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ENHANCEMENT OF STUDENTS' CRITICAL THINKING SKILL IN FUNGI CONCEPTS BASED ON SCIENCE, TECHNOLOGY, AND SOCIETY LEARNING APPROACH

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ABSTRACT: This study aimed to evaluate the enhancement of students' critical thinking in fungi concepts based on Science, Technology, and Society learning approach. The learning process involved a single class consisting of 30 students on the first grade of State Senior High School of 16 Surabaya as the subject of this study. One group pre-test and post-test design was used in the learning process to determine the enhancement of students' critical thinking skill. The findings indicated that critical thinking skill on students boosted highly as the effect of the learning process. It can be concluded that Science, Technology, and Society learning approach is able to increase the students' critical thinking skill in fungi concepts.

INTRODUCTION

Learners should have good thinking skills, in order they are able to solve many problems in the real world. One of thinking skills including critical thinking skill defined as a process of thinking clearly in analyzing problems and identifying issues (Lau, 2011). By having this thinking skill, students can increase learning experiences and enhance their science knowledge (Ibe, 2013).

However, the student's questionnaires taken from State Senior High School of 16 Surabaya showed that student's critical thinking skill was low as the impact of teacher-centered learning activities. The traditional teacher-centered learning activity often favors passive reception of knowledge. Students were not active in attaining concepts that they should learn. In contrast, the interactive learning activity encourages active learning which is able to create a center of student's attention to learn and improve their thinking skills (Coughlan, 2007).

Science, Technology, and Society learning approach can be an alternative to create an interactive learning activity. Mai et al. (2011) stated that this learning approach guides students to be able to study and comprehend science concepts actively by integrating them with technology and society. Similarly, Facione (2010) also reported that learners are able to learn scientific skills and increase high thinking skills through Science, Technology, and Society learning approach. Since this learning approach provides an effective learning situa-

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tion because students can understand science concepts by conducting researches to solve problems that are related to the life (Chantaranima and Yuenyong, 2014).

Science, Technology, and Society learning approach has been proved that capable to guide students to learn concepts and enhance their critical and creative thinking skills (Branch and Oberg, 2005). Students in this learning activity had higher thinking skills rather than students in the traditional teacher-centered learning process because they learned actively by conducting several researches. Students taught by Science, Technology, and Society learning approach were reported that are able to learn science by themselves (Aikenhead, 2005).

The implementation of Science, Technology, and Society learning approach provides students to be able to learn by themselves. It has been found that if learners are able to learn by themselves, they will be easily processing information (Pewnim et al., 2011). The result of observation at State Senior High School of 16 Surabaya indicated that students consider fungi as one of the most difficult topics in biology that affect their low mastery. A plenty of complex terms which are difficult to memorize followed by inactive learning activities influence low student's comprehension and thinking skills.

Several previous studies related to Science, Technology, and Society learning approach indicated that this learning process provides an interactive learning condition which can enhance student's critical thinking skill. According to those previous views, this research aimed to evaluate the enhancement of student's critical thinking skill on the topic of fungi according to Science, Technology, and Society learning approach.

METHODS

This descriptive research was conducted using one group pre-test and post-test design. This research design provides students a Science, Technology, and Society learning approach as the treatment in which they will be given tests to evaluate the critical thinking skill before and after the treatment. Pre-test given in the initial learning activity and post-test in the final activity determined the rise of critical thinking skill.

This study involved a single class consisting of 30 students on the first grade of State Senior High School of 16 Surabaya at the first semester. The test instrument was used to evaluate the critical thinking skill arranging in the form of essay. The critical thinking test asked about four indicators; 1) focus on the questions, 2) ask and/or answer some questions, 3) consider the credibility of certain information, and 4) define terms.

