IMPROVING SCIENTIFIC ARGUMENTATION SKILLS OF JUNIOR HIGH SCHOOL STUDENTS IN SCIENCE LEARNING BY EMPLOYING PHENOMENON-BASED LEARNING WITH VIDEO ASSISTANCE THROUGH A MODIFIED "*FLIPPED CLASSROOM*" APPROACH

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Abstract

One of the epistemic purposes in science learning is developing scientific argumentation skills. Scientific argumentation skills become important because learning occurs through the process of scientific discussion between students and teachers in the classroom. Collaborative argumentation activities will help the students explore the relationship between ideas, change student conceptions, find evidence for claims so that a whole conceptual understanding formed. In fact, the application of the argumentation activity is rarely be used in science courses. Based on the questionnaires that had been given to eight Junior High School teachers in the province of Bengkulu related to science learning problems, the result was that students' argumentation skill is still very low compared with the other skills. The low ability of students' scientific argumentation might be caused by demonstration method applied and dominated by teachers in the classroom due to the lack of availability of tools and practicum materials. There is an effort that can be done by teachers in developing students' scientific argumentation skill, it is by implementing phenomenon-based learning with video assistance through a modified "*flipped classroom*" approach. The learning video may contain interesting science phenomena related to the material courses. These kinds of videos will be watched by students before classroom learning session begins in order to stimulate students' curiosity about the material they will learn. In addition, students will also be given individual worksheets based on the video they have watched. Through video, it is expected it can develop the thinking ability of learners to express their ideas and opinions so that it can develop their ability in writing their argumentation. The classroom learning sessions will contain phenomenon-based learning that is considered sufficiently appropriate to be applied in the *flipped classroom* approach as it corresponds to the video containing the phenomena of science. In phenomenon-based learning, students are involved in a series of scientific activities through the stages of learning. The dominant stages in facilitating the students to develop their argumentation skills in phenomenon-based learning is at the stage of orienting students on observing phenomena and stages of developing and presenting the work. If in the phenomena observation stage is expected to foster students' written argumentation skills, then in the stage of developing and presenting the work, it is expected to foster students' oral argumentation skills. At this stage, students are given the opportunity in the group to present the results of their group experiments. The teacher's role is to direct the class discussion, in which the other students respond to the group statement in the presentation, approve or refute the statement if it is not in accordance with the outcome of their group. This class discussion aims to get a true and complete

explanation of the material being studied until all students gain the same conceptual understanding. Based on this rationale, it is hoped that by applying phenomenon-based learning with video assistance through modified *flipped classroom* approach can facilitate students in improving their scientific argumentation skills.

Keywords: Scientific Argumentation Skills, Science Learning, Phenomenon-Based Learning, Video Assistance, Modified Flipped Classroom.

1 INTRODUCTION

One of the epistemic and conceptual goals of science learning is to construct students' argumentation skills (Duschl & Osborne, 2002). The purpose of science education is not only to lead students to master the scientific concept but also to engage them in scientific discussion (Bricker & Bell, 2009). Basically, science learning does not only engage with how natural laws appear or how the universe exists but it also concerns on how the universe will be in the future so that science learning begins with critical discussions related to the main reasons of the facts and natural theories (Erduran, Simon, & Osborne, 2004). The essential of argumentation is not in line with its implementation in science classroom. Teachers have not comprehensively applied scientific argumentation in science classes due to several factors (Driver et al., 2000). Many studies reveals that students 'difficulties in formulating arguments are caused by lack of participation in scientific discussions and limitations of teachers' pedagogical competence to support argumentative activities such as a lack of teacher ability to initiate and manage the course of discussion (Newton et al., 1999; Duschl & Osborne, 2002).

Refering to the results of a questionnaire focused on science learning issues survey given to eight science teachers from several junior high schools in Bengkulu province, teachers argue that students' argumentation skills is still very low compared to other skills. This phenomenon might be caused by the lack of educational learning process that facilitates students in expressing their opinions according to scientific evidence both orally and in writing. The dominant learning process done by science teachers in the classroom is through demonstration method. This method is applied by the teacher because of inadequate science laboratory and the lack of the availability of tools and practicum materials so that the practicum cannot be participated by all students. As a solution, teachers try to do demonstration in front of the class as a substitute for practicum. According to Yamin (2008: 27) the demonstration method becomes less effective if it is not followed by an activity where the students themselves can participate in the experiment and make the activity become a personal experience.

