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ARGUMENTS REPRESENTATION OF STUDENTS TO THE SOSIOSCIENTIFIC ISSUE ABOUT VITAMIN D RESOURCES FOR HUMAN

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ABSTRACT

Exploration study was conducted to analyze the students argument representation of the sosioscientific issue. Analysis carried out on the answers which given to the students about the issue of vitamin D resources for humans. To understand the student argument representation, analysis is done on the quality and student argumentation schemes. Exploration conducted on 32 students of biology education UPGRIS that following the anatomy and physiology of the human body course. Toulmin`s Argumentation Pattern (TAP) was used to asses quality of the student's argument. Based on its quality, the student argument on simple category that only consists of claims, evidence, and reasoning, some students showed advanced argumentation capabilities to provide an alternative explanation and rebuttals. Arguments scheme which used by the student to express explanation includes causal schemes, inductive schemes, and arguments from examples.

Keywords: argumentation scheme, representation, the quality of argumentation

INTRODUCTION

Physiology was a branch of biology that has a domain study of physiology. Materials coverage includes mechanisms at the molecular level up mechanism at the level of the organism (Sherwood, 1996; Matter, 2001). Feder et. al. (2012) states that physiology teaches that all of biological phenomena were interrelated. Meanwhile Ritchison (2007) revealed that the physiology reveal how organisms did its function and survive in an ever-changing environment. Thus concepts in studying the physiology associated with each other to form a concept systems (Lawson, 2003).

Think comprehensively needed to study physiology. Mehanna (2004) states that after studying the physiology concepts students are expected to think comprehensively, that was capable to connect between the physiological processes that occur in the human body systems and able to analyze physiological phenomena occur. Michael (2009) states that there were nine core principles that must be understood in the study of physiology, namely: evolution, ecosystem and environment, mechanisms of cause and effect, the cell, relationship of structure and function, the level of organization, information flow, change and energy transfer, and homeostasis. This implies that the physiology will be more meaningful if the student were able to relate the concepts in physiology with these principles.

Critical thinking skills needed to analyze in relating concepts of physiology with the principles for assessing physiology presented in the form of case study analysis (Clift, 1996), active learning (Russell, 2003), as well as through the issues in physiology (Silverthorn, 2006). Critical thinking skills developed along with building skills of argumentation. Argument was a process which used by someone to analyze information on a topic and then results of the analysis were communicated to others (Inch & Warnick., 2006). Thus the using of argumentation in science learning was part of the development of higher order thinking skills (Thiberghien in Erduran, 2008).

The using of argumentation in science learning has three theoretical framework. The first framework, scientists involves argumentation to develop and improve the knowledge (Lawson, 2003; Aufschnaiter et al., 2007). The second framework, the public must use arguments to engage in scientific debate (Simon et al., 2003; Aufschnaiter et al., 2007). The third framework of science learning process, students need arguments (Osborn et al., 2004; Aufschnaiter et al., 2007). Thus the

using of argumentation in learning has implications for the understanding of the nature of science, ability to communicate critically and the need to explain scientific concepts in scientific.

The study results of Andrews et al. (2006) states that every field of study has the different characteristic of arguments discourse. Biology as one of the disciplines of science that examines the phenomenon of life has special characteristics, especially the branch of physiology. Physiologists examines the phenomenon of cause and effect (causality) ranging from interaction between molecular level elements up to the level of organs and organisms. Thus an understanding of the physiology with the phenomenon of causation needs to be invested from lower education to higher education. As well as scientists, students need to understand the causal mechanism of living beings that begins by examining its body. Thus the scheme of causality argument can be used by students to make scientific explanations related to the phenomena related to the concept of physiology.

According to Toulmin (1984) argument resembles an organism that has the individual parts with different functions related to the claim. Toulmin model includes three sections in each argument (evidence, reasoning, claim) and parts that were included in the advanced arguments (counterargument, rebuttal). These components work together and explain how they adapted the argument to the variety of situations and contexts, as seen in Figure 1.1. Toulmin`s Argumentation Pattern (TAP) offers a method for analyzing and critiquing arguments, so that each component of the argument can be tested, graded strength.

