	83.3	91.7	75.0	75.0
9	83.3	75.0	83.3	83.3
10	83.3	83.3	75.0	75.0
11	75.0	75.0	83.3	83.3
12	75.0	83.3	83.3	83.3
13	100.0	75.0	75.0	75.0
14	83.3	83.3	75.0	75.0
15	83.3	83.3	83.3	91.7
16	83.3	75.0	75.0	75.0
17	75.0	75.0	83.3	75.0
18	83.3	75.0	83.3	83.3
19	75.0	83.3	75.0	75.0
20	91.7	75.0	75.0	75.0
21	83.3	83.3	75.0	83.3
22	75.0	75.0	75.0	83.3
23	75.0	83.3	75.0	83.3
24	83.3	75.0	75.0	75.0
25	83.3	75.0	75.0	75.0
26	91.7	75.0	75.0	75.0
27	83.3	83.3	75.0	83.3
28	75.0	83.3	75.0	83.3
Average (Category)	83.3 (very high)	78.9 (high)	78.0 (high)	78.6 (high)

Table 3 shows that the students' critical thinking skill achieve high category.

According to this research, it can be made the inference which is the students' critical thinking ability of Ecology material through environmental approach in creating interpretation is very high (83,3%), analysis is high (78,9%), evaluation is high (78%), and inference is high (78,6).

4. Discussion

Ecological learning can be presented with environmental approach-based learning. The learning process is supported by the student worksheet which helps students in implementing the learning stages so that they are more focused while training the students' critical thinking skills. The students' critical thinking skills turned out to reach the high category. Students can carry out a series of learning activities and during the learning process guided by student worksheet indirectly make the students train their thinking skills. One of the advantages of the developed student worksheet is that there are examples of working according to the indicators of critical thinking skills so that it will facilitate learning. The student worksheet can provide motivation and opportunities for students to actively participate in the learning process. In addition, the student worksheet helps the students in carrying out learning sequences and helps teachers to create more effective learning.

The learning with an environmental approach can facilitate students to develop their critical thinking skills. These results will imply on their learning outcomes if they can master these skills. This was explained by Rosita (2011) that the application of the environmental approach method was effective enough to improve student learning outcomes. This learning can change the habits of learners by listening and receiving information from the teacher to learn by thinking a lot and finding it directly.

The student worksheet is an important focus when preparing the learning since it is used directly by students during the learning process. The development of student worksheet must be adapted to environmental conditions in order to be contextual so that students can see examples directly in the real environment. This will shape learning to become more meaningful and have an impact on students' cognitive. According to Partono (2015), there are several supporting factors that cause learning models with student worksheet to influence student learning outcomes including 1) the problems presented in the student worksheet are able to arouse students' interest and curiosity. The statement was shown by the presentation of ecological problems that exist around the students in the developed student worksheet. 2) practical tools that support direct and real learning activities. The statement also appeared in the student worksheet which was developed to include the tools used. 4) the opportunity for students to communicate the results of the discussion. This statement is also indicated by the discussion sheet on the developed student worksheet.

According to these observations, it is known that learning with the student worksheet with the environmental approach can also be seen from the activities of students during learning. Based on observations during the learning process, it was seen that the atmosphere of learning in the field when the investigation used the

environmental approach came alive and active. This learning makes students get a better understanding and students are more interested in knowing it. Malajdim (2003) revealed that the achievement of learning outcomes of students after following the learning process with an environmental approach has increased. The utilization of the school environment as a learning resource can improve critical thinking skills and student learning activities (Lestari, 2014).

According to the critical thinking skill research result, it is obtained the average categories are high and very high

A. Interpretation Indicator

The students' critical thinking skills in the interpretation indicator reached a very high category. The developed student worksheet can be used well to study ecological concepts in high school. This is thought to be caused by the superiority of the developed student worksheet, namely the problems that are equipped with the images in the student worksheet unit are around the students' environment, making it easier for students to find problems and associate with the material being studied.

The advantages of the student worksheet are thought to be able to foster the ability of students to understand and express, explain and give meaning to information data. So, that they can interpret images or phenomena according to their visual abilities. As explained by Sanjaya (2006) learning strategies with a series of learning activities that emphasize the critical thinking process to find out for themselves a problem in question.

B. Analysis Indicator

The students' critical thinking skills in the analysis indicators reached a high category. Students who are able to answer the student worksheet on the indicators of analysis, one of which is caused by the superiority of the student worksheet that provides motivation for students to find and find their own answers to a problem they face. As explained by Sanjaya (2006) learning strategies with a series of learning activities that emphasize the process of thinking critically and analytically to find out for themselves the answers to a problem in question. This is in line with Hartati (2010), which states that the ability to analyze includes: identifying relationships between data, testing the data produced and being able to detect arguments.

C. Evaluation Indicator

Students' critical thinking skills in evaluation indicators reach a high category. The developed student worksheet can be used well to study ecological concepts in high school. This is allegedly caused by the superiority of the developed student worksheet, namely the problems that are equipped with the images in the student worksheet unit are around the students' environment, making it easier for students to relate the material to be studied. Images, colors, are in accordance with the contents of the material of the ecological concept being studied, so students will be motivated to assess

the credibility of a statement and test the truth of the results of the analysis of images or phenomena found.

Facion (Filsaime, 2008), states a person's ability to assess the credibility of a statement or other representation of one's opinion or the ability to test the truth by evaluating or evaluating the results of image analysis or phenomena that have been interpreted. This is shown by Firdani's research (2015), which found the ability of students to evaluate the truth of the acid-base concept was determined by critical thinking skills evaluation. The same study Afrizon, et al (2014), one of the students' evaluation abilities is the ability to see information and real power and the ability to express one's thoughts.

D. Inference Indicator

Students' critical thinking skills on the inferential indicator reach high categories. The developed student worksheet can be used very well to study ecological concepts in high school. This is thought to be due to the inference phase of the students being asked to make guesses according to the facts to make a conclusion so that the material that must be processed on this indicator already exists in the previous indicator. Besides the student worksheet there are examples of working on the indicators of critical thinking skills. Making it easier for students to obtain the material needed to make rational conclusions by considering information that fits a problem based on the data they found. Facion (Filsaime, 2008), states a person's ability to identify or obtain elements or elements needed in making reasonable or rational conclusions by considering information that is relevant to a problem with consequences based on existing data. This is supported by research that includes Hayatullisma (2014) who reports that by observing examples of ecosystems students can improve the results of their critical thinking abilities. In the inference indicator does not rule out the possibility that there are still some students who get a value of 2, this is due to the mistakes of students when answering in the evaluation indicator, so that when answering questions at the infernation stage is also not right. This is corroborated by the research of Karim and Normaya (2015), that although almost all students have been able to draw conclusions in accordance with the context of the question, there are some students who are not right in making conclusions, this is one of the causes when solving questions in the student evaluation stage make mistakes in answering, so the conclusions they get are incorrect.

5. Conclusion

It can be concluded that:

- The students' critical thinking skill on the Ecological learning through environmental education reached very high category on the interpretation category and reached high category on the indicator of analysis, evaluation, and inference

- Environmental education can become an alternative to train the critical thinking ability of the students

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