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Analysis Mapping Of Students' Skills on Implementing of Scientific Approach in Biology Learning

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***Abstract*— This study aims to make analyze of students' skills on implementing of scientific approach in biology. This study was a descriptive-qualitative method participated by 256 students of grade 11 science class at nine state senior high schools in Yogyakarta. Scientific approach skills are illustrated as abilities to apply science, i.e. observing, problem formulation, making hypothesis, designing of experiment, investigating, making conclusion (Kuhn, 2010). Data of students' skills were collected used a non-test technique by using worksheet, documentation and interview methods. Instrument had been validated by expert judgment and students as user. The result of the study showed the students' skills on implementing scientific approach in biology are: observing (37.22), problem formulation (37.88), making hypothesis (35.44), designing of experiment (43.33), investigating (60.11), making conclusion (64.44). It is supported by interview data showed they (teachers and students) felt difficulties when implementing the scientific approach in biology learning. It can be concluded that the students' skills on implementing of scientific approach in biology learning was low. It is suggested that they (teachers and students) need the accompanied on making lesson plan-based scientific approach as science curriculum suggestion.**

Keywords— scientific thinking abilities; biology learning; science curriculum

I. INTRODUCTION

The development of science learning in many countries has led to a scientific approach that puts students active with inquiry through a scientific approach. In Indonesia the shifting paradigm of science learning is marked by an emphasis toward a scientific approach as it is preserved in the curriculum of 2013. Factually the application of scientific approach especially on biology learning still encounters many obstacles both of teachers and students (Suciati, 2015). Teachers in applying scientific approach tend to emphasize on the aspect of knowledge and less directed to the activities of scientific methods so that students learn not find the concept by memorize. Many research related with how teachers' abilities on implementing of scientific approach was done, but how students' abilities on implementing of scientific approach rarely done. This study aims to make analyze mapping of students' skills on implementing of scientific approach in biology learning.

The purpose of science learning is directed to develop methods, procedures, and explanations as part of the process of acquiring knowledge or in other words called scientific thinking (Li & Klahr, 2006; Lehrer & Scauble, 2007). New knowledge gained in the learning process of science is obtained through data collection, data analysis, and problem-solving processes known as scientific discovery methods (Maxwell, Lambeth, & Cox, 2015). The application of scientific discovery methods involves: problem-solving skills, producing, proving, and correcting a theory, are the result of scientific thinking (Zimmerman, 2007). This is relevant to the 2013 curriculum which emphasizes a scientific approach that includes 4 steps: observing, asking, make reasoning, trying and communicating (Kemendikbud, 2006). Scientific approach suitable for use in science learning because the spirit of scientific approach is refers to the three pillars namely: process, product and scientific attitude (Zeidan and Jayosi, 2015; Guevara, 2015; Guevara and Almario, 2015). This is relevant to the purpose of science learning that trains students' scientific skills and scientific literacy. This is relevant to the OECD (2003) that if science is taught by facilitating students with a series of scientific inquiry activities through a scientific approach, it can be a strategic way to empower students' science literacy as problem solving in daily life. Students will competen to use scientific knowledge, identify questions and make the conclusions based on the facts to understanding the nature and make decisions of changes that occurring due to human activities and competent to use

scientific knowledge and scientific abilities to identify problems, ask questions and make conclusions based on data to make decisions about nature and its interactions. Kuhn (2010) suggests that the scientific approach is described as a student skill that includes 6 skills: observing, problem formulation, making hypothesis, designing of experiment, investigating, making conclusion. Departing from the above, it is necessary to do mapping related skills of students in the application of scientific approach. The result of mapping ability of students in applying this scientific approach can be useful to perform the action (treatment) for students and teachers in order to optimize the implementation of curriculum of 2013

II. METHOD

This study was descriptive-qualitative method with 256 students of XI grade science class at nine state senior high schools in district of Yogyakarta were involved in this study. Students' skills on implementing of scientific approach illustrated as students' abilities in six skills included: observing, problem formulation, making hypothesis, designing of experiment, investigating, making conclusion (Kuhn, 2010). Data on students' skills on implementing of scientific approach were collected used non-test technique by using worksheet, documentation and interview methods. Instrument had been validated by expert judgment and students as user

III. RESULTS AND DISCUSSION

The result of the study showed there was relation between students' scientific thinking ability with the schools' geographical position.

