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APPLICATION OF THE SOCIO SCIENTIFIC ISSUE STRATEGY TO IMPROVE STUDENTS' SCIENTIFIC ARGUMENTATION SKILLS ON THE CONCEPT OF THE RESPIRATION SYSTEM IN CLASS XI MIPA SMAN 1 SURANENGGALA

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Abstract: Argumentation ability is one of the main objectives of science learning because students must know the scientific explanation of natural phenomena, use it to solve problems and be able to understand other findings that students get. SSI learning (Socio-scientific Issues) is expected to develop the ability to learn scientifically, because in SSI (Socio-scientific Issues) learning is carried out on scientific concepts that have an impact on people's lives. The purpose of this study (1) to describe the application of Socio Scientific Issues learning strategy in the experimental class (2) to analyze the differences in the improvement of students 'scientific argumentation skills between the control class and experimental class on Socio Scientific Issues learning strategies, (3) describe students' responses to Socio Scientific's learning strategies Issues on the concept of the respiratory system. This research was conducted at Suranenggala Public High School 1 in the even semester with a pretest-posttest control group design research design design. The sample in this study were students of class XI-MIPA 1 (experimental class) totaling 35 people and class XI-MIPA 4 (Control class) totaling 35 people. Data collection techniques: observation, student worksheets, tests (pretest and posttest), and questionnaires. The results of the study show that (1) the implementation of the Socio Scientific Issues strategy as a whole can be carried out very well, (2) There is a difference in the ability of scientific argumentation between students using Socio Scientific Issues learning strategies and students who do not use Socio Scientific Issues learning strategies in learning biology. (3) Students' responses to the application of Socio Scientific Issues learning strategies show an agreed response from students and can produce positive responses from students.

Keywords: Socio Scientific Issues; Respiration System; Scientific Arguments

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INTRODUCTION

Argumentation skills are important to be empowered in science learning so that students' science literacy skills can be improved. According to Erduran et al., (2006) an important aspect of scientific literacy, one of which is understanding and applying scientific argumentation skills. Osborne et,al., (2004) argue that argumentation is the main thing to underlie students in learning how to produce evidence, test, and evaluate theories, and communicate like a real scientist. According to Song & Deane (2014), argumentation plays an important role in developing critical thinking patterns and adding a deep understanding of an idea or ideas. Argumentation is important to develop in biology learning because it is able to improve thinking to test students' understanding.

The ability of argumentation is one of the main objectives of science learning because students who study science must know scientific explanations regarding natural phenomena, use them to solve problems and be able to understand other findings they get, in addition to being able to understand the character of scientific knowledge that always develops over time. Students who understand science as a whole must be able to understand the language of science and actively participate in scientific activities such as observation and argumentation. In reality, there are still many students who have difficulties in this matter so learning must begin to be directed towards involving students in scientific argumentation as part of science. This is the ability to analyze and the student's argumentation ability is low. Based on the results of previous research conducted by Sandoval (2005) which stated that high school students in developed countries, have difficulty in making scientific arguments, the difficulty felt in explaining the symptoms of science empirically in class discussions. Students' scientific argumentation skills that are still considered low are likely to be related to the lack of student learning experience and the teacher's dominance in the learning process causes students' understanding of the material to be lacking, this causes low analytical ability so that *scientific argumentation* ability) undeveloped. As Newton &Osborne (2000) and Erduran et al., (2006) argue, that science learning lacks the opportunity for learners to learn how to engage in scientific argumentation productively as part of teaching. Aspects of argumentation can be developed through an appropriate learning process. One of the efforts to improve students' argumentation skills is to apply the SSI (*socio scientific issues)* learning strategy. According to Andryani (2016: 12) SSI (*Socio-scientific Issues)* learning streamlines learning on aspects of daily life with pro and con science issues and social issues in the community environment, so that this SSI learning has a sense of curiosity for students to recognize controversial issues in everyday life. Learning based on Socio scientific Issues can develop students' critical way of thinking about an issue or problem faced in the real worldScio-scientific Issues (SSI*)* learning strategy is a learning strategy that in the learning process material is associated with social issues in the environment and society that have the potential to support the development of intellectual abilities, communication skills, social attitudes, concerns and student participation. This strategy aims to stimulate intellectual, moral and ethical development as well as awareness regarding the relationship between science and social life (Zeidler, et al., 2005: 359). The scientific argumentation ability of students at SMA N 1 Suraneggala is still relatively low, this is based on the results of surveys

