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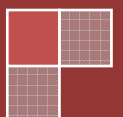
*Special Issue for INTE 2017
December 2017*

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Contact Address:
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Message from the Editor-in-Chief

Dear Colleagues,

We are very pleased to publish Special Issue for INTE-2017, ITICAM 2017 & IDEC 2017 conferences. This issue covers the papers presented at International Conference on New Horizons in Education, International Trends and Issues in Communication & Media Conference and International Distance Education Conference which were held in Freie Universität Berlin, Germany. These papers are about different research scopes and approaches of new developments and innovation in education, communication, media and technology.

Call for Papers

TOJET invites you article contributions. Submitted articles should be about all aspects of educational technology. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. Manuscripts must be submitted in English. TOJET is guided by its editors, guest editors and advisory boards. If you are interested in contributing to TOJET as an author, guest editor or reviewer, please send your CV to tojet.editor@gmail.com.

December, 2017

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The Process of Students' Higher Order Thinking Around Coffee Plantation Area in Solving Open-Ended Problems Related to Coffee Theme

SURATNO

*Study Program of Biology Education,
Faculty of Teacher Training and Education,
University of Jember, Indonesia
suratno.fkip@unej.ac.id*

Dian KURNIATI

*Study Program of Mathematics Education,
Faculty of Teacher Training and Education,
University of Jember, Indonesia
dian.kurniati@unej.ac.id*

ABSTRACT

This research aims to describe the high-order-thinking process of students around coffee plantation in solving open-ended problems on topics germane to coffee. The present study was a descriptive research with qualitative approach. The research participants were 80 students chosen from elementary and primary high schools around a coffee plantation. High order thinking skill denotes the ability to think critically and deploy metacognition capacity encompassing the following indicators: (1) the ability to solve the problems, (2) the ability to give reason and evidence, (3) the ability to communicate, and (4) the ability to reflect and evaluate. The research results indicated that elementary school students tended to have problem-solving ability related to themes regarding coffee with different possible answers, but they were unable to provide logical reasons and evidences, and they were unable to reflect and evaluate the answers given. Furthermore, students' high order thinking skill in junior high school around the coffee plantation was also not maximal in that students were only able to provide various answers correctly along with the logical reasons and evidences. However, those junior high school students were unable to reflect and evaluate on the process of solving open-ended problems. In general, the tendency of the students around coffee plantation indicated that the students did not have a maximum high order thinking skill in solving the open-ended problems related to themes pertinent to coffee. It was because the students still had yet to master satisfactory metacognition ability, particularly germane to the ability to reflect and evaluate and the ability to give logical reasons and evidences.

Keywords: Thinking process, critical thinking skill, metacognition, coffee plantation

INTRODUCTION

Indonesia is the third largest coffee-producing country in the world after Brazil and Vietnam. Furthermore, East Java is the second largest coffee producer in Indonesia and Jember is the second largest city producing coffee after Malang in East Java (Suratno & Kurniati, 2017). This evinces that most of the regions in Indonesia, especially Jember district, are coffee plantation areas. This is also in line with the existence of several schools devoted to providing education around the coffee plantation.

The ability of students around the coffee plantation of Sidomulyo Jember in solving the problem on themes pertaining to coffee within the realm of Mathematics and Science is very low, in that the students are only able to do problem solving operation procedurally as taught by the teacher by writing simple mathematical formulae. However, the students have difficulty deploying the knowledge related to coffee and their experience in coffee farming when they deal with solving problems at school (Suratno & Kurniati, 2017). In addition, the cognitive thinking ability of students in Jember district in solving high-order thinking problems, especially those complying with PISA standard (The Program for International Student Assessment), is reported to be low inasmuch as it only reaches the exploration and comprehension stage, while at the stage of representing and formulating daily-life problems, the students have not been able to develop these competencies (Kurniati & Annizar, 2017).

Based on the data aforementioned, making changes in classroom learning especially for Mathematics and Science lessons is inevitable. In this study, Mathematics and Science teachers around coffee plantations are accustomed to applying conventional instruction with expository methods. The task given by the teacher is routine task in that the completion stage is similar to what the teacher has taught. Therefore, critical thinking skills and metacognition of these elementary and primary school students around coffee plantations do not develop optimally. The determination of learning models which match the characteristics of the students around the coffee plantation and focus on the ability of high-level thinking is based on the students' initial ability and condition, one of which is their thinking process. So and so, the results of the present study are expected to help

teachers to determine the instructional model or method or approach suitable to develop high-order thinking ability of the students, especially critical thinking and metacognition skills.

