Analysis of Argumentation Skills in Biological Learning in Senior High School Students

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Abstract. This research was conducted to find out the students' initial skills in empowering argumentation skills in biological learning in Senior High School students. The data to obtain the initial ability of students in the argumentation was drawn from written tests consisted of 2 questions that referred to the argumentation aspect indicator. Data analysis was done in a descriptive manner. This study involved all XII grade students of Mathematic-Science (MIA) program at one school in the Surakarta area. The results showed that students' argumentation skills were still dominated in giving claims and reasons only, while students were still lacking in providing evidence and rebuttal. From this study, it was seen that students had difficulty in developing scientific argumentation skills because they experienced confusion in determining argumentation content. Thus, students needed teacher guidance in the process of arguing. Students' argumentation skills were still lacking in training. Therefore, students needed to be empowered again.

1. Introduction

Education is an important basis for the progress of a nation and through education the nation will be easily achieve progress, both in the development of human resources and in the management of natural resources. Education is a system that consists of several components including the first component, namely input, which consists of students and teachers as educators, the second component is a process that is influenced by the environment and teaching instruments, the third component is result, which is the impact of the interaction between educators and students and is supported by process.

The 21\textsuperscript{st} century is an era of globalization marked by the rapid development of technology and information. In line with the development of technology and information, it requires superior human resources, quality, high-thinking skills and able to compete in the global era. Three concepts of 21\textsuperscript{st} century education have been adapted by the Ministry of Education and Culture of the Republic of Indonesia to develop a new curriculum for Elementary Schools (SD), Junior High Schools (SMP), Senior High Schools (SMA) and Vocational High Schools (SMK). The three concepts are 21\textsuperscript{st} Century Skills, scientific approach and authentic assessment.

Based on the 21\textsuperscript{st} Century Partnership Learning Framework, there are several competencies and/or expertise that must be possessed by human resources in the 21\textsuperscript{st} century, namely critical thinking and problem solving skills, communication and collaboration skills, creativity and innovation skills, information technology and communication literacy, contextual learning skills, and information and
media literacy skills. A challenging future cannot only be dealt with by relying on conscious and technological literacy, but also thinking skills.

Argumentation skill is one of the competencies needed by students in the 21st century because arguing is an important process of thinking skills. Students who have good argumentation skills are indicated to have good thinking skills. The argumentation process is used to analyze information about a topic, thus students are accustomed to analyzing in advance an information before being accepted as a whole. The main part of the learning process is learning to be involved in various aspects of important learning including formulating questions, describing mechanisms, and constructing arguments [1].

Essential argumentation skills are developed in the learning process. Argumentation skills can increase the potential of students. In addition, stated that there are several advantages by developing argumentation in learning, among others, supporting the development of students' cognitive and metacognitive processes, supporting the development of competencies in communication and critical thinking, supporting the achievement of scientific literacy in students and empowering students in speaking and scientific writing and support the development of student reasoning [2]. Argumentation skills are one of the most complex thinking skills in the learning process [3]. One of the goals of learning by developing argumentation skills is to introduce scientific literacy that prepares students to be responsible as part of society and citizens in the future.

Argument according to [4] in [5] is a process of connecting various ideas with the right reasons, based on available data. Argumentation is an important component in the learning process because the process of arguing, students learn various scientific concepts and have the opportunity to practice students' scientific skills. In the 2013 curriculum, the learning process of physics must be able to develop students' abilities both in terms of attitude (affective), knowledge (cognitive), and skills (psychomotor). The arguments made by students are weak in including evidence and support that can guarantee the truth of the claim submitted. The notion of the importance of briefing the skills of argumentation to students is that (1) argumentation skills play an important role in building an explanation, model, and theory of a concept learned, because practicing argumentation skills means exercising cognitive and affective skills that can be used to help understand basic concepts and processes of physics [2, 6].