The survey results also showed that teachers need an interesting and innovative learning media to cope the problem encountered in science learning at junior high school in Bengkulu as during this time teachers face difficulty to find, create or use learning media that can facilitate them in delivering material to students. One of the interesting and innovative learning media that can be used by teachers in science learning to develop students' scientific argumentation skills is by using video learning. Several studies have proven the benefits of using video in science learning. According to Andarini & Masykuri (2012) the use of video media in learning biology can improve students' learning achievement since the video media show more attractive appearance in the form of real moving images, delivering material in the form of audio-visual, interesting and motivating students to learn more material. In accordance with Sun, Ye and Wang (2015) who claim that digital video can integrate visual and auditory explanations that provide an interesting learning environment for students. In addition, digital video has become the most popular teaching tool that can improve learning practices (Sherin and Han, 2004).

Besides having positive impact, the use of video in science learning also has some drawbacks such as the visual complexity of animations in the video can disrupt the students' attention from important things that should be focused on in the video so that it indirectly affects students' understanding (Tversky et al., 2002). Moreover, less optimal use of time in learning with video also causes students to spend more time to analyze the video. The results of a study conducted by Larkin-Hein and Zollman (2000) focusing on students' ability in analyzing and interpreting motion graphics in kinematics materials through laboratory-based learning using interactive digital video argue that students in the experimental class are more focused on video analysis leading to the consequences like students spend a lot of time with data and graphics analysis from video. Similar with the subsequent meetings, in laboratory activities students spend a lot of time on the technical aspects of learning such as in the use of computers and video. Moreover, if the use of learning videos is accompanied by experimental activities, experimental activities require relatively extra time allocations, the availability of experimental equipment, more control over students during the experimental

process so that time optimization becomes a very important point to note (Rahmawati, et al., 2016).

The solution that can be done by the teacher to optimize the use of video media in learning process of science is by applying the flipped classroom, the latest teaching methodology where the subject matter presented in the learning video is observed by the student before the classroom learning. Sessions in the classroom are mostly implemented for student-centered activities such as laboratory activities, problem solving and so on (Jeong, et al., 2016). This methodology is based on the notion that direct instruction is not effective for group learning but it is more suitable for individual learning. Flipped classroom provide the opportunity for students to learn by their own way and be more flexible in managing their time to study and make students more accountable with their learning. With the availability of video learning that can be repeated continuously wherever students are land tailored to the needs of students can improve their understanding with learning content. Learning sessions in the classroom, where more time is spent on active learning such as inquiry activities, problem solving, and discussion are expected to make students more interactive (Gomez, et al., 2016).

The implementation of this flipped classroom approach will be slightly modified by the use of videos that do not contain the subject matter but contains interesting science phenomena regarding to the material to be studied. This is because if the video contains lesson material, it will reduce students' interest in learning activities in the class because they already know the material as a whole through the video and also felt less appropriate with the theory of constructivism in learning science where students who must actively construct or build their own knowledge through direct experience (Trianto, 2007). Videos containing these science phenomena will be observed by students prior to classroom learning sessions in preparation to stimulate students' curiosity about the material they will learn. Besides given an obligation to observe the video, students will also be given worksheets that must be filled individually based on the video they observe. Through video, it is expected to develop students' thinking ability to express their ideas and opinions so that students' can indirectly develop their ability in delivering their arguments in writing.

The classroom learning sessions implemented flipped classroom approach will be filled with phenomenon-based learning that is reasonably appropriate with the video used. This phenomenon-based learning model includes object or phenomenon analysis, interaction analysis (object or phenomenon relationship), and process analysis (Darliana, 2008). In this study, students observe the events that appear on an existing phenomenon, then analyze the cause of the emergence of the phenomenon, or the reason the phenomenon may occur. It has been proven that phenomenon-based learning is able to increase students' learning interest (Bojovic, 2003), it can also improve understanding of concepts and problem-solving abilities (Hotang, 2010). Based on the background that previously described above, the effort that can be done by the teacher to improve the scientific argumentation skills of junior high school students is by applying phenomenon-based learning with video assistance through "a modified flipped classroom" approach.