High-order thinking skills, based on Bloom's Taxonomy, consist of analytical skills (C4), evaluation (C4), and creation (C5) (Anderson & Krathwohl, 2013). At the level of C4, C5, and C6, students are said to have high-order thinking ability because students are able to perform investigations, analysis, conclusion formulation, and the invention of new ideas from a problem given by teacher. The other abilities of high-order thinking are critical thinking, logical thinking, reflective thinking, metacognitive thinking, and creative thinking (Collins, 2014). Furthermore, Brookhart identifies high-order thinking skills in three categories, namely knowledge transfer, critical thinking, and problem solving (Brookhart, 2010). Referring to the notion of high-order thinking skills above, the indicator of high-order thinking in this study only focuses on the ability of critical thinking and metacognition. The selection of these two indicators is because the abilities feasible for maximum development to the students in coffee plantation area only pertain to the ability of critical thinking and metacognition. As such, future study can focus on the other facets of high-order thinking abilities.

Critical thinking categories consist of providing logical, reflective reasonings that focus on "believe or do" thought (Norris & Ennis, 1989), and "artful thinking" consisting of reasoning, questioning and investigating, observing and describing, comparing and connecting, finding complexity, and exploring viewpoints (Barahal, 2008). Furthermore, critical thinking and problem-solving skills according to P21 encompass the ability to reason effectively, use system thinking, make judgments and decisions, and solve problems (P21, 2017). In critical thinking skills, the term *thinking* means that students can apply decisions and procedures with critical reasons.

Metacognition is the knowledge that focuses on the cognitive processes in the thinking process of each student and produces all thoughts and activities required in thinking (Desoete, Roeyers, & Buysee, 2001). Metacognitive skill denotes a component of the executive control of individual's cognition. Metacognitive skills refer to three skills which comprise of self-monitoring skills, self-assessment skills, and self-regulation skills (Kayashima & Inaba, 2004).

Based on the theoretical studies concerning critical thinking and metacognition abovementioned, the high-order thinking indicators in this research pertain to the indicators of critical thinking and metacognition, *inter alia*: (1) problem solving ability, (2) the ability to give reason and evidence, (3) the ability to communicate, and (4) the ability to reflect and evaluate. First, the problem-solving skill referred to in this study is students' ability to understand problem, design the problem-solving strategy, implement the strategy that has been designed, and re-check the problem solving process. In addition the problem-solving abilities under investigation are also based on students' collaboration, which complies with the ability stipulated in P21. Collaboration-based problem-solving ability is an important component that can be useful in the daily life of students as the question given is an open-ended daily-life questions (Ras, Krkovik, Greiff, Tobais, & Maquil, 2014). Second, the ability to provide reasons and evidence related to the problem-solving process is the ability to state the reasons for each step of problem solving along with relevant definitions and theorems. Third, the ability to communicate in question constitutes oral and written communication. Written communication is related to the ability to write symbols related to Mathematics and Science, the ability to provide detailed answer, and the ability to connect materials that have been studied with the learning experience surrounding themes regarding coffee. Furthermore, oral communication is related to the students' ability to present the results of problem solving. Fourth, the ability to reflect and evaluate under investigation is pertinent to the ability to re-check answering process and to determine other methods or solutions of the solutions already given. If the students' answers are found erroneous, then they will be able to locate the error and able to rectify it. Problems given to the students are problems that are related to themes concerned with coffee and problems of non-routine matters. Non-routine problems in this regard are open-ended in nature, which are open to various answers and solutions for a single problem.

RESEARCH METHOD

The present study was qualitative descriptive in nature, which was devoted to gaining the description of high-order thinking skills particularly pertinent to critical thinking skills and metacognition of students at elementary and primary schools situated around Garahan coffee plantation in Jember. The high-order thinking skills under investigation were scrutinized when the students dealt with open-ended questions related to themes on coffee covered in Mathematics and Science subject. Research subjects in the study were 80 students chosen from 2 elementary schools and 1 primary school in the aforementioned area. The determination of high-order thinking process was backgrounded by the accomplishment of students' thinking process, which met 4 indicators. The indicators of critical thinking and metacognition of the students in the research comprised of (1) problem-solving ability, (2) the ability to provide reason and evidence, (3) the ability to communicate, and (4) the ability to reflect and evaluate.

The phases in the present study encompassed (1) providing open-ended questions germane to themes concerned with coffee to the research subject, (2) analyzing the students' answer so as to probe their critical thinking and

metacognition process, (3) carrying out data triangulation through interview to gather more data, which had yet to be obtained during test item accomplishment, and to confirm students' answer, and (4) drawing conclusion pertinent to the students' critical thinking and metacognition process by referring to the analysis on test performance and interview. The determination of research subjects was done by snowball throwing, coupled with guided open-ended interview.

In addition to analyzing the results of test and interview, observation on students' performance during taking the test through think aloud method was made operative. Students were requested to speak softly upon accomplishing the open-ended questions given. The clues of students' tendency in high-order thinking process when doing open-ended question were amassed by transcribing all results obtained from the test, interview, and think aloud process into tables, so the tendency of thinking process could be made visible.

