Enhancement of Students' Argumentation Skills based on The Implementation of Argument Driven Inquiry Learning Model

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Abstract

This research was conducted because there are still many junior high school students who have low argumentation skills so the purpose of this study is to improve students' argumentation skills with the Argument Driven Inquiry (ADI) learning model. The research method was included in the Pre-experiment with One Group Pretest-posttest Design which was carried out at Al-Hamidiyah Blega Junior High School for the 2021/2022 Academic Year. Data collection techniques are carried out through tests, questionnaires, observation, and documentation. Furthermore, the hypothesis test was carried out using paired sample t-test. The results showed that there were differences in the results of the implementation of the ADI learning model toward the students' argumentation skills with a significant value of 0.000 <0.05, then H0 was rejected and H1 was accepted. The results of calculating the n-gain score using SPSS have an average score of 0.66 with moderate criteria. Student responses positively toward the implementation of the ADI learning model with an average score of 84.15; The implementation of the ADI learning model obtained a score of 88% with a good category. It can be concluded that the implementation of the Argument Driven Inquiry learning model can improve students' argumentation skills.

Keywords: Argument Driven Inquiry learning models, Argumentation skills, Global warming

INTRODUCTION

The word science comes from the Latin word "Scientia" which means "I know" in Indonesian (Saharuddin, 2018). Natural science is generally defined as a science that studies nature and its contents and the interactions within it. The definition of integrated natural science in general is a combination of physics, chemistry and biology that are interrelated(Agustami et al., 2017). The essence of IPA according to Narut & Supradi (2019), there are 3 kinds of natural science as a process, product, and attitude. Natural science as a process means that it contains definite steps in

investigating a problem. Natural science as a product means that there are facts, principles and laws that have been proven true. Science as an attitude contains moral values such as curiosity, critical, creative, and having an open view.

The current modern era requires 21st century skills considering that currently students are very easily controlled by the rapid flow of information(Nuraeni et al., 2019). Furthermore, the national education system faces very complex challenges in preparing human resources to compete globally(Nawawi et al., 2017). Also, the 21st century skills

engage students to have learning in innovation skills (skills in learning and obtaining new discoveries) which include critical thinking and problem solving, communication skills, collaboration skills, creativity and innovation(Zahara et al., 2018). By facing challenges toward 21st century skills, government in Indonesia prepare with the implementation of the 2013 Curriculum which is expected to improve students' scientific and reasoning processes(Faiqoh et al., 2018). The revised 2013 curriculum teaches students to be able to practice hard skills and soft skills in which include observing, asking, trying, analyzing, and communicating. Furthermore, the communication ability that has an important role in science is the argumentation skills(Zahara et al., 2018).

Argumentation comes from the Indonesian language, namely "argument" which has the aim of justifying g an idea or opinion from an individual (Arfiany et al., 2021). In addition, scientific argumentation is an activity carried out by students in the process of learning science which is carried out to improve students' reasoning abilities(Akili et al., 2022). The problems that occur in the classroom are students who are less active in the learning process and students who have not been able to express statements or arguments. Based on these reviews, it can be interpreted that the argumentation skills possessed by students are still low(Siregar & Pakpahan, 2020). Hidayah et al(2022) also states that students have difficulty in understanding the purpose of arguments where evidence is used as support for claims as well as

reasoning and refutation. Students also lack the ability to express scientific ideas and concepts related to everyday life, lack the skills to argue, formulate hypotheses and scientific investigations(Hidayah et al., 2022). This situation indicates that students' scientific argumentation skills still need to be developed.

The Argument-Driven Inquiry learning model or commonly abbreviated as ADI is the result of developing an inquiry learning model which has the goal of developing students' argumentation skills(Arfiany et al., 2021). As it is already stated that studying science is not only limited to knowing but also having to understand science concepts(Dina et al., 2022). The ADI learning model focuses on a series of investigative activities because it emphasizes construction and validation activities so that students become active in the learning process(Nurrahman et al., 2018). Students have the opportunity to carry out inquiry activities such as identifying problems, compiling research activities, collecting data, observing, measuring, recording as well as interpreting data, argumentation skills as well as reviewing and writing reports. So that during ADI learning process, students are able to improve the argumentation skills(Siregar & Pakpahan, 2020).

The 2013 Curriculum for seventh grade in the Global Warming material is one of the environmental problems that has received quite a lot of attention in recent years. Global warming is one of the natural science concepts contained in PISA. In learning the concept of Global Warming,

students will analyze the symptoms and impacts on life. This situation will enable students to submit ideas based on the information obtained (Alatas & Fauziah, 2020).

