

Improving Students' Argumentation by Providing Analogical Mapping-Based Through Lab Inquiry for Science Class

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Abstract. Science education researchers will never stop looking for the best way in learning. This is based on the fact that research on this issue has been mostly conducted in 21 century, the present science subject is not only about transferring knowledge but also how the students obtain a knowledge directly. This paper is concerned with one kind of the learnings that can support the students to get a knowledge called as a learning-based on lab inquiry. In Lab Inquiry learning, the students directly experience and look for the solution from a phenomenon through particular ways thus the learning will be more meaningful. Those steps are as follows; observation, asking, conducting an experiment, concluding and communicating. All of them are mainly important includes the communicating step. Communication ability can be viewed from how a student can provide an argument. Argumentation ability of a student will be crucially better if there is a use of analogical mapping-based. In this literature study, it is therefore argued that the students' argumentation ability by that analogical mapping-based can be improved through Lab Inquiry.

1. Introduction

In science world today, science is no longer about transferring knowledge. Learning science is not only about mastering some facts, concepts or principles but it is also related on a discovery process. It is needed while learning science in the class so that students are able to well-understood about science. This discovery process is predicted that students could learn about their natural environment and afterwards able to apply in their daily life. Learning science is expected to improve the ability of thinking, scientific attitude, and communication which are important aspects of life skills.

Learning paradigm in 21st century has been changed along with the age of times. Nowadays, the learning characteristics focus more on information, computing, and communication. Kemendikbud (2012) stated that the work in the 21st century required the existence of a complex communication, collaboration and cooperation in resolving the problem. Learning should be geared to train the ability of communication and collaboration so that students could contribute to the community. Contributions in the form of knowledge that is already got while learning in school and could applied in the community. Then it means that the understanding of the science concept is not quite enough. Therefore, high communication capability is incredibly needed to support it.

Communication skills can be demonstrated through argumentation skills done by learners [1]. Modern reform in science education is to accentuate the context, activities, and scientific communication. Scientific communication is very important because it is considered able to improve understanding and changing the understanding of science [2]. They also concluded that provides



scientific data with respect to the topic of argument will help students cope with the difficulties they experienced in argumentation about scientific topics.

Communication can also be conducted through an analogy. Generally, someone will try to employ analogies to reduce their less understanding towards a problem. This premise is similar with what has been stated by Emig that the use of analogy will powerfully help someone to be well-understood [3]. Many researchers have suggested to use the analogy in learning and science within the classroom [3].

The analogy is generally used as a tool to explain a phenomenon or getting solutions to problems that are given during the science learning in class. In addition, explanations towards something that uses the analogy of individually were able to reduce the occurrence of misconceptions while in groups able to give time and space to the students to do a comparison or even develop an analogy [3].

In fact, overall at the moment of learning science still far from expectations. The low achievements of science is shown from analysis of the TIMSS 2007 results and 2011 in the field of science for students of 2nd grade at junior high. Results of a study in 2007 and 2011 showed that more than 95% of Indonesia students were only able to reach the medium level, while almost 40% of Taiwan's students are capable achieve a high level.

Based on the research that has been conducted also pointed out that many of the students' ability in providing argumentation was still minimum. In accordance with the statement [4] that has a lot of research that shows about the lack of students' ability in arguing. On his research shows that there is a difficulty experienced by students in constructing the nature of scientific argumentation. Many of the students' arguing ability are still very lack [5]. The lack of students' ability in arguing might be reviewed from how students perform the steps in the reason for learning.

Students are still able to issue their opinion in form of writing [6]. However, students were unable to transcribe the evidence or make argument supporting to fit the theory. Thus, at the time of the argument which should provide the scientific nature, most students still use emotional or personal arguments, forming a situation argument type 'win-lose' on an argument activities [5].

Students at secondary schools are still very weak in constructing arguments [7]. Students still possibly put an emotional feeling and are not based on the proof or scientific evidence of the arguments in the classroom activities. Such conditions show that the the students' ability is less arguing. One of the reasons of students lack in arguing because their gather facts or scientific evidence which could support their claims [4]. With regard to the matter, learners mostly tend to insist with claims according to their true despite proof. They do not look into if the evidences are quite adequate or have any contradictions.

In the recent literature project, the researchers fundamentally attempt to study further about how the effects of argumentation skills by employing mapping-based analogy in laboratory inquiry.

1.1. Argumentation for science learning

Recently, there is a special skill, argumentation skill, which have paid serious attention by many educational researchers [8]. The argumentation includes in science practices to evaluate, to provide feedback and to establish a new theory as well as to be considered in learning science activities [4].

Argumentation is considered to be an important matter in educational field because it is consistent with its objectives. Such argumentation facilitates students in addressing reasons against problems or related issues [1]. The implementation practice of argumentation activities played an important role in developing the understanding of students towards science concepts [7].

Scientific argumentation is one of the criteria used to assess students and has been emphasized in the science education standards. Major steps that students could develop their skills in scientific argumentation through the inquiry process. Firstly, students will learn and demonstrate some data with their classmates. Secondly, they will present the information. Afterwards, they will provide feedbacks, debate and they probably would conduct revision [7].

The argumentation practice is a powerful part in science education [7]. Such premise becomes instrumental communication in science learning to improve the understanding of science concepts. In addition, the practice of argumentation could promote the literacy and develop higher-order thinking skills (HOTS). With regard to this issue, an argument is basically important in learning

science and has a positive impact for students [9]. For example, this enables them to increase the understanding of the concepts and skills of students' reasoning.