and interviews with teachers of Biology subjects at SMAN 1 Suranenggala, that learning at SMA 1 Suranenggala still uses the *Teacher Center* system which means that learning is still teacher-centered, students are not given the opportunity to be actively involved in learning so that students' abilities do not develop, one of which is the ability scientific arguments, especially in the Cirebon Regency area, the issue developed that the learning system at SMA 1 Suranenggala was not good, many students were still skipping lessons and so on. Based on this, it is necessary to conduct research as an effort to develop and improve the ability to argue scientifically for students through the SSI (*Socio scientific Issues)* learning strategy with the title "Application of *Socio Scientific Issues* Strategies to Improve Students' Scientific Argumentation Ability on the Concept of a Respiration System Class XI MIPA at SMAN 1 Suranenggala. The objectives of this study include (1) describing the application of the Socio Scientific Issues Learning strategy to the concept of a respiration system in Class XI MIPA SMAN 1 Suranenggala to improve students' scientific argumentation skills, (2) analyzing differences in students' scientific argumentation abilities between the control class and experimental classes with the socio Scientific Issues learning strategy on the concept of a respiration system in Class XI MIPA SMAN 1 Suranenggala and (3) describing the response students towards learning biology by using the *socio scientific issues* learning strategy on the concept of a respiration system in Class XI MIPA SMAN 1 Suranenggala.

MATERIALS AND METHODS

The research was conducted in the even semester of the 2018/2019 school year, starting from March to April 2019. The place of this research is at SMA Negeri 1 Surenenggala which is located on Jl.Syekh Magelung Village / Kelurahan Suranenggala, Suranenggala District, Cirebon Regency, West Java. The method used in this study is a quantitative-descriptive method, with a *pretest-posttest control group design* where the experimental group and the control group are randomly selected (Sugiyono, 2009). The population in this study was class XI MIPA at SMA Negeri 1 Suranenggala, while the sample in this study was class XI MIPA 1 as an experimental class and class XI MIPA 4 as a control class.

DATA COLLECTION TECHNIQUES

Data collection in this study used observation techniques, student worksheets, tests and questionnaires. First, the observation technique using an observation sheet is used to measure the implementation of student activities in learning with the *Socio Scientific Issues* strategy by using the observation assessment rubric that must be filled out by the observer. In addition to the observation sheet, student worksheets (LKS) are also used as a supporting instrument for assessing the implementation of learning with *the Socio Scientific Issues strategy.* Second, the test used is in the form of a description test (essay) in the form of a description test (essay) as many as 6 questions. Tests are carried out in control classes and experimental classes to obtain data on students' scientific argumentation ability on the concept of the respiration system. The making of the question is guided by aspects of scientific argumentation according to MC.Neil and Krajick (2006). Third, a questionnaire or questionnaire which is a list of statements that must be filled out by respondents (students) to get data on student responses to learning with the *Socio Scientific Issues strategy.*

STATISTICAL ANALYSIS TECHNIQUES

Data analysis in this study uses statistical methods, because the research method used is a quantitative research method. There is[un stage of analysis and the formula used is as follows: (1) analysis of research instruments, namely validity tests, reability tests, differentiating power and analysis of difficulty levels carried out using *Anates Software* description, (2) N-Gain test, used to show an increase in students' scientific argumentation ability after being given treatment, (3) statistical tests of research results using *SPSS* Software version 21.0, which is in the form of prerequisite tests (normality test and homogeneity test) and hypothesis tests such as the independent parametic test *of the T-test sample* if the data obtained are normally distributed and homogeneous, while if the data obtained are abnormally distributed and inhomogeneous, a non-parametric test *of Mann-Whitey U* is used. Hypothesis tests were carried out to determine the differences in improving students' scientific argumentation abilities in the experimental class and the control class.