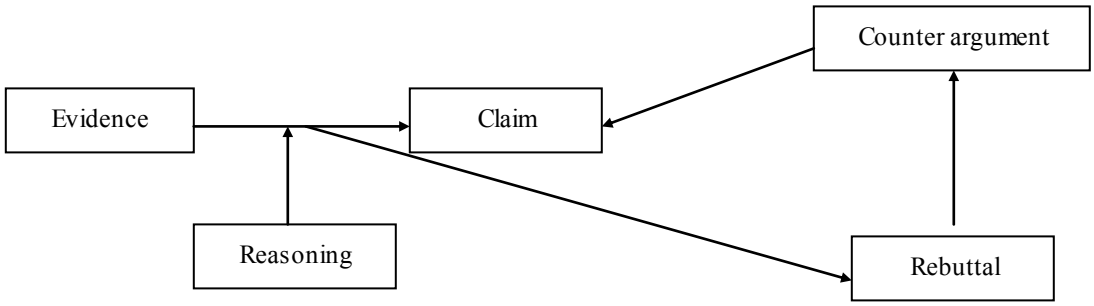

Figure 1. Toulmin`s argumentation pattern, based on Toulmin (1984)

Roshayanti research results (2009) concluded that the using of arguments assessment can improve the student argument ability, however, requires a longer learning period when students were involved in the argument discourse. It also corresponded to the using of arguments on inquiry activities also require two times more than prescription inquiry learning (Katchevich, et al., 2013). Based on the using of arguments in assessing the physiological implications in longer learning time, so it need a device that can help more efficiently. Based on it, so it was necessary to make a device to develop the skills of argument. However, to design such devices needed information about how the quality of the students argumentation as well as information about the argumentation scheme that was used to construct arguments.

METHODS

Exploratory research to describe the representation of student argument using quantitative and qualitative approaches. Open ended test instruments used to collect data about the quality of arguments and to identify the types of schemes used to construct arguments. Quantitative data about the quality of argumentation assessed using the argument instrument assessment rubric adapted from Toulmin`s Argumentation Pattern (TAP) aspects (Table 1).

Table 1. Argument assessment rubric instrument (Schen, 2013)

Aspect	0-Poor	1- Weak	2 –Adequat	3 – Strong
Claim	No claim made or is irrelevant to data	Weakly supported by data	Clearly supported by data/scenario and concervative	N/A
Evidence	No evidence given,	Raw data given as list	Non-specific	Specific evidence

	is irrelevant to calim	of columns or rows or no trends identified	evidence given with some trends identified and list of raw data	given with trends and particular list of data
Reasoning	No reasoning made or is irrelevant to data	Restatement of data or vague principle given	Principle stated is relative but not specically connected to evidence or claim	Principle stated with clear, specific relationship to evidence and/or claim
Counterclaim	No claim made, is irrelevant to data	Weakly supported by data or is weakly opposed to original claim	Clearly supported by data/conservative and directly opposed to original claim	N/A
Rebuttal	No rebuttal made, is irrelevant data	Restatement of original claim or rational or new, vague principle given	Expands previous claim/rationale to addres countercalim	New principle stated with clear support for previous claim/rationale and targets counterclaim directly

To analyze the strategies used by students in constructing arguments then used argumentation schemes. Argumentation schemes used was developed based on the using of warrants in the argument, such as table 2 (Basel, et.al., 2013). Next to describe the quality of the arguments and argumentation schemes that were used to construct the argument by the students, then the quantitative data were analyzed descriptively.

Qualitative data were used to find the constraints faced by students in constructing arguments. For this purpose, the method applied in depth interviews. Results of subsequent interviews coded according to the aspects of the Toulmin`s Argumentation Pattern (TAP). Results of the next coding was used as the basis for categorizing student difficulties in constructing arguments based on Toulmin`s Argumentation Pattern (TAP).