2 RESEARCH METHODS

This article is a preliminary study of the author's thesis research plan entitled "The Implementation of Phenomenon-Based Learning with Video Assistance through a "Modified Flipped Classroom" Approach to Improve Scientific Argumentation Skills and Conceptual Understanding of Junior High School Students on Material Pressure. This preliminary study was prepared based on the results of a questionnaire survey which has been given to eight science teachers from several junior high schools in Bengkulu province and a literature review of science learning issues in schools and efforts to address them. The questionnaire provided contains questions such as the usual method of teaching science by teachers in the classroom, the difficulties or constraints faced by teachers in teaching science, what skills are still low or have not mastered by their students, and the most urgent need in overcoming the problems of science learning in class. Each survey question is supplemented by several alternative answers that can be selected more than one and there are also other answers that the respondent can answer if there is no choice of answer that corresponds to the respondent's answer. The survey data were then analyzed descriptively to obtain an overview of science learning problems in general in Bengkulu province and then conducted a literature review to find a solution in overcoming the problem.

3 RESULTS AND DISCUSSION

3.1 Results

Survey results discover several data as follows:

The first question on the questionnaire is the teaching method used by teachers in the science class. There are eight alternative answers: lecture, discussion, demonstration, practice, role playing, project, outdoor and

other activities. Respondents may choose more than one answer. Respondents mostly choose the method of demonstration as the method they often use in teaching in science class. To be clear, this diagram 1 pictures the respondent's answer.

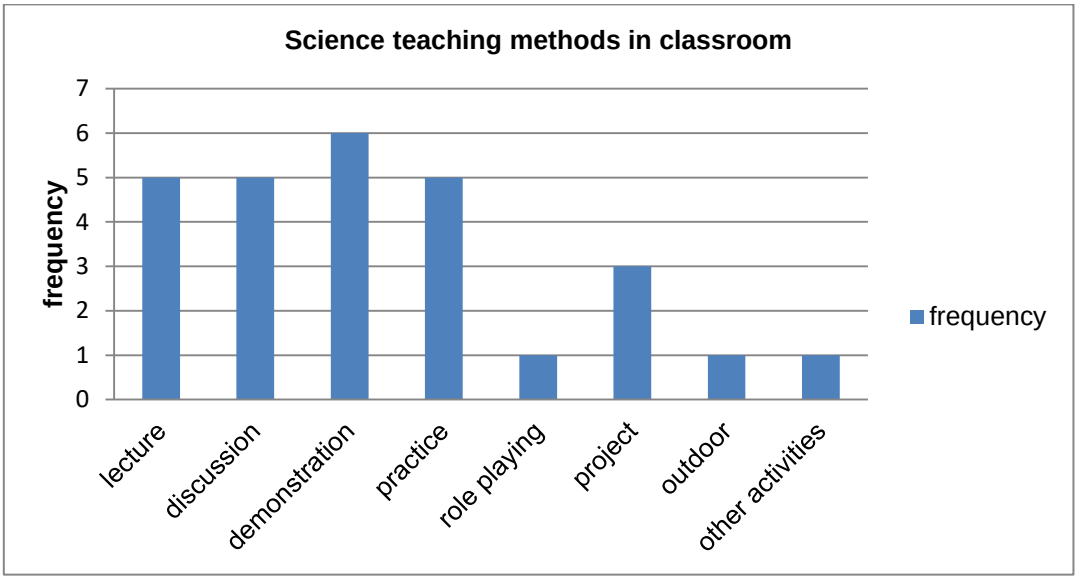

Diagram 1. Distribution of respondents' answers to questions of science teaching methods that are often applied in the classroom

The second question on the survey questionnaire is the difficulties or constraints faced by teachers in the science class. Respondents were given alternative answers such as lack of availability of tools and practicum materials, unavailability of special laboratory science, students with the tendency of low level of ability, the absence of officers who help to create an effective laboratory activity, science laboratories that switch functions into classrooms so it cannot be maximally utilized, as well as other answer choices filled by respondents if there are other causes of difficulties or obstacles they face in teaching science. Respondents may choose more than one answer. Based on the answers from the respondents, it was found that 40% of teachers believe that the difficulties in teaching science is caused by the lack of tools and practicum materials, 30% due to the low ability of students, 15% due to the unavailability of special laboratory science, so that the lab becomes ineffective, the science lab turns the function into a classroom so it cannot be utilized maximally. Meanwhile, for the other answer choices each contributes 5% to the cause of teachers' difficulties in teaching science. It appears that the lack of availability of tools and practicum materials is the main factor causing difficulties or constraints faced by teachers in teaching science. To further clarify, the data distribution of respondents' answers is presented in diagram 2.