Global warming material at the junior high school level has the aim of educating groups of youth to develop knowledge, behavior and future decision making. Global warming is included in this study for research and discussion by students during science lessons so that students are able to provide arguments to evaluate and interpret human behavior that has an impact on global warming (Septaria et al., 2019). Hairida (2017) also describes the active role of students in the learning process which has a close relationship with self-efficacy in students. High students' self-efficacy will make it easier for students to solve problems, achieve learning goals and be able to survive and face difficulties.

Based on these views, the problems encountered in science learning arise, namely the low argumentation skills of junior high school students, the confidence of students in expressing their ideas is still very low, and students who tend to be passive during the learning process. Thus the alternative solution offered is by implementing the Argument-Driven Inquiry (ADI) learning model to improve students' argumentation skills.

METHODE

This research is a quantitative research with pre-experimental research. Pre-experiment is an experiment that still has external variables that influence it.

That situation occurs because there are no samples and control variables chosen randomly (Sugiyono, 2020). The research design used was one Group Pretest-Posttest Design. This research method was chosen since it can be more accurate where there are results of comparative values before and after learning process (Sugiyono, 2020). The research was conducted in June in the even semester of the 2021/2022 academic year. The place used for research is SMP Al-Hamidiyah Blega. Data were collected by tests, questionnaires, and documentation.

Data analysis techniques were carried out by testing the validity of the following formula.

$$v = \frac{\sum s}{N(C-1)}$$

Information :
V = Validation value
N = Number of validators
S = r-lo
lo = The lowest validation rating score
c = The highest validation rating score
r = The number given by the researcher

Based on the value of the validation results that have been obtained, the data were interpreted based on the criteria. The following are the criteria for validity based on table 1.

Table 1. Instrument Validity Criteria

Intervals	Criteria
V ≤ 0.20	Very low
0.20 < V ≤ 0.40	Low
0.40 < V ≤ 0.60	Enough
0.60 < V ≤ 0.80	Tall
0.80 < V ≤ 1.00	Very high

Wati et al.,(2019)

The reliability test in this study uses the Borich formula which is stated in the following formula.

$$R = 100\% x (1 - \frac{A-B}{A+B})$$

Information :
R = instrument reliability
A = High frequency given by validator
B = Frequency given by the validator

Furthermore, the categorization is carried out according to the criteria in table 2 below.

Table 2. Reliability Percentage Criteria

Intervals	Criteria
V ≤ 0.20	Very low
0.20 < V ≤ 0.40	Low
0.40 < V ≤ 0.60	Enough
0.60 < V ≤ 0.80	Tall
0.80 < V ≤ 1.00	Very high

Wati et al.,(2019)

The results of students' argumentation skills from the posttest and pretest are calculated by the following formula.

$$TestValue = 100 x (\frac{\sum score}{\sum maximumscore})$$

The score obtained based on the calculation will then be interpreted according to the criteria. The resulting criteria for the percentage score of student argumentation skills can be seen in table 3 below.

Table 3. Criteria for Students' Argumentation Skills

Value Range	Criteria
V ≤ 0.20	Very low
0.20 < V ≤ 0.40	Low
0.40 < V ≤ 0.60	Enough
0.60 < V ≤ 0.80	Tall
0.80 < V ≤ 1.00	Very high

Rochman (2021)

The results of the students' argumentation skill tests that have been obtained are then carried out using a normality test to find out whether the data obtained from the research results are normally distributed or not. In this study, tests were carried out using the SPSS program. So if the resulting data has a significant value < 0.05, then the data is not normally distributed. However, the data can be said to be normal if the significant value is ≥ 0.05 (Falahi & Andrijanto, 2019).

After obtaining data that is known to be normally distributed, it is continued by conducting a paired sample t-test using SPSS. Furthermore, the N-Gain Score test was carried out which aims to find out how much the development of students' argumentation skills before and after the implementation of the ADI learning model. The N-Gain Score test was carried out using SPSS with the following criteria in table 4.

Table 4. Value Acquisition Criteria

N-gain	Category
g>0.7	High
0.3 ≤ g ≤ 0.7	Moderate
g ≤ 0.3	Low

Kurnia et al (2021)

RESULTS AND DISCUSSION

Students' argumentation skills are determined through pretest activities before learning process using the ADI learning model. The posttest activity was carried out to find out the final results of students' argumentation skills after learning process using the ADI learning model. After obtaining the data from the pretest and posttest results, descriptive statistical analysis, analysis of argumentation skills, normality test, and hypothesis testing were then carried out.

