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Analyzing Scientific Argumentation Skills of Biology Education Students in General Biology Courses

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Abstract. Scientific argumentation is one of the most important components of science literacy. This was a descriptive research that aimed to describe the prior skill about quality of argumentation of 30 biology students who take the subjects of General Biology at Sriwijaya University. Assessment has been done through visual audio transcripts and written arguments. The argument quality assessment is determined Toulmin Argumentation Pattern (TAP) and based on Eduran categories of argument quality. The results showed that the quality of argumentation of students both written and oral were low, it can be seen from the highest aspect achived by students was claim aspect about 80% while the warrant, backing and rebuttal aspects did'nt reach 50%. This is also reinforced by the level of argument obtained by students who did not reach the fifth level. The most achievement of the level argumentation in the first and second level, that students still have difficulty to convey the results of his analysis both orally and writing. These findings can serve as a basis for further research on the use of strategies and development of teaching materials based on innovative teaching strategies that facilitate students to develop their scientific argumentation skills.

I. Introduction

Scientific argumentation is one of the most important components of scientific literacy. Biological science is not only a product but also a process and value that requires students not only to understand concepts but also to be skilled. One of them is skilled to communicate the results of his analysis orally and in writing, sometimes the learning process is hampered due to weak ability of students to communicate. Biology as a part of science requires students to be able to generate and evaluate scientific explanations and scientific argumentations.

The argumentation proficiency is the main thing that underlies the students in learning how to think, act and communicate scientifically. This competence must be mastered by biology students at every level of education. Argumentation is a critically important discourse process in science and it should be taught and learned in the science classroom as part of scientific inquiry and literacy [1]. The process of learning in the classroom is influential on communication skills in the form of argumentation both in writing and orally. The achievement of these competencies is inseparable from the role of educators which includes many things.Teaching and learning activities often do on one way, which causes communication between teachers and learners do not work properly, consequently the communication skills of learners are not well honed. Weak communication skills often lead to misconceptions between the material submitted by the teacher to the concepts received by learners.

The ability to understand concepts and communicate them is one of the competencies in science literacy, therefore the lack of opportunity to understand concepts and communicate them leads to low student science literacy [2]. The importance of scientific argumentation is not matched by implications in the classroom. Empirical research, however, indicates that many students do not develop this

knowledge or these abilities while in school[3;4;5]. Therefore, teachers are required to be smart in choosing and applying teaching materials and learning models that can improve students' concept understanding and support communication skills, one of them can be achieved by reading and discussing. Development of class argumentation can be done with various learning methods, one of them by discussing scientific discourse in class [6]

Information obtained from learning activities should be communicated between the students and students to the teacher. But sometimes the communication process is hampered because not all students can explain the argument both orally and in writing. The factor causing learning difficulties in speech skill is mental attitude includes shame, fear, anxiety, and self-confidence which cause the students to be very depressed during learning. Therefore the communication process can be done through writing, so that students are given the opportunity to express their opinions freely without having to be shy or afraid. Teacher should be able to develop students' scientific argumentation both orally and in writing. Before designing instructional materials and strategies appropriate to improve the ability of scientific argumentation, we must be known how the ability of scientific argumentation. This study is a preliminary study in order to obtain data on how the scientific argument proficiency of biology education students FKIP Unsri

2. Research and Method

This research is a descriptive research conducted on the students of Biology education program that take the subjects of General Biology. The ability of argumentation is obtained from the transcript of visual audio and students' argumentative scientific writing after they read the discourse provided. The given stand point lifts one of the ecosystem problems on ecological material. The ability of the argument is analyzed by elements developed by Toulmin[7], which include data (claim), warrant, backing and rebuttal. The quality of the argument was analyzed based on Erduran et al[8] analysis frame work.

Table 1. Analytical framework of quality argumentation

Level	Criteria
5	The argument presents an expanded argument with more than one clear rebuttal
4	The argument presents an argument with a clear argument and has multiple claim and counter claims.
3	The argument contains an argument with a series of claims or counter claims with data, guarantor, or weaks backing and weak rebuttal
2	The argument contains an argument from one claim against another claim with data, guarantor or support but does not contain a rebuttal
1	The argument contains an argument with a simple claim against a claim that contradicts (counter claim) or a claim against the other claims.

3. Result and Discussion

Exploration of argumentative skills is done orally and in writing. From the graph (figure 1) we can see that only some participants can generate claim, either in writing or oral. This means that only some participants can provide good statements. Some participants have more opinions without referring to previous opinions. Interview results obtained information that students have difficulty to take key information, and do not think to connect it with data and facts.

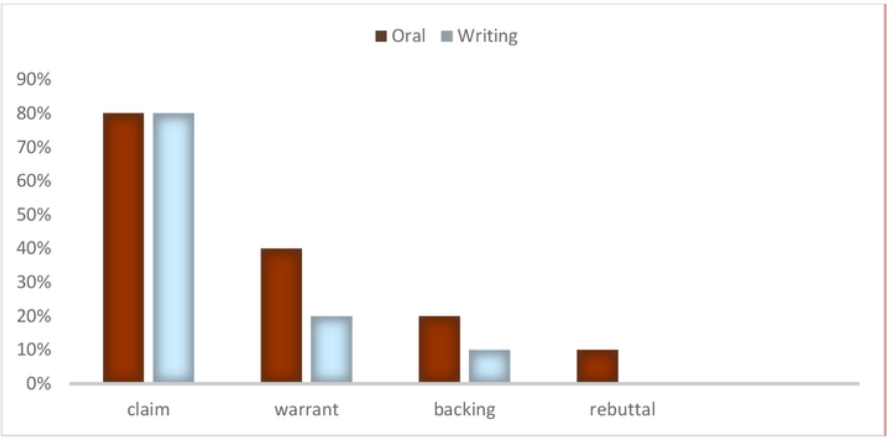

Figure 1. Aspects of scientific argument ability

The percentage aspect of argumentation shows there is a difference between written and oral. For aspects of claim, data and warrant scientific argument in writing is greater while for the supporting aspects (backing) and rebuttal. Backing and rebuttal appear more when expressed verbally, because during the discussion students are encouraged to make a rebuttal to the claim and warrant that they convey based on supporting data. Discussion methods based on sosiosaintifik issues can improve students' argumentation skills[9;10].