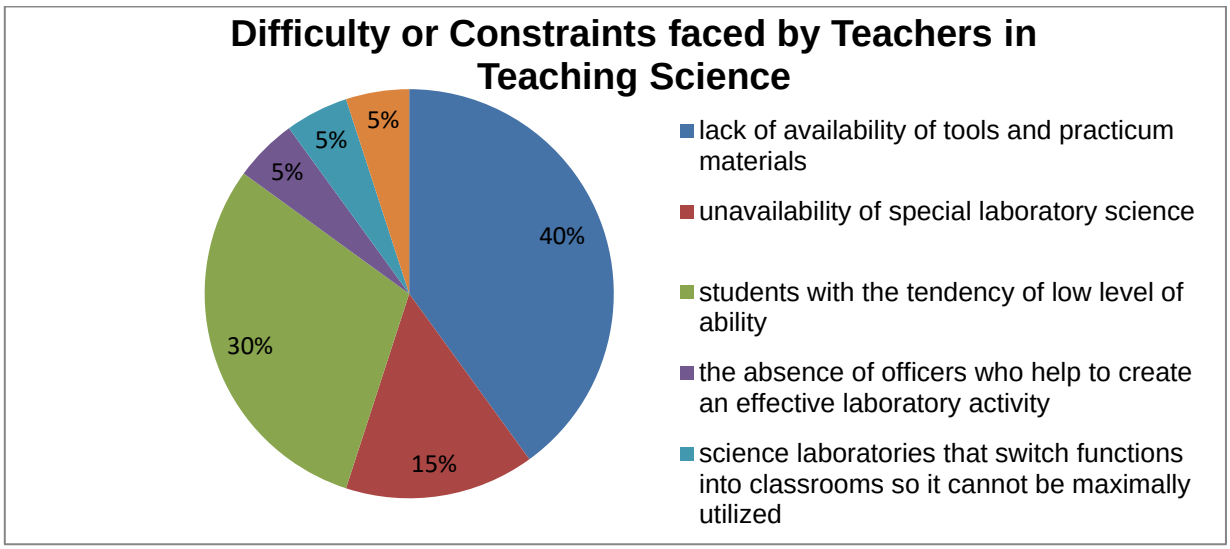

Diagram 2. Distribution of respondents' answers to questions of difficulty or constraints faced by teachers in teaching science

The third question on the survey questionnaire is the students' low ability according to the teacher. There are six choices of answers that can be selected by the respondents namely the skills of the process of science, the argumentation skills, critical thinking skills, creative thinking skills, the ability of science literacy and student independence. The hghest percentage that is 22% refers to the argumentation skills. According to the teacher, their students argumentation skills is the lowest category compared to other skills. Data distribution of respondents' answers is presented in diagram 3.