RESULTS AND DISCUSSION

The quality of the student's argument shows how students stated a claim, used reasoning to formulate evidence to support the claim, as well as the ability to show the weakness of claim to give a rebuttal. Analysis results of the student's argument quality with the topic discussion of how to fulfil the need of vitamin D by the body was presented in Figure 1 below.

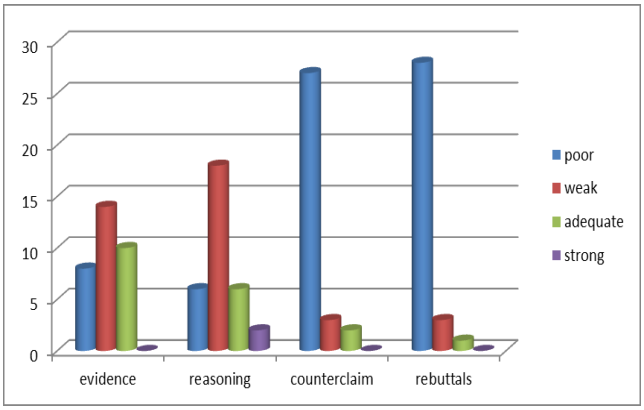

Figure 1. Representation of the student's argument quality with the topic of how to fulfil the needs of vitamin D by the body.

Based on the figure 1, students have been able to state a claim. However, the quality of the student's claims were lacking. It was proven by there were 31% of students claim quality adequat category, while others were weak and poor. The ability to state claim corresponds to the ability to use evidence to support the statement of claim. Students have not seen the trends of the data (44% of students) to support the claim. The ability of students to state a claim was also influenced by the ability of reasoning. Based on Figure 1, many students (56%) using reasoning to restates the data, it was unclear the principles of reasoning used. It was also corresponds with Basel, et al. (2013) research that the student's argument in the theory of evolution was only simply justified. While Berland & Mc Neill (2010) states that most students find its difficult to justify their claims and give reasons to provide evidence that supporting the claim.

The fact also represent how the using of critical thinking for students. It showed from many students who have not been able to declare counterclaim or rebuttals. Thus it can be said that the students' ability to formulate arguments must be trained. It was based on the facts on the table 2 below.

Table 2. The Quality of Student's Argumentation

aspects	min	max	mean	SD
claim	1,00	2.00	1.41	0.50
evidence	0.00	2.00	1.06	0.76
reasoning	0.00	3.00	1.03	0.79
counterclaim	0.00	2.00	0.22	0.55
rebuttals	0.00	2.00	0.19	0.47
initial argumentation	1.00	7.00	3.59	1.78
advanced argumentation	0.00	4.00	0.41	1.01

Based on Table 2, the ability of argumentation was still low and it was the state average student when viewed from the deviation standard. In general, students were only involved in the ability of initial argumentation, while the capabilities as advanced argumentation was very low.

Thiberghien in Erduran (2008) states that the using of argumentation in science learning was part of the development of higher order thinking skills. Developing critical thinking skills along with building skills of argumentation. Argument was a process which used someone to analyze information on a topic and then the results of the analysis were communicated to others (Inch, et al., 2006).

Most of students use argumentation scheme which built from sample covered 34%, while the other was based on causal schemes reached 19%, against preposition reached 16% and inductive schemes 6%. This indicates that the student has had the potential to do reasoning with various schemes, but it was not optimal.