TABLE 1. The Achievement of Students' Skills on Implementing Scientific Approach in Biology Learning

No.	Indicators of scientific approach	Average
1.	Observing	37,22
2.	Problem formulation	37,88
3.	Making hypothesis	35,44
4.	Designing of experiment	43,33
5.	Investigating	60,11
6.	Making conclusion	64,44

The result of the study showed the achievement of students' skills on implementing scientific approach in biology learning included six aspects: observing (37,22), problem formulation (37,88), making hypothesis (35,44), designing of experiment (43,33), investigating (60,11), making conclusion (64,44).

A. Student's observation skill only equal to 37,22. This is related to the design of teachers' lesson plan which lack to facilited students to observing. The analysis results of students' worksheet showed that teacher directed to answer of teachers' questions that related to the topic of learning. The results of the interviews indicated that teachers worried lost the learning time if they facilitating students observing. Furthermore it was revealed that observation activities perceived by the teacher as an activity of observing objects directly outdoor. Though the observation can be done through a picture or video presentation of the phenomena that occur in daily life of students relevant to the topic of learning. Interview results also revealed that teachers tend to be less familiar with the role of the image or phenomenon that should be observed by students as a trigger that students can express questions as the formulation of the problem.

B. Students' problem formulation skill is also low only equal to 37,88. The result of student work analysis shows that the formulation of problem made by the student is far from expected. Questions posed by students tend to be less relevant, meaning less disconnected with the topic discussed. This is related to the lack of observation activities in teacher-designed learning. The results of the analysis also show that the question is generally expressed by the teacher and the students just answer it. Interviews indicate that teachers tend to be less aware that the questioner should be students rather than teachers. This clearly indicates a misperception, so correction is necessary.

C. Students' hypothesis formulation skill is also low (35,44) The skill in preparing the hypothesis is related to the skill of formulating the problem, because the hypothesis is the answer while the question in the formulation of the problem The findings are interesting from the aspect this suggests that students tend to put forth a temporary answer (hypothesis) not from the results of group discussion based on the knowledge they already have but by taking from the source book.Thus there is no group discussion, debate or cognitive conflicts among group members as expected in the scientific approach does not arise.Students tend to simply move the answers from the source book into the worksheet.In this case it illustrates that the teacher seems to lack understanding of the role of hypothetical activity in the scientific approach.Teachers only demand the results (product) students in answering questions, not process how students answer questions. The interview result revealed that the teacher was worried if the student's answer would be wrong or not in accordance with the source book. This is a wrong perception, because in the student answer hypothesis is still a temporary that becomes a bridge to be done further test (test the hypothesis) conduct investigation or experiment. This is also a mistake of teachers' perceptions, so correction is necessary.

D. Student's experiment design skill is also low that is only equal to 43,33. The analysis results indicate that teachers tend to have given clear and systematic instruction in conducting investigations including: objectives of activities, tools and materials, and activity steps) systematically. Of course this is very contrary to the principle of a scientific approach, where students are required to be active in learning including in designing investigations. This condition will only print students as a "robot" scientist who works based on the instructions the teacher has provided. Students lack the opportunity to express their ideas in designing an inquiry based on the hypothesis it makes. The results of the interview with the teacher indicate that the teacher is worried if the experiment fails or the procedure does not matcjing. Of course such perceptions can not be justified, because students are expected to be creative and learn from their mistakes.

E. Students' investigation skill is quite good that is equal to 60,11. The average figures obtained though not yet optimal, but are quite good compared to other indicator of scientific approaches. This is because students only do a sequence of inquiries as instructed by the teacher. Here students are not required to think high-level, but just do the steps sesua procedures that have been made by the teacher.

Students' making conclusion skill is quite good that is equal to 64.44. The results of interviews with students indicate that they do not feel difficult when drawing a conclusion, because it can be read easily from the results of his investigation. In addition, students who are still difficult in drawing conclusions suggested teachers to read the book source. Of course this is less justified, because the conclusions made should be based on the results of the experiment is not based on the source book that acts as a reference only.

IV. CONCLUSION

Based on the result of the study can be concluded that the students' skills on implementing of scientific approach in biology learning was low. It's suggested that they (teachers and students) need the accompanied on making lesson plan-based scientific approach as science curriculum suggestion. The researchers would like to express their gratitude to all parties involved in this research, the school principals, the Biology teachers, peers and students who have worked well together during data collection in the field.

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