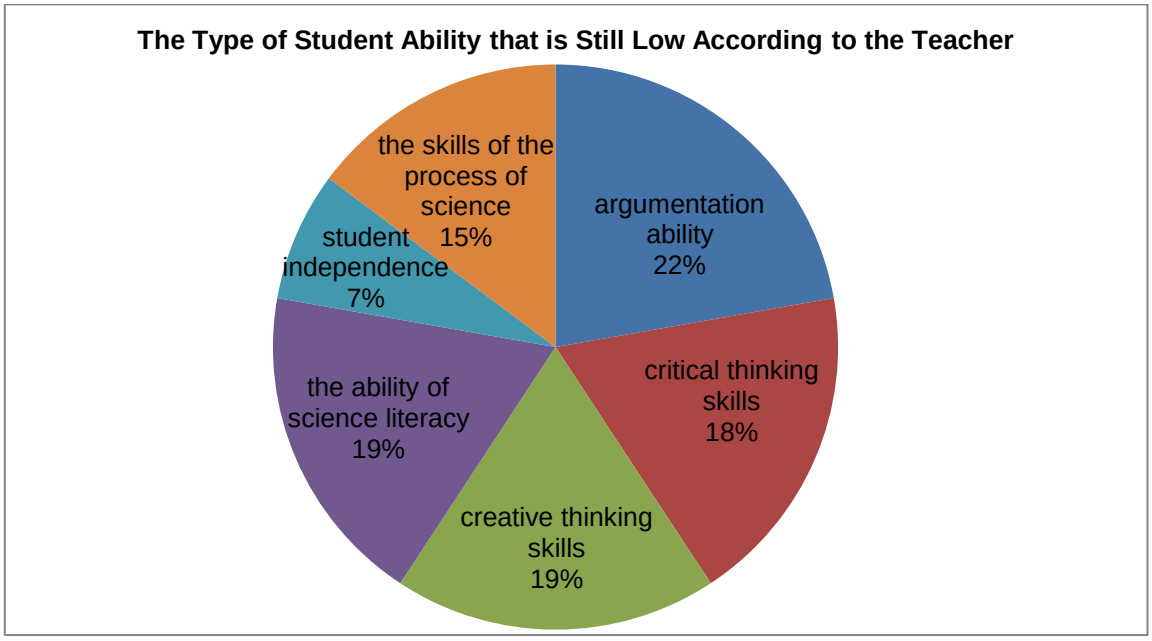

Diagram 3. Distribution of respondents' answers to questions of the type of student ability that is still low according to the teacher

The fourth question on the survey questionnaire is what teachers mostly need to address the science learning problem. There are five alternative answers namely interesting and innovative learning media, alternative assessment in science learning, application of active learning models, teacher teaching materials, and others. The highest percentage, 46% represents the answer chosen that is interesting and innovative learning media, then 27% choose teacher teaching materials, 20% choose alternative assessment in science learning and 7% choose facilities and infrastructure. This shows that according to the teacher's response, the most urgent need in overcoming the problem of science learning that is need of existence of interesting and innovative learning media of science. Data distribution of respondents' answers is presented in diagram 4.

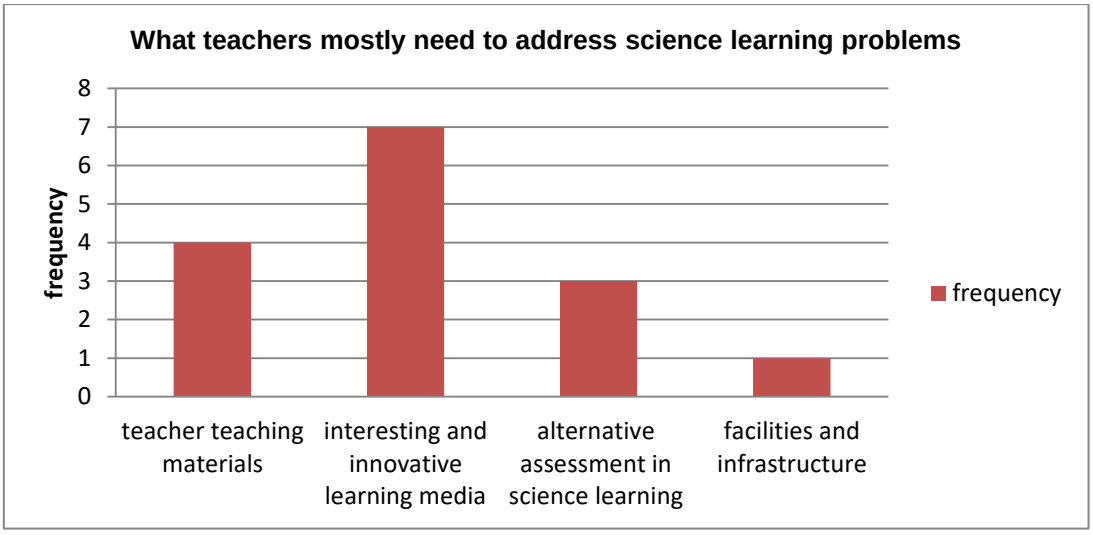

Diagram 4. Distribution of respondents' response on question what teachers mostly need to address science learning problems

3.2 Discussion

Based on the survey result previously presented above, literature review was conducted to find solutions or efforts that can be done by teachers in overcoming the problem of science learning. According to teachers, the lowest ability of their students is the argumentation skills and interesting and innovative learning media is the most urgent need to overcome the problems of science. Therefore, researchers try to combine the use of learning videos with appropriate learning models in an effort to improve students' scientific argumentation skills. The result of literature review discovers that applying phenomenon-based learning with video assistance through "a modified flipped classroom" approach can improve the scientific argumentation skills of junior high school students. Phenomenon-based learning emphasizes natural phenomena as the learning focus. Science, especially physics studies natural phenomena that often occur in everyday life and can be explained scientifically. Events or natural phenomena that are often encountered by students in the environment where they live can be used as learning resources that can activate the critical thinking skills of students (Pujianto and Maryanto, 2009: 2). Phenomenon-based learning steps are adopted from problem-based learning steps, consisting of five major steps beginning with the presentation of phenomena by teachers and ending by analyzing and evaluating the process of explanation of phenomena with teachers and students. The application of phenomenon-based learning in science class has positive impact for students such as improving critical thinking skills (Pareken, Patandean, & Palloan, 2015), science process skills (Yudiana, 2009, Kaniawati, 2010), problem solving skills (Hotang, 2010) and conceptual understanding (Asih, 2011; Hotang, 2010) as well as increasing student learning interest (Bojovic, 2003).