Data collected in this study were analysed qualitative-quantitative descriptively. Data of critical thinking skill were collected from paper-and-pencil tests. Student's scores were calculated using the following formula:

$$\text{Score} = \frac{\sum \text{true answers}}{\sum \text{maximal score}} \; x \; 100 \qquad (1)$$

If the student's scores met the minimum mastery: 75, it can be said that they mastered the topic. Furthermore, the values of enhancement of student's critical and creative thinking skills were counted using the following formula:

$$\langle g \rangle = \frac{(\langle S_f \rangle - \langle S_i \rangle)}{(S_{max} - \langle S_i \rangle)} \qquad (2)$$

Note:

$\langle g \rangle$ = N-gain value $\quad \langle S_i \rangle$ = pre-test score

$\langle S_f \rangle$ = post-test score $\quad S_{max}$ = maximal score

The values obtained from that calculation are categorized using the criteria; 1) If the N-gain score is more than equal to 0.70, it means that the enhancement is high, 2) if the N-gain

score is more than equal to 0.30 and less than equal to 0.70, it means that the enhancement is moderate, and 3) if N-gain score is less than 0.30, it means that the enhancement is low.

RESULTS AND DISCUSSION

In this study, the students' critical thinking skill on fungi topic was assessed by paper-and-pencil test. The students' critical thinking skill mastery level and its enhancement is shown in the Table 1.

Table 1. Enhancement of Students' Critical Thinking Skill

Students	Pre-test		Post-test		N-gain value	Criteria
	Score	*Mastery*	*Score*	*Mastery*		
A1	27.08	nm	81.25	m	0.74	High
A2	27.08	nm	83.33	m	0.77	High
A3	16.70	nm	77.08	m	0.72	High
A4	25.00	nm	72.92	nm	0.63	Moderate
A5	62.50	nm	81.25	m	0.50	Moderate
A6	25.00	nm	83.33	m	0.78	High
A7	27.10	nm	75.00	m	0.66	Moderate
A8	18.75	nm	81.25	m	0.77	High
A9	35.42	nm	75.00	m	0.61	Moderate
A10	22.90	nm	75.00	m	0.68	Moderate
A11	35.42	nm	81.25	m	0.71	High
A12	20.80	nm	93.75	m	0.92	High
A13	18.75	nm	75.00	m	0.69	Moderate
A14	12.50	nm	81.25	m	0.79	High
A15	18.75	nm	83.33	m	0.79	High
A16	14.58	nm	77.08	m	0.73	High
A17	20.83	nm	87.50	m	0.84	High
A18	25.00	nm	81.25	m	0.75	High
A19	20.80	nm	77.08	m	0.71	High
A20	31.25	nm	75.00	m	0.64	Moderate
A21	22.91	nm	81.25	m	0.76	High
A22	20.80	nm	87.50	m	0.84	High
A23	12.50	nm	87.50	m	0.86	High
A24	12.50	nm	83.33	m	0.81	High
A25	39.58	nm	89.58	m	0.83	High
A26	12.50	nm	87.50	m	0.86	High
A27	6.25	nm	72.92	nm	0.71	High
A28	31.25	nm	79.17	m	0.70	Moderate
A29	33.33	nm	95.83	m	0.94	High
A30	31.25	nm	87.50	m	0.82	High
Average	**24.30**		**81.67**		**0.75**	**High**

Note:
nm: not master m: master

Based on data shown in the Table 1, all students did not master the pre-test of critical thinking skill. However two students did not master the post-test of critical thinking skill. It also can be seen that the classical enhancement score of critical thinking skill was 0.75 with high criteria. Data also indicates that eight students had moderate enhancement of critical thinking skill. Findings of the mastery percentage of indicators of critical thinking skill is presented in Figure 1.