Descriptive statistical analysis was carried out to find out and describe the amount of data obtained, the maximum value, minimum value, and average value

in the assessment obtained. The research data used in descriptive statistical analysis is the pretest-posttest value in seventh grade. The research test was carried out using the SPSS program. The results of the descriptive statistical analysis can be seen in the following table 5.

Table 5. Descriptive Statistics Test

		Min	Max	Means	std. Deviation
Pre-test	28	44.05	61.90	55,27	4.21574
Post-test	28	73.81	97.62	85.1	6.72852

The following are the results of the pretest-posttest of students' argumentation skills arranged according to the criteria.

Table 6. Results of Argumentation Skills Criteria

Criteria	Pretest		Posttest	
	$\sum student$	%	$\sum student$	%
Very good	0	0	20	71.4
Good	0	0	8	28.5
Not good	28	10	0	0
Very bad	0	0	0	0

Based on the results of the table it can be seen that the pretest percentage of students' argumentation skills in the not good category is 0% with 28 students. The percentage of posttest results obtained by 20 students in the very good category was 71.42%. The posttest results for 8 students in the good category obtained a percentage of 28.57%. The following is the result of calculating the normality test using the SPSS application.

The pretest significance value based on the table is 0.38 and the posttest significance value is 0.11. The result of the calculation of significance > 0.05 is a requirement for the data obtained to include normally distributed data. So it can be concluded that the poretest-posttest values are normally distributed because the significance value is > 0.05.

Table 7. Argumentation Skills Test Normality Test

Criteria	Shapiro-Wilk		
	Statistics	df	Sig.
Pretest	0.96	28	0.38
Posttest	0.94	28	0.11

ADI learning has an influence on students' argumentation skills which is determined and known after testing the hypothesis. The hypothesis test used a paired sample t-test using the SPSS program. Based on the data obtained, it shows that the significance value is 0.000. Nuryadi et al (2017)explains that if the significance value is ≥ 0.05 then H0 is accepted, but if the significance is <0.05 then H0 is rejected. Based on this view, it can be concluded that H0 is rejected, which means that there are differences in argumentation skills before and after the implementation of the ADI learning model based on a significance value of 0.000 < 0.05. According to research by Zahara et al (2018) that ADI learning affected on differences in students' argumentation skills.

There are differences in students' argumentation skills when compared between before the implementation of learning and after the implementation of learning using the ADI model on global warming material. This is illustrated by the descriptive statistical analysis test which obtained a pretest score of 55.27 and an average posttest score of 85.10. Prior to

the implementation of the ADI learning model, students had difficulty working on evidence and support. However, in the posttest, students can work on the argumentation skills test according to what they have learned before.

Differences in argumentation skills on the pretest-posttest were also shown by an increase in the results of students' argumentation skill scores. The results of calculating the N-gain score are shown in the graph of Figure 1. The following is a graph of the results of calculating the N-Gain score.
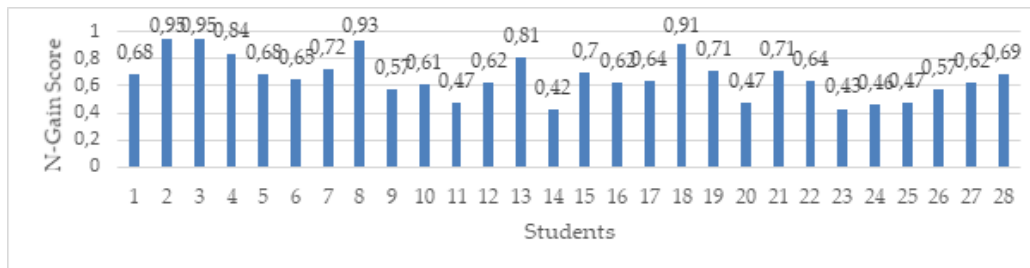
the result of mental construction, namely students construct ideas or concepts or based on their current and previous knowledge. Octaviyani et al(2020) also stated that knowledge construction is easier if done through cooperation and collaboration. Based on the results obtained, it can be concluded that there was an increase in students' argumentation skills before and after the implementation of the ADI learning model.

The results of student response can be seen in the following table 8.

Figure 1. Graph of N-Gain Score Calculation Results

Based on the results of calculating the n-gain score using SPSS assistance, the highest result was 0.95 and the lowest result was 0.42. The average result of increasing student argumentation skills is 0.66 in the moderate category. There is an increase in students' scientific argumentation skills before and after the implementation of the ADI learning model. In contrast to other methods, students are given the opportunity to be involved in the process of investigating the problems given by the teacher in the students worksheet.