Scientific argumentation has been increasingly recognized as an important practice in the education of science. It allows students to actively engage in creating ideas through a process that produces the similarities with scientific practices. Such argumentation is the main mediator for accessing knowledge [10,11]. So, the practice of argumentation is similar to scientific practice. This is expected to be able to improve the understanding of the science concept are studied by students.

Based on the research, many of the learning process that occurs in the arguments either in individual or group activities involve thinking deeper and integrate new knowledge with students' prior knowledge [2]. So learning that involves arguing that was built by individuals and groups can support an understanding of students in scientific concepts. The practice of argumentation has played an important role in learning because it is able to develop the ability of understanding the students towards concepts that are scientific [7].

Students' difficulties in the constructing argument will make students become misunderstood the concept of science. The students were wrong in constructing arguments then it would cause misconceptions [7].

1.2. Inviting analogy in argumentation activities

The analogy is an ability to feel and use similar or similar relationship between the two situations or events. Most people routinely use the analogy in her everyday. It is due to the use of reason in the form of an analogy is a fundamental aspect of a person's cognitive ability [12]. In addition, the analogy used in science and every daily life as thought and communication tools. This is because normally someone will do the analogy when he don't understand against something. And thus in addition to being a tool of thought and communication tools, then the analogy is able to be used as a tool to explain something on learning science [3].

An analogy often used on the activity of the argumentation. Through analogy, a speaker can guide his audience toward more specific through a framework or inference. There are several variations of the analogy that is based on its content and its use. But all of that can be categorized based on a process that is generally used in analogy to all variations; 1) process of getting back a information: he gave some of the current topics in a memory, someone will be able to recall long-term memories through 2) process mapping: he gave two recent cases in a memory (through the process of recall or simply through two cases which reunited simultaneously), mapping involves the process of awarding points representation and inference from the nature of the project that one analog to analog the other , 3) evaluation: after the mapping process is complete, the analogy and inference given assessment [12].

Mapping is the core process of analogy, and has therefore been the main focus of analogy research. At a first level, the mapping process consists of finding how two situations are similar, and then bringing across further inferences from the better-known situation (the base, or source) to the less familiar one (the target).

What distinguishes analogy from other kinds of similarity is that for two situations to be analogical, they must be similar in their relational structure. Analogy research has largely agreed on a set of principles laid out by Dedre Gentner in 1983, in a theory called structure mapping. According to structure mapping theory, analogical mapping requires aligning the two situations based on their commonalities – particularly their common relational structure – and projecting inferences from the base to the target, according to this alignment.

1.3. Inquiry based-laboratory

During activities lasting argument, students must perform activities that involve communication, interpretation, and provide scientific reason to understand the concept of science through questions [3]. One study involving communication is inkuiri-based learning. Inkuiri-based learning, students demanding to find the solution of the problem or phenomenon through inquiry and the giving of reasons which are scientific [13,14]. Learning inquiry have several stages, formulate the problem, observing or doing obervation, analyzing and presenting the results, as well as communicate [15]. On inquiry based-lab, students are given the opportunity to do the investigation directly using their hands or doing experiments [10,14,16].

2. Results and discussion

The argumentation mapping-based which is inviting the analogy of being able to make students learn more in on the content of the science [3]. The use of a variation on the use of frame alignment (alignment) in learning science shows a process of analogy [3,17,18]. Inviting students in small groups to create argument using the analogy of the mapping offers a way to build the argument so that they learn about simple aircraft that content is used.

Students create a product or argument in two ways. First, they make a comparison between the analogy of machine elements (plane) simple (eg: Fulcrum levers such as the axis of rotation of the wheel and the shaft). Second, they make a major argument between the two aircraft was simple, they declared it the most analogous (e.g.: wheel and axle works like lever rather than a pulley). Mapping and comparing as done in this research is basically to make connections. These connections create a possibility for one engine (aircraft) simple support structure for the engine (aircraft) of the other simple in order to focus the attention of the students and the argumentation-based mapping of analogy.

A merger between argumentation and mapping the analogy very suggested in learning science and capable of being one of the tools to solve a problem which is connection or similarity [12]. The use of argumentation-based mapping of analogy can be used to concepts that have a connection. For example on the material plane is simple [3] Although it is not completely the same, but have similarities in structure.

Thus the merger between the ability of reason through the mapping of analogy in learning science will certainly further improve the communication skills of students both individually or in groups. This is because communication by the argumentation-based mapping of analogy will provide solutions on the basis of scientific argumentation. Learning science with activities of argumentation-based mapping of analogy will make the learning process becomes more active. Besides, helping students to become someone who is active in the justification of knowledge [3] students develop answers or reasons they have, choosing the most appropriate answer among several other answers, explanations do backing, claims, be able to distinguish between a good argument or not, scientifically speaking, other students and through convincing argumentation analogy can help students develop higher-order thinking abilities [8].

3. Conclusion

This report presented the findings of research as follows:

- 1) the use of mapping-based analogy in laboratory inquiry has significantly helped the students' argumentation in the classroom activities.
- 2) In addition, the use of analogy could notably reduce the numerous of misunderstanding and misconception.
- 3) With regard to this report, the analogy aid might encourage students to choose proportional facts and evidences without involving any feeling or emotional insights during the argumentation activities.

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