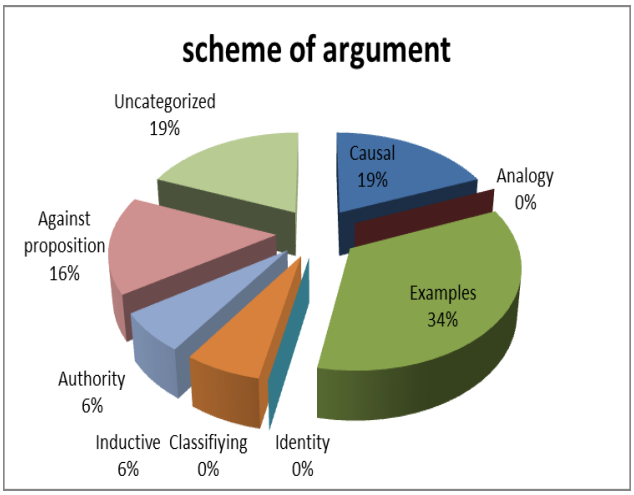

Figure 1. Argumentation schemes which used by student in argumentation with the topic of how the need of vitamin D.

Interviews results for students to reveal difficulties in argumentation, represented excerpt of interview from the two students follows.

Table 3. Excerpt of Interview with the Students

Interview with student A		Interview with student B	
Question	**Answer**	**Question**	**Answer**
Whats your opinion about the statement that to get vitamin D it must be get the sun?	I agree with that statement, for example : in the morning the baby get sunlight to get strong bone. It because sunlight is the resourches of vitamin D, and vitamin D need to make strong bone.	Whats your opinion about the statement that to get vitamin D, it must be get the sun?	I think to get vitamin D it must not come from sunlight, but from the vitamin D resourches, like vitamin D supplements. So, I disagree.
Why you use the baby as the samples?	Because I found it and they sure that the baby will have strong bone if it get sunlight, because there were vitamin D.	Have you the reason why to get vitamin D, it must not need the sunlight?	Maybe not at all like sunlight because they afraid if the skin become black.
How if the baby become sensitive to the sunlight, for example: it has albino	I don't think about it and I don't know.	How about the dangerous of cancer which caused by UV light from	Yes, may be it is the better reason.

abnormalities. Why you don't think about it?		sunlight?	
How about the dangerous of cancer which caused by UV light from the sun?	May be, it doesn't matter if the intensity in getting sunlight is enough.	Have you another examples?	I think not at all resistant to the sunlight, for example a person with albino abnormalities.
So, how to construct the argument?	I think it need variety of alternative.	So, how to construct the argument? Is it only different opinion?	Maybe, but I think it need many knowledge so our opinion can be comprehensively.

Based on the results of interviews with students showed that there were misconceptions, which believed that the sun was a source of vitamins. It was represented by student "A" answers (representation of most of the students). Students difficulties in did argumentation identified because it was not using its variety of knowledge (for example: about cancer and albino abnormalities), was also way of thinking that has not been comprehensively and consider various alternatives.

It was also stated by Mahinda (2008) that after studying the physiology concepts, students are expected to think comprehensively, that was capable to connect between the physiological processes that occur in the human body systems and was able to analyze physiological phenomena occur. Thus the implication of this research was how the argument discourse strategies can be applied in learning and it also invites the participation of the students involved, meaning that students realize to engage in argument, they should be ready with a comprehensive knowledge. But if it was applied that should be considered was the resources that available if it only sufficient time to perform and train arguments for students. Therefore argumentation acquisition scheme as epistemic aspects to build the argument should be considered in exercising argument. Through exercised to build arguments based on the scheme have argued, it hope they were able to make it easier to apply the principles stated claims and justify it. In addition to support the knowledge that they have to provide in supporting for the argument, if required device that accommodates variety of relevant information sources to the argument topic. Thus students will be accustomed to think comprehensively and consider various alternatives in argumentation.

CONCLUSION

Quality, simple category arguments of the student was low in justifying argument. Few students demonstrated advanced argumentation capabilities to provide an alternative explanation and rebuttals. Arguments scheme used by the student to express explanation includes causal schemes, inductive schemes, and arguments from examples. Thus, it need to develop tools that can help students rehearse the arguments so they have the ability to think critically, comprehensively and consider various alternatives.

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