RESULT AND DISCUSSION

The subjects in this research were 50 students of grade V and VI at Sidomulyo 3 Public Elementary school of Garahan village, Silo, Jember, and 30 students of class VII at Satu Atap Primary school of Garaghan village, Silo, Jember. All research subjects worked on open-ended questions for Mathematics and Science materials with the theme concerning vegetative cultivation of coffee. The questions given were 4 essay questions which had to be done in 90 minutes. Before students worked on the open-ended questions, they had been asked to write a short story of their experiences related to farming coffee and a short description on whether their parents owned coffee plantation or worked as labourers at coffee plantation. There were 60 students whose parents worked as laborers at coffee plantations and 20 students whose parents had their own coffee plantation. All students knew and even once experienced the process of farming coffee through grafting and the process of determining the spacing between coffee trees in order for proper growth.

The students' tendency in working on open-ended questions was limited to accomplishing 1 out of 4 questions given, with the ability to provide logical reason and the reflection ability found low. The data obtained from the open-ended question found out that 5 students could answer 2 questions correctly, 50 students could work on 1 question, and 25 students could not answer the questions correctly. Each cluster of data was analyzed in terms of the tendency in critical thinking and metacognition.

The students who could answer 2 out of 4 questions had medium high-order thinking ability as they only mastered satisfactory problem-solving ability and communication ability, be it oral or written. On the other hand, in terms of the ability to provide logical reason and evidence as well as the reflection and evaluation ability, the students had yet to be competent. The students tended to think procedurally when solving problems as taught by their teacher. As such, their answers in doing open-ended questions were correct, yet their ability was not maximal. Upon accomplishing the first question, the students tended to apply the knowledge taught by their teacher, but they had not provided logical reason and evidence related to their experience concerned with farming coffee. When working on question 2, the students could in fact do it correctly and write symbols of the angle and width of two-dimensional figures to determine the spacing between coffee trees. The students' reflection ability on question 2 developed quite well, because they could do re-checking when they accomplished open-ended question and they could find out other ideas or answers, which were different from the initial answers. These additional answers or ideas were based on their experience in farming coffee aged at 0-6 months old. In addition, they also were able to find out the cutting angle of coffee stalk for grafting, which was tapered angle ranging from 35 to 65 degrees.

The students who could answer 1 out of 4 questions had low high-order thinking ability with satisfactory problem-solving and communication ability, be it oral or written. However, their ability to write symbols was proven erroneous in that they used hectare for meter scale. The symbols of width, circumference, and length for the spacing between coffee trees were written correctly. The ability to provide logical reason and evidence as well as the reflection and evaluation ability were not evident in the students with low high-order thinking ability. The students tended to think inductively as they worked on open-ended questions in that they referred to several examples of coffee planting they experienced when helping their parents. Mathematics knowledge they mastered was proven very low, inasmuch as they had yet to apply the formula of circumference, width, and angle determination based on mathematical theorems and definitions. The students were not able to determine the ideal angle for grafting, yet they were only able to determine tapered angle without any precise figure. The students could not determine the ideal age of coffee stalk for grafting, but they could determine the stalk diameter for the very purpose, which was 15 cm. The students could not determine the solution or find out new idea for question number 1 as they were only able to provide 1 correct solution.

The students who were not able to do the questions correctly were classified as having no high-order thinking ability. This was because they had not been able to master (1) problem solving ability, (2) the ability to give reason and evidence, (3) the ability to communicate, and (4) the ability to reflect and evaluate. The students were unable to solve the open-ended questions due to the following reasons. (1) They never knew the vegetative cultivation process. (2) Their parents did not work in coffee plantation. (3) The mathematical ability germane to

determining the circumference and width of two-dimensional figure, angle of a figure, and length was not maximal. (4) The students' knowledge related to grafting and vegetative cultivation was not maximal.

The research findings evinced that the elementary school students tended to master problem-solving ability related to themes concerning coffee with variant answering process, but they were not able to provide logical reason and evidence, nor were they able to do reflection and evaluation on the answers given. Furthermore, the high-order thinking ability of the primary school students around the coffee plantation had yet to reach its uttermost inasmuch as they were only able to provide various correct answers supported with logical reason and evidence. Nevertheless, these primary school students were not able to do reflection and evaluation on problem-solving process on open-ended questions. In general, the students' thinking tendency had yet to attain maximal high-order thinking when working on open-ended questions related to themes concerning coffee. This was because the students had not mastered satisfactory metacognitive abilities required, particularly pertinent to reflection and evaluation ability as well as the ability to provide logical reason and evidence.

CONCLUSIONS

Based on the data analysis scrutinizing the students' tendency of thinking process, the study concludes that in general they have yet to master maximum high-order thinking skills in dealing with solving open-ended questions concerned with themes on coffee. This is because they have yet to master satisfactory metacognition ability, particularly the ability to reflect and evaluate as well as the ability to provide logical reasons and evidences.

SUGGESTIONS

One suggestion resulting from the study recommends teachers of Mathematics and Science teaching around the plantation area to determine apt instructional model or method or approach for developing their students' critical thinking and metacognition skill. Critical thinking and metacognition process of the students revealed in this study can serve as the cornerstone to extrapolate elementary and primary school students' initial ability in solving problems related to themes concerning coffee.

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