Analysis of Argumentation Skills in Biology Learning at Surakarta Senior High School

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Abstract. Argumentation skill is essential academic skills in comprehensive learning in the 21st century for developing, evaluating and validating knowledge. Argumentation skills are ability to criticize an idea or information so that the information was obtained correctly by connecting data and information to produce strong and precise ideas. This research aimed to analyze argumentation skills of students at Surakarta Senior High School in biology learning. The research subjects were the twelfth-grade students of public senior high schools in Surakarta. The data collection was conducted online with Edmodo media. The results showed that 17.8% were still at level one, where the arguments issued by students only contained a simple claim, and for the level two 3.3% were in which the arguments issued by students were supported by data without warranting and backing document. The results of the initial ability test showed that the rebuttal aspect had not developed. The result indicates that the students' argumentation skills in Surakarta Senior High School were still quite low.

Keywords: *Argumentation Skills, Learning Biology.*

1 INTRODUCTION

The need of skill in the 21st century have changed from acquiring structured knowledge to skills mastery [1]. These skills include collaborative skills, communication skills [2], analytical thinking skills, critical thinking skills and argumentation skills [3]. Argumentation skills which is define as the ability to criticize an idea or information so that information is obtained correctly [4], and this could be found by connecting data and information to produce valid, strong and precise ideas [5].

Argumentation skills are very much needed especially in evaluating logically arising issues [6] and justifying decisions in both written and oral formats [7]. This skills can empower students' communication skills that can be used in everyday life. The adequacy of good argumentation skills allows to make decisions and solve the problems, especially complex problems which arose in human daily life.

Aspects of argumentation skills according consist of six aspects, namely claim, data, warrant, backing, qualifier, and rebuttal [8]. Claim is a topical affirmation that is being studied. Data is a statement that is used as evidence to support claims. Warrant is a statement that explains the relationship between data and claims. Backing is a statement used to

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strengthen a warrant. A qualifier is a statement that gives rise to the power of data that supports claims [9].

The quality of an argument or the weakness of an argument is determined by understanding the concept supported by data or evidence, an explanation that contains the reasons, and how to build these components so that they are convincing. Assessment of the teacher's argumentation skills can provide a variety of questions and students answer the question.

1.1 Research Method

This research is quantitative using the written test scores of the students as the data. They were analyzed to find out the argumentation skills in every aspect. 75 twelfth-grade science students of public senior high schools in Surakarta of the fifth semester became the subject of this research. They were divided into 3 classes with 25 female and male students, respectively. The data were collected online by using Edmodo media using short questions accompanied by reasons. The short question consisted of 3 questions. Quantitative and qualitative methods were applied during data analyses. The scores were categorized according the each aspect. They were then made into 5 categories of decisions as shown in the following table.

Table 1. Argumentation skill categories in four different levels [10].

Level of Argumentation		Argument Structure
Level 1	:	Arguments that contain a simple claim.
Level 2	:	Arguments consisting of claim and data.
Level 3	:	Arguments consisting of claims with data, warrants, or backings, but do not contain any rebuttals.
Level 4	:	The above plus one or more rebuttals.

1.2 Result and Discussion

The result of the research showed students' argumentation skills in Biology learning in Surakarta Public Senior High School using short-question written test as the instrument is as follows:

Table 2. Result of argumentation skills analysis in four different levels.

Level of Argumentation		Percentage
Level 1	:	17,8 %
Level 2	:	3,3 %
Level 3	:	0%
Level 4	:	0%

The results of the argumentation skills test in collecting data argumentation skills of students as much as 17.8% are still at level one, in which the arguments issued by students only contain simple claims, 3.3% are at level two where arguments issued by students are supported by data without warranting warrant and backing. The results of the analysis show

that the rebuttal aspect has not developed. Rebuttal is an essential aspect in argumentation skill [11].

The ability to argue is able to increase the potential possessed by students. The development of arguments in learning can support several advantages, including the development of cognitive and student metacognitive processes, developing competencies in communication and critical thinking, achieving scientific literacy in students and empowering students to speak and write scientifically and support development of student reasoning.

