The use of argument based science inquiry learning model by using science writing heuristic approach to build students argument ability in environmental pollution theme

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Abstract. Given the importance of the ability to argue for students in Natural Science learning, it was necessary to find a solution, which is a method and learning approaches that are expected to develop students’ argumentation. One of the methods that could be apply was the Argument Based Science Inquiry (ABSI) learning model with Science Writing Heuristic (SWH) approach. The object of this study was learning natural science by using webbed-based with the theme of environmental pollution. This study aims to obtain a description of students’ argument ability in SMPN 1 Malingping. This research was the Quasi Experimental research with Non Equivalent Pre-test Post-test Design type. The subject involved of students’ class VII in SMPN 1 Malingping. Experimental class and control class were given the same test, they were pre-test and post-test. The results showed that the N gain score of students' argument ability in the experimental class was 0.40. While the value of N gain students' argument ability in the control, class is 0.25. The researcher recommended that this research should be done in schools that have excellent classes and regular classes in order to make comparisons clear.

1. Introduction

The research of natural science plays a very important contribution, especially in students' thinking ability. The learning of natural science is an active process in which students have to do something, not something done to students \cite{1}. Therefore, the learning process of natural science in schools should be emphasize the provision of direct experience inquiry so that students can be actively involved in constructing their own knowledge. The scientific discovery process that conducted by scientists involves various scientific skills through lab work in the laboratory. Inquiry learning with practicum activities will involve students directly in various activities such as hypotheses, planning an experiment, predicting, interpreting data, processing information and making conclusions \cite{2}. The purpose of science education is not only on the mastery of scientific concepts alone, but also learn how to engage in scientific discourse. To achieve the implementation of scientific discourse, students must have the ability to argue in the learning to train the students to get used to argue.

The purpose of science education is not only on the mastery of scientific concepts, but also learning how to engage in scientific discourse. To achieve the implementation of scientific discourse, students must have the ability to argue that in learning to train students to get used to argue. The practice of
argumentation as a center in science education and recently enforced as an essential need for scientific instruction to enhance students' understanding of scientific concepts. Therefore, developing the ability of students to understand and practice the ways of argument in scientific context through science learning becomes important. With the students' argument ability, the learning process in the classroom will be more interesting because the students will actively either participate in the class, in the form of opinion, rebuttal, and question or answer the teacher's question [3]. Based on previous research the mastery of argument ability for all students is not satisfactory. This is due to the lack of experience that students have in building arguments in the classroom. In addition, teaching and learning science in the classroom still focuses on teacher orientation and does not expose students to argue [4].

Based on these problems is needed a solution in overcoming the problem. One of them is by applying a model and learning approach, which is expected to develop students' argumentation. Therefore, it is necessary for learning that can provide inquiry experience as well as train and develop students' argumentation. In addition, from the interview results, the teacher suggested that learning with inquiry model has not been applied before in natural science learning. With the application of learning with inquiry model becomes a new thing for students. This learning model is needed to be able to accommodate the development of argumentation ability. Argument based science inquiry is an argumentation learning model that integrated science inquiry in learning. Argument based science inquiry is a learning model that aims to improve the ability of critical thinking, argument ability, reasoning, and tools to develop students' understood of the nature of science. This argument based science inquiry model tried to integrate students' argumentation and writing skills in laboratory activities. Students are also required to engage actively in the practice of constructing scientific arguments as an integral part of laboratory activities [5]. Argument based science Inquiry is an argumentation model intended to build students' understood of scientific practice as well as to raise an understood of ideas within a discipline [6]. The learning approach used is the science heuristic approach. The science writing heuristic (SWH) approach is one form of argument-based approach intended to give students the opportunity to engage in science practice [7]. The SWH approach provided a supportive learning environment for the development of metacognitive students because the inquiry based approach built on a series of questions and student centered [8].