Sometimes it is difficult to present real-world problems in this case of science phenomena occurring in nature into the classroom. One way to make it easier to bring these science phenomena into the classroom is through video. Some of the advantages of the video include visual, dynamic, spatial, and actual information representation (Sherwood et al., 1987a, b, c; Sharp et al., 1995). In addition, the technology through learning videos that contain interesting and authentic phenomena of science presented into the classroom can make the inquiry process more interactive, allowing students to ask questions related to the videos they see (Ketelhut et al., 2010), giving opportunities students to collaborate and connect with the world outside the classroom (Harmer and Cates, 2007), and can increase the internal motivation of students in solving problems (Rosenbaum et al., 2007). In this research plan, the video is utilized as one of the media that helps facilitate teachers in presenting interesting science phenomena related to the material to attract students' interest and attention. This video will be given before the classroom in which students can watch the video at home then fill out the worksheet after watching the video. It is hoped that the presentation of the video before the classroom learning can stimulate students to think and argue to find out the causes of science phenomena that occur through scientific inquiry activities that will be conducted in classroom learning sessions.

The ability of scientific argumentation is the ability of the individual to engage in academically discussions in which the individual seeks to convince others that his or her statements, opinions, attitudes or beliefs are true value supported by scientific evidence and facts. Arguments are used to tell others and convince them of the truth. Practicing arguing through group discussion activities is an effective way to develop the basic skills of students' argumentation. In group discussions, students communicate their statements or opinions about something and then give reasons or arguments for their explanations to be stronger and scientific (Osman, Chuo Hiong, & Vebrianto, 2013). It is also supported by Golanics and Nussbaum (2008) who observed that collaborative argumentation through discussion activities is important in an educational context because it can help students explore relationships between ideas, change student conceptions, negotiate for evidence for statements or claims.

Phenomenon-based learning with video assistance through a modified "flipped classroom" approach can facilitate students in developing their argumentation skills. In phenomenon-based learning, students are involved in a series of scientific activities through the stages of learning. In the early stages of student orientation on phenomena observation, students are asked to observe the phenomenon of science through video display. From the observation of the phenomenon, students will think about the phenomenon they saw, why the phenomenon can occur or what causes the phenomenon can occur. The teacher's job at this stage is to motivate students to express their ideas and opinions about the phenomenon they see and explain that the phenomenon can be explained scientifically by conducting an investigation through experimental or scientific experiments.

After students conducted an investigation activities through experiments to find an explanation of the causes of the occurrence of science phenomena and scientific theories that explain it, the next phases of phenomenon-based learning is to develop and present the work. At this stage, students are given the

opportunity in groups to present their group experimental results. The teacher guides the class discussion, in which the other students respond to the group's statement of the presentation, approves or refutes the statement if it is not in accordance with the outcome of their group. This class discussion aims to get a true and complete explanation of the material being studied so that all students gain the same understanding. This is consistent with the explanations of Erduran, Simon, & Osborne (2004) that science learning is not only about how natural law occurs or how the universe exists but also focuses on the explanations of how the universe will be in the future. Thus, learning science begins with a discussion of the main reasons for facts and natural theories. So hopefully from this scientific discussion activity can improve students' scientific argumentation skills. To further clarify the research thinking flow, this research plan is presented in the frame of mind shown in Figure 1.