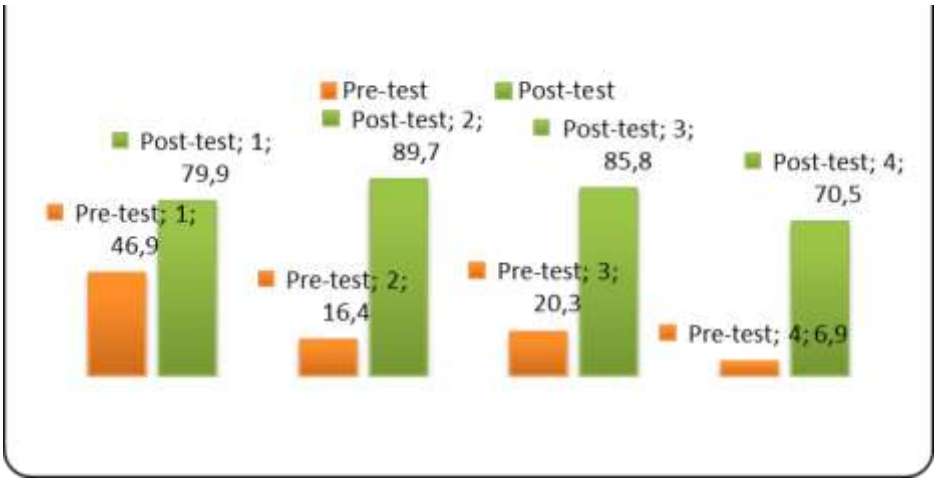

Figure 1. Mastery of critical thinking skill indicators

According to data shown in the Figure 1, all indicators of critical thinking skill did not reach mastery in the pre-test which were contrary to the post-test result that all indicators mastered. It also can be seen that indicator 1 (focus on the questions) and indicator 4 (define terms) obtained moderate enhancement value while indicator 2 (ask and/or answer some questions) and indicator 3 (consider the credibility of certain information) had high enhancement value.

Learning environments provided by this learning approach were contextual and authentic in which capable to develop students' learning motivation. Learners have high motivation to learn if educators not only teach verbally but also provide interesting and fun learning environments (Rule, 2006). Furthermore, contextual learning environments are able to create meaningful learning experiences since they can learn, comprehend, build knowledge, and increase skills by themselves. This learning activity is also proved that was capable to improve learners' critical thinking skills since students were guided to face several authentic problems and this influenced into the good comprehension of concepts and high thinking skills. Similarly, Vygotsky has already stated that an affective learning process can happen if learners can finish the difificult tasks which have not been studied yet (Arends, 2012).

Critical thinking is an active thinking process in analysing problems and identifying issues. Critical thinking needs high cognitive skills. The implementation of Science, Technology, and Society learning approach was capable to improve learners' critical thinking skill shown by the high enhancement value. It is caused by the learning process gave students meaningful learning experiences such as when they learned fungi in the laboratory and through animation video (Filsaime, 2008). It has been already proved that critical thinking skill can be developed through meaningful learning environments. Furthermore, by implementing this learning activity students were able to solve several problems and develop their skills. That's why students taught in this class have higher critical thinking skills rather than students in traditional class.

The result of observation in the class indicated that low students pre-test score was caused by their learning habit. Students were not used to have pre-test before start a learning process and they were not also used to comprehend the concepts by themselves. However, this learning activity was proved that was able to trigger to be active learners in order that they are used to build knowledge and skills themselves. In contrast, the different enhancement values of learners are caused by different cognitive development. It has been reported from Rule (2006) that students grow in the same intellectual development but this growth occurs in the different rate.

Furthermore, indicator 1 of critical thinking skill (focus on the questions) and indicator 4 (define terms) obtained moderate enhancement value while indicator 2 (ask and/or answer some questions) and indicator 3 (consider the credibility of certain information) had high enhancement value. It is caused by the low students' prior knowledge about fungi. Most of them considered fungi as same as plants.

Findings of students' critical thinking skill also showed that there were two students who did not master the post-test of critical thinking. This can be happened because the students' physical condition. The learning activity was begun in the morning and learners were not having breakfast before the class started. This phenomenon made them weak and not motivated to join the learning activity then it was affected to the low critical thinking mastery. To conclude, the Science, Technology, and Society learning approach was proved to be able to increase students' critical thinking skill especially in fungi topic.

CONCLUSION

According to the results obtained in this current study, it can be concluded that Science, Technology, and Society learning approach was able to increase the students' critical thinking skill in fungi concepts in which the score was 0.75, in the category of high.

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