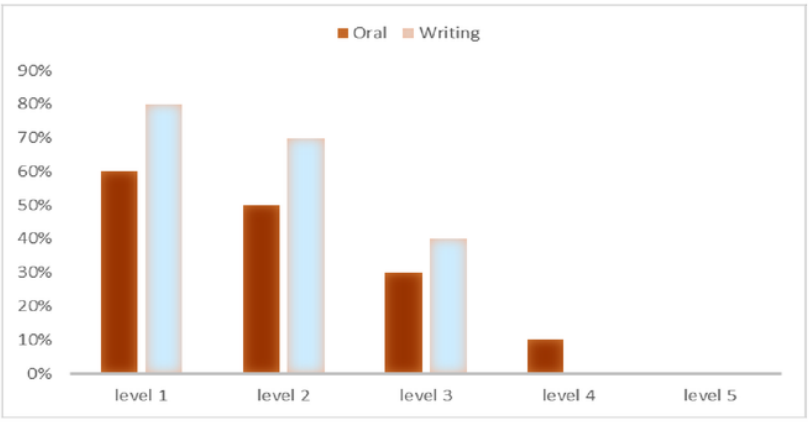

Figure 2. The level of argumentation quality

The quality argument could be seen from the achievements obtained by the students, either in writing or orally (fugure 2). In writing the ability of students no one reached fourth level, the argument presents an argument with a weak argument and has no multiple and counter claim. while orally no one reached fifth level, the argument was weak and the rebuttal wasn't clear. The orally can reached the fourth level, because through the discussion, students can gain inspiration to present a better scientific opinion orally. These qualities also shows that students are not accustomed to express their opinion scientifically, they used to express their opinion in accordance what was going through their minds. Therefore it is imperative for teachers or lecturer to introduce how to argue scientifically well. It is also important for teachers and students to understand how an argument (i.e., a written or spoken claim and support

provided for it) in science is different than an argument that is used in everyday contexts or in other disciplines such as history, religion, or even politics[11].

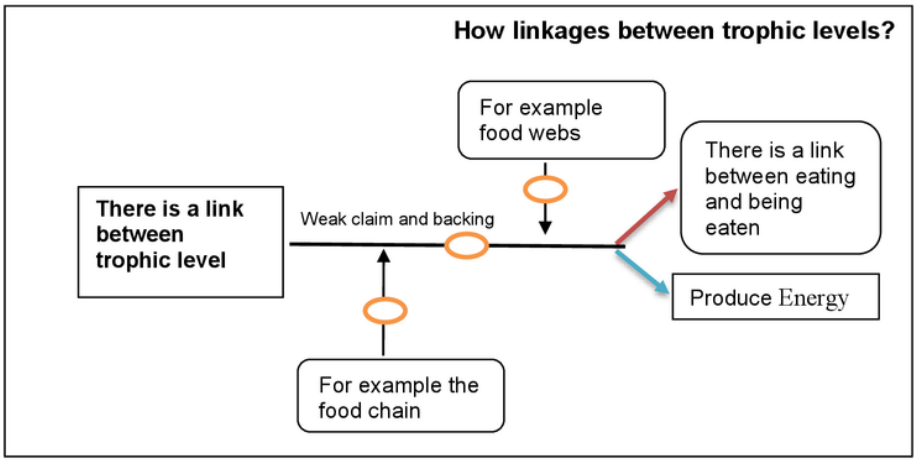

Figure 3. The pattern of the argument made by student

The pattern shows that the quality of students sscientific argumentation still low, the resulting claim is a simple claim, weaks backing and no rebuttal. The college students do not relize that to understand some forms of evidence and some types of reasons are better than others in science. Empirical research, however, indicates that many students do not develop this knowledge or these abilities while in school [12;4;5]. Scientific argumentation is an important practice in biology science. the importance of scientific argument should be followed by application in science education. One way to address this problem is to engage students in scientific argumentation as part of the teaching and learning of biology [13;14;15]. In order to accomplish this goal, teachers will need to design lessons that give students an opportunity to learn how to generate explanations from data, identify and judge the relevance or sufficiency of evidence, support and articulate an explanation in an argument, respond to questions or counterarguments, and revise a claim based on the feedback they received or in light of new evidence. Teachers also need to find a way to help students learn, adopt, and use the same criteria that biologists used to determine what counts as warranted scientific knowledge in a particular field of biology. Discussing and evaluating controversial issues that occur in everyday life make the science literacy of learners more developed[16].

4. Conclusion

The quality of students argumentation both written and oral were low, it can be seen from the highest aspect achived by students was claim aspect, about 80% while the warrant, backing and rebuttal aspects did'nt reach 50%. This is also reinforced by the level of argument obtained by students who did not reach the fifth level. The most achievement of the level argumentation in the first and second level, that students still have difficulty to convey the results of his analysis both orally and writing. These findings can serve as a basis for further research on the use of strategies and development of teaching materials based on innovative teaching strategies that facilitate students to develop their scientific argumentation skills.

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