A bad argument is caused by students not knowing the components of the argument. Good argumentation describes the process of thinking and social interaction that builds and evaluates individual arguments [12]. Students often do not include aspects of argumentation in full (statement, reason, evidence) or do not mention clearly, the evidence used is sometimes not able to be developed, students also sometimes do not respond to other alternative views. A good argument is an argument that contains a statement accompanied by evidence and reasons that link the statement with evidence.

The results of the initial ability test showed that the rebuttal aspect had not developed. It means that science learning needs to be changed. Empowerment of argumentation skills must be integrated in the learning system in the classroom [13]. Argumentation skills are empowered by: (1) Establishing daily life problems that are appropriate for learning content [14]; (2) Debates related to problems raised in learning; (3) Present questions according to learning content. Problems encountered in learning are problems that have several alternative solutions [15] and raise many perspectives which trigger debate [16]. During learning students are asked to identify problems and provide critical judgments by giving claims that are supported by data and rebuttal to reject a claim against problems raised.

Debates related to problems or issues and cases in everyday life taken from mass media advertisements, scenarios, and government speeches [17] that are in line with learning content that stimulates students to understand content well to maintain claims given. Argumentation skills can be introduced in science classrooms by facilitating student discourse through Socratic questioning, conceptual questions, open-ended questions, multiple choices are accompanied by reasons or short questions that require students to give reasons to stimulate the development of argumentation skills [18].

Question and answer and debate methods are considered effective in stimulating students' argumentation skills [19]. The Socratic Question and Answer Method is a popular approach in teaching. This method applies a form of investigation with open discussion where individual perspective is compared to the other. Learning is done through investigating and thinking about the questions as to stimulate the students' original thinking. The benefit of the Socrates method is that students get to know their gaps of knowledge, encouraging them to clarify ideas and understand the concept better.

Conceptual questions are used to help students begin the process of problem-solving while guiding students to master important concepts in the subjects taught [20]. Open-ended questions allow students to interact dialogically with peers to build, criticize, and perfect understanding of scientific phenomena [21] Open-ended questions are a feature of problem-based learning that is retained as a learning stimulus. Open-ended is intended to improve the ability of students to argue, one way is to observe how students use the knowledge that has been learned and then applied in everyday life that is contextual in nature. Open-ended questions force students to find a solution positively, with the existence of several answers and ways of solving obtained from joint activities that he himself did is a posited experience that will increase students' insight into diversity, especially in dealing with similar problems. Open

questions have keywords discussed, interpreted, explained, evaluated, compared, if or what. The types of questions that can empower argumentation skills are shown in Table 3.

Table 3. Question Types which could Empower Argumentation Skills of Student [22].

Question Type	Description	Sample question
Divergent	Open, has many responses; enabling exploration of diverse perspectives; encourage dialogue.	There are several regions that do not allow GMO products to be marketed. Why?
Focal	Students must choose or justify a position.	Today's development of Molecular Biology encourages major findings for human life, such as cloning, IVF and other forms of genetic engineering. Various debates then arose and were voiced as a form of protest because these efforts actually violated human ethics and damaged the order of life that was actually perfect. What is your position as a biologist about that? If you agree, why? If not, why?
Brainstorm	Questions that generate a list of ideas or points of view.	If you can create ideal molecular biology products, products that can be widely used, what will you make?

2 CONCLUSIONS

Argumentation skills of the twelfth-grade science students of public senior high schools in Surakarta have not yet been optimized as evidenced by reviewing the aspects of argumentation skills that 17.8% were still at level one where the arguments issued by students only contained a simple claim, 3.3% were at level two where arguments issued by students were supported by data without warranting and backing. The results of the initial ability test showed that the rebuttal aspect had not developed. The results indicate the low argumentation skills of the students in Surakarta Senior High Schools. It is suggested that the teacher improve the students' argumentation skills with a learning model that trains their high-order thinking skills, which reflect their skills through the learning process.

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