A good argument is if it contains a claim accompanied by evidence and reasons that relate the claim to the evidence. Aargumentation skills into four aspects, namely: 1) claim that is a statement or conclusion that answers the question; 2) evidence that is scientific data that supports the claim. The data used is the right data to support the claim; 3) reasoning is a justification or reasoning that connects claims and evidence and shows an explanation that connects the data as evidence that supports the claim using appropriate scientific principles and 4) rebuttal is a refutation of the claim, reasoning and evidence provided [7].

2. Data and Methods

2.1 Data analysis
Data This study used the design of direct test giving, namely argumentation skills test. This research was carried out on odd semester in the 2017/2018 school year in Surakarta State Senior High School 4 (SMA N 4). The sample of this study were all students of XII grade of Mathemathic-Science (MIA) major in SMAN 4 Surakarta.

2.2 Data collection
Data collection method in this study used paper and pencil test. Argumentation skills tests that were tested have been adapted to aspects of argumentation skills. The number of test items consisted of 2 questions regarding the material of bacteria and biodiversity. The form of questions was in the form of essay tests that have been developed. Scoring was given to each question with the highest score of 4 and lowest 1 based on the scoring rules that have been compiled by the researchers taking from the
aspects of argumentation skills. The argumentation skills test tested has been validated. Based on the results of the test, test was declared as valid. Tests were given after treatment in the class.

Analysis was carried out descriptively. The data were analyzed descriptively which analyzed each item to see the form of representation used in solving the problem.

3. Results and Discussion
The question of argumentation skills used aspects of McNeill and Krajick [7] which included four aspects, namely: claim, evidence, reasoning and rebuttal, where this test was used to measure students’ argumentation skills.

Table 1. Results and Discussion of the test results of students’ argumentation skills of XII grade of Mathemathic-Science (MIA) major in SMA 4 Surakarta.

| No | Argumentation Skills Aspect | Claim | Evidence | Reasoning | Rebuttal |
|----|------------------------------|-------|----------|-----------|----------|
| Average |                              | 70%   | 33%      | 25%       | 2.05%    |

The problem of lack of empowerment of argumentation skills and observations occurred in SMA Negeri 4 Surakarta. Observation of students’ argumentation skills was carried out by giving a description test that contained indicators of argumentation skills based on [7]. The test results showed that the average of student's argumentation skills was 32.5%. The results obtained included skills in expressing a claim of 69%; skill in using evidence of 33%; skills in giving reasoning by 25%, and skills in giving rebuttal of 2.05%. These results were relatively low. The observation results were in line with which stated that students have difficulties in constructing scientific arguments because they experience confusion in determining argumentation content, so students need teacher guidance in the process of argumentation [8].

Less precise students in expressing arguments were supported by the facts of the findings in the field which showed that in the classroom learning shows students who were less active in learning. The teacher had actually used a learning model that trains student activity, but in reality what appears in teaching learning process was still teacher-centered. Student activities in the classroom were still lacking. The teacher actually also had asked students questions, but the questions were still in small numbers and the questions asked were quite short and easy to answer simultaneously by all students in the class. This causes the students' skills in argumentation and activity to be poorly trained.

Argumentation skills could be increased by giving problems in daily science learning. Learning science was not enough to be taught about the concept of science but the concept of science must be prepared to answer the problems of everyday life. Learning science that was linked to daily life will help students to develop the concept of science holistically. Therefore, it was important to use social-scientific problems in learning. The use of problems in learning will improve students' understanding of scientific concepts related to values and other sciences. Socio-scientific problems will help teachers to guide students to understand problems in a multi-perspective. Problems in the pedagogical context develop knowledge across disciplines, values and argumentation skills [9].

4. Conclusions
Based on the description above, it could be concluded that students’s argumentation skills in solving biological problems in the material of metabolism were still not empowered. Students were less able to recognize problems that were easy and difficult to solve. The same difficulty was experienced by students in giving reasons, evidence and also rebuttal. This indicates that students rarely trained their argumentation skills. Researchers suggest to conduct follow-up research on learning strategies that could empower students’s argumentation skills in solving biological problems. Briefing skills on argumentation should be carried out by using scientific activities through data collection. Based on the findings of the researchers, this could make it easier for students to be more skilled in doing argumentation.
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