2. Method

In this research, the researcher used Quasi Experimental with the nonequivalent pretest posttest Design. This design was used for experimental class which using existing classes as a group, by selecting classes with similarly expected conditions [9]. This design was chosen because during the research it was not possible for the researcher to change the existing class. The research design of The Non Equivalent Pretest Posttest Design showed in table 1.

| Class | Pretest | Treatment | Posttest |
|-------|---------|-----------|----------|
| A     | O₁      | X₁        | O₂       |
| B     | O₃      | X₂        | O₄       |

Information:
A: experimental class
B: control class
O₁: pretest experiment class
O₂: posttest experimental class
O₃: pretest control class
O₄: posttest control class
X₁: argument Based Science Inquiry (ABSI) model with Science Writing Heuristic (SWH) approach
X₂: guided inquiry model with contextual approach
Subjects in this study were seventh grade students as many as two classes, amounting to 56 students. These two classes consist of control and experimental class; it amounts 28 from each class. The control class was a treated class that used by guided inquiry model with contextual approach while the experimental class was a class that gets treated by using argument based science inquiry with Science Writing Heuristic approach. Researcher conducted the research at SMP Negeri 1 Malingping, which is located in Lebak regency school years of 2018/2019.

The research procedure was divided into 3 stages; they are planning stage, implementation stage, and data processing stage. The planning stage was 1). Conducting interview with teachers of the field of study especially IPA in the school which is intended as a place of research to know which methods / strategies / approaches / learning models that have been used, student activity in the classroom and any difficulties experienced by teachers, 2). Make observations to the target school as a place of research to see the problems to be studied. 3). conducting studies and literature studies on the argument based science inquiry model, the science writing heuristic approach, the ability to document, socio scientific issues, and integrated Webbed type IPA learning, 4). Preparing learning tools such as lesson plan (rpp), teaching materials, and student activity sheets (LKS). 5). preparing research instruments in the form of test and non-test. The instrument was essay consisting of the ability to argue. Non-test instrument consists of observation sheet of the implementation of researcher and student learning, interview of science teacher of class VII and questionnaire of student responses to learning using argument based science inquiry model with science writing heuristic approach, video recording was used for viewing elements of argument that arise during the process of group discussion and class discussion. 6). perform test instrument validation. 7). conducting tests on test instruments, instruments of argument ability.

Implementation stage was 1). Carry out preliminary tests of student’s argument ability (pretest) to determine the level of students’ initial ability on the theme of environmental pollution, 2). Carry out the learning process by using argument based science inquiry model with argument based science inquiry with science writing heuristic approach in experiment class. While in control, class of learning process with inquiry model is guided by contextual approach. 3). carry out the final test of students’ argument ability (posttest) to find out the learning outcomes after being given treatment through the learning process using argument based science inquiry model with science writing heuristic approach. Stage of data processing that is 1). Process and perform data analysis of research results obtained from the implementation of research. The data obtained will be analyzed through normality test, homogeneity test, hypothesis test and correlation test, 2). Making conclusions from the results of data analysis researchers.

3. Result and discussion
The result of students 'argumentation capability shown in Figure 1 shows that there is an improvement in students' ability to argue in writing after learning using argument based science inquiry model with science writing heuristic approach applied in experimental class and guided inquiry model with approach contextual applied in the control class. However, the average acquisition of n-gain in the experimental class and control class indicates a difference, meaning that the increase in students' written argument ability in the experimental class is higher than in the control class. The gain of n-gain from the experimental class of 0.40 means that the average n-gain of students' argumentation ability in the experimental class increases with the medium criterion. While the gain of the control class of 0.25 means that the average n-gain students' argument ability in the control class increases with the low criterion. The average difference between the n-gain of the experimental class and the control class of 0.15 means that the increased ability to argue both classes is quite different. This is in line with the results of research with the opinion that the application of the argument based science inquiry model enhances the ability to think critically, argumentative skills, reasoning, and tools to develop students' understanding of the nature of science [10].
Figure 1. Average n-gain argument ability written overall in control and experiment classes.

The argument based science inquiry model also seeks to integrate students' argumentation and writing skills in laboratory activities. Students are also required to be actively involved in the practice of constructing scientific arguments as an integral part of laboratory activities. In addition, the science writing heuristic approach is a form of argument-based approach intended to give students the opportunity to engage in science practice. The SWH approach facilitates conceptual change through argument based inquiry activity. Students are able to negotiate and construct knowledge, reflecting on their understanding through writing. Then share and compare it with the knowledge of a group of friends [11].

4. Conclusions
Based on the results of this study it can be seen that the average n-gain value of the control class is 0.25 with the low criterion while the average n-gain value of the experimental class is 0.40 with the medium criterion meaning the average of n-gain in the class the experiment is higher than in the control class. This research should be conducted in schools that have excellent and regular classes so that the n-gain cell is so different that the comparation are clear.

Acknowledgments
The researcher would like to thank as advisors, part of school, mother, father, big family, and friends who have helped and supported researcher in this study.

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