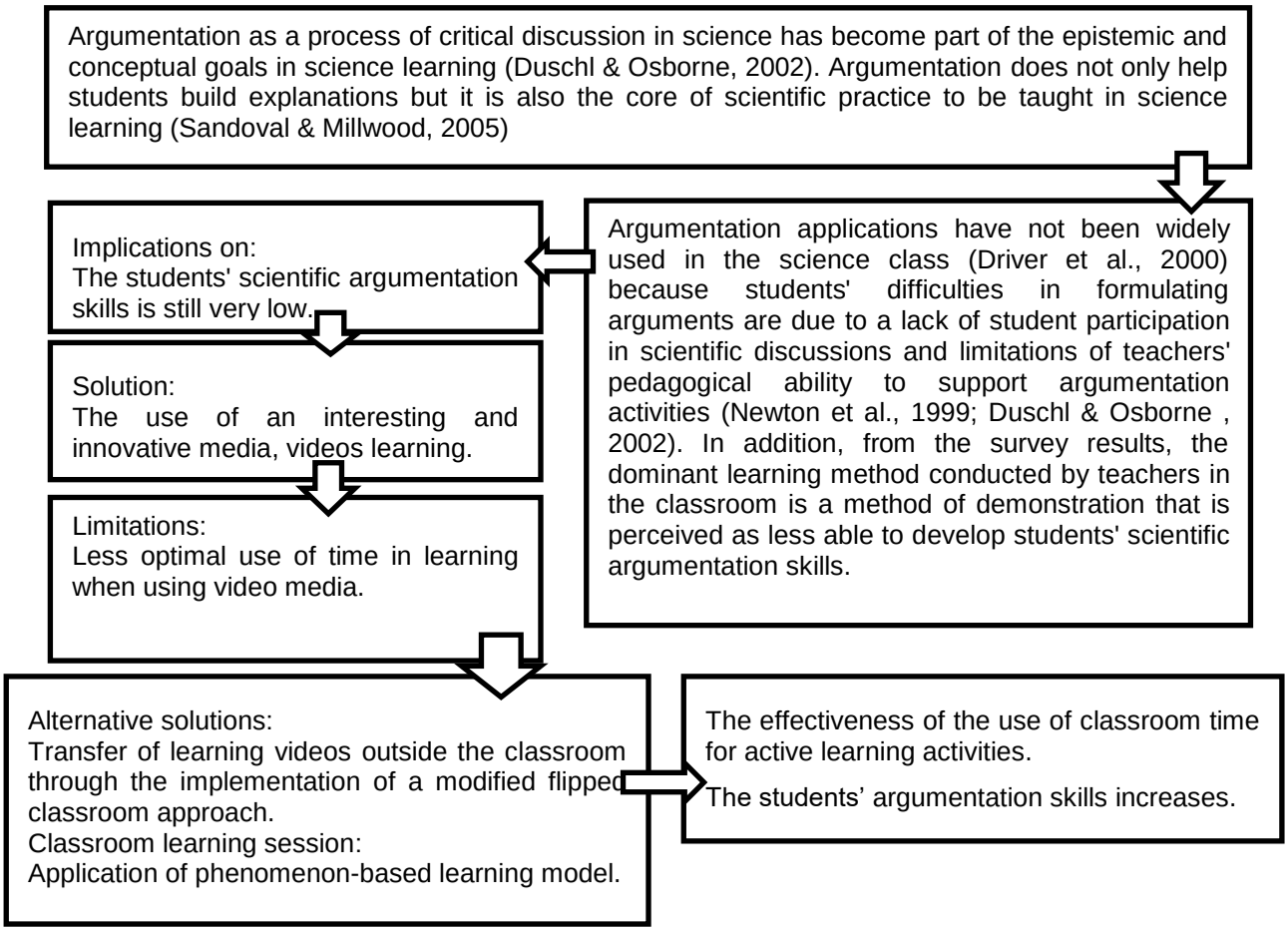

Figure 1. Conceptual Framework Research Plan

4 CONCLUSION

Based on the background of problems faced by science teachers from several junior high schools in Bengkulu province and result of literature review, this study proposes the idea to apply phenomenon-based learning with video assistance through a modified "flipped classroom" approach to improve students' scientific argumentation skills. This idea is based on the assumption that based on a study of phenomenon-based learning literature with the help of videos wrapped in a flipped classroom approach where students observed videos outside the classroom learning sessions can optimize classroom learning time. In classroom learning sessions, students are involved in a series of scientific activities through phases of phenomenon-based learning. The dominant stages in facilitating students to develop their argumentation skills in phenomenon-based learning is at the stage of orienting students on phenomenon observation through video and stages of developing and presenting the work. If the stage of observation phenomenon through the video is expected to foster the ability of students' written argumentation in the stage of developing and presenting the work is expected to foster students' oral argumentation skills.

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