Investigation activities carried out by students are carried out in groups to make it easier for students to find answers. This is in accordance with Vygotsky's constructivism learning theory which is

Table 8. Student Response

Indicator	%	Criteria
Show interest in learning model	86.60	Very good
Compatibility of the model with the material	82.36	Very good
Language use	83.48	Very good
Average	**84.15**	**Very good**

The result of the calculation of the student response on the indicator of interest in the learning model is 86.60 with very good criteria. So that it can be said that the ADI learning model can increase student learning interest. This happens because students are actively involved in learning so that students do not feel bored in learning.

The data obtained shows the results of

obtaining a score on the model suitability indicator with the material, namely 82.36%. Interpretation of answers based on student response questionnaires on the suitability indicator of the model with the presentation of the material can be interpreted as very appropriate.

Based on the data obtained, the score on the language indicator is 83.48% in the very good category. Based on the data obtained, it shows that the language used in learning is very good. The use of language affects the process of understanding in delivering material, because with good language it will equate perceptions and lead students' understanding towards the desired understanding. The use of good language will bridge students' understanding in the same direction as the understanding conveyed by the teacher, which later the material can be easily understood by students. So based on the student response questionnaire that the use of language in learning using the ADI model is in the very good category.

Student responses to the implementation of the ADI learning model were very good. Based on the data obtained, the average student response questionnaire score was 84.2% in the very good category. The implementation of the ADI learning model is in accordance with the material on global warming. Based on the percentages in the student response questionnaire, the conclusion is that the use of discussion and suitability of the model with the presentation of material in the implementation of the ADI model is very good and students really like the

learning activities in this study on table 9.

Table 9. Observation Results of Learning Implementation

Meet-ing	Precentage of Implementation (%)			Cate-gory
	Ob-server 1	Ob-server 2	Aver-age	
1	82.76	82.76	82.76	Good
2	93.1	93.1	93.1	Very good
3	92.86	92.86	92.86	Very good
Average			**89.57**	**Good**

Based on the analysis of the observation sheet of the implementation of learning using the ADI learning model, it can be explained that the average percentage of research meeting one implementation of learning is 82.76% in the good category. This shows that the ADI learning model in its implementation has not been fully implemented. At the first meeting many activities had not been carried out because students did not understand how to write argumentation skills and write reports so the teacher was too focused on these stages. So that the learning at the first meeting was not carried out 100%.

The average percentage of the assessment of the implementation of learning at the second meeting was 93.1% in the very good category. The stage that has not been implemented in the second stage is the closing activity. this is because the ADI learning model requires a long time and the teacher is still unable to manage time management in the learning process. So that the stages of the learning process still cannot be carried out perfectly, namely 100% even though there has been an increase in the first meeting.

The average percentage of learning implementation at the third meeting was 92.86% in the very good category but still not 100% implemented. This happened because the work on the posttest questions was carried out at the same time as the learning hours. The teacher also did not pray at the end of the lesson because at that time there was still another lesson so the teacher did not pray before ending the science lesson. This resulted in learning at the 3rd meeting still not implemented 100%.

The results of the percentage score of the implementation of learning at all meetings are also calculated as an average percentage. The results of the calculation of the assessment of the implementation of learning in all meetings is 89.57% in the good category. So it can be concluded that the ADI learning model is important to use for increasing the students' argumentation skills.

As for the research that has been carried out, it can be concluded that the learning process using the ADI model is proven to be able to improve students' argumentation skills even though in this case it is still in the moderate criteria, so it is important to carry out a continuous learning process using this model.

As it has been described that the ADI learning model focuses on a series of investigative activities because in the learning process it emphasizes construction and validation activities so that students become active in the learning process. Therefore, the ADI learning model has an influence on improving students' argumentation skills.

CONCLUSION

The conclusions in this study are: (1) The results of the hypothesis test of the argumentation skill test using the paired sample t test showed that the significance value was 0.000 > 0.05 with the assessment criteria if the significance value was > 0.05 then H0 was rejected and H1 was accepted. This data shows that there are differences in the results of the implementation of the ADI learning model to students' argumentation skills; (2) The results of the N-gain Score test obtain an average score 0.66 with moderate criteria. This shows an increase in students' argumentation skills. (3) The average score of the student response questionnaire was 84.15%. Based on this, it can be concluded that the students' responses to the ADI learning model were very good; (4) The average implementation of learning is 89.57% in the good category. Based on these results it can be concluded that the implementation of the ADI learning model was carried out well.

Based on the research results that have been obtained, it can be concluded that the increase in students' argumentation skills is still relatively moderate so that there is a need for a learning process with the ADI model that is carried out continuously on other topics so that students' argumentation skills can increase higher.

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BRIEF PROFILES

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