RESULTS AND DISCUSSION

A. Application of Socio Scientific Issuses Learning Strategies in experimental classes

Description of Learning With the Application of Socio Scientififc Issues Learning Strategies on the Concept of Respiration System

The process of measuring the application of learning strategies is used student worksheets and observation sheets. The student worksheets used are arranged based on the stages of *socio scientific issues* learning strategies according to Yulistiani, et al (2016) combined with aspects of scientific argumentation according to Mc.Neil Krajick. (2006). Student worksheets are carried out during 2 meetings and are carried out by forming groups in the learning process. The data obtained for each meeting can be seen from the following diagram:

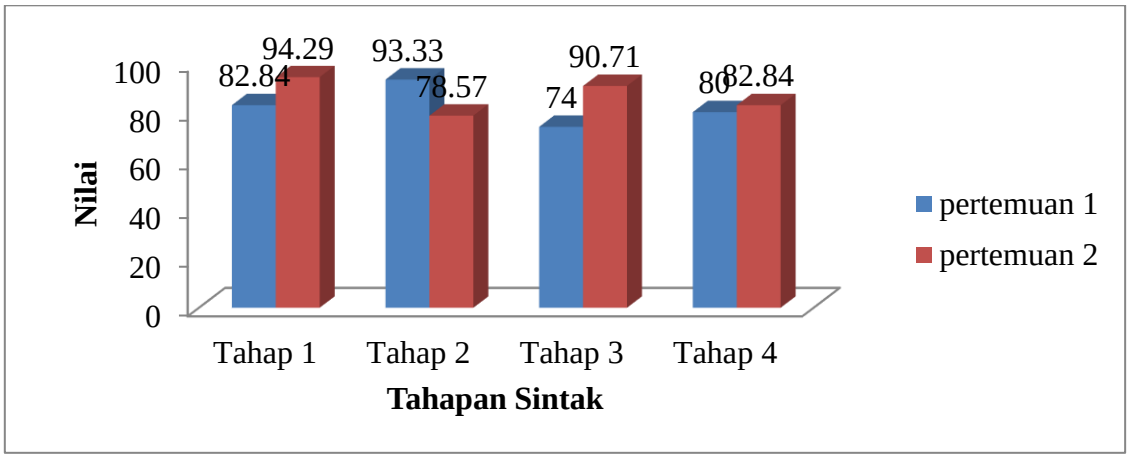

Figure 1. Diagram of the value of the student worksheets at each meeting per syntact of *the learning strategy socio scientific issues.*

Description of the stages:
1: scientific background
2: evaluation of information
3: local, global and national dimention
4: decision making

Based on (figure 3.1) the student worksheet values at the first meeting show each group and its syntactics. The results showed that the highest presentation was obtained by the second syntactic, namely *the evaluation of information* with a percentage of 93.3%. This percentage shows that the implementation of the second syntactic in the learning strategy *of socio scientific issues* is carried out very well. At this stage, students identify problems in a social science issue and present scientific data and evidence related to social science issues in the student worksheet which in the student's worksheet is presented in the form of an article. While in the first syntactic, namely *scientific background*, the percentage shows 82.85%, meaning that the implementation of the first syntactic also has very good criteria. At this stage students explain social issues from a scientific point of view. The third syntactic, namely *Local, global and national dimension*, shows a percentage of 74%, this also shows that the implementation of this third syntactic is well carried out. At the third syntactic students identified the local, global and national impacts of the social issues of science presented. And the smitten syntactic is *decision making*, the percentage shows 80%, meaning that the implementation of this fourth syntactic is well carried out. At this syntactic, students present decisions related to problems in social science issues that are presented in student worksheets. Meanwhile, the student worksheet scores at the second meeting (see figure 3.1) show the student worksheet scores of each group and per syntactic. The results showed that the highest presentation was obtained by the first syntactic, namely *scientific background*, with a percentage of 94.29%. This percentage shows that the implementation of the first syntax in the learning strategy *of socio scientific issues* is carried out very well. At this stage students explain social issues from a scientific point of view which in the student worksheet is presented in the form of an article. Meanwhile, in the second syntactic, namely the *evaluation of information*, the percentage shows 78.57%, meaning that the implementation of this second syntactic has good criteria. At this stage, students identify problems in a social science issue and present scientific data and evidence related to social science issues in the student worksheet which in the student's worksheet is presented in the form of an article. The third syntactic, namely *Local, global and national dimension*, showed a percentage of 90.71%, this also shows that the implementation of this third syntactic is very well carried out. At the third syntactic students identified the local, global and national impacts of the social issues of science presented. And the kempat syntactic is *decision making*, the percentage shows 82.84%, meaning that the implementation of this fourth syntactic is very well carried out. Based on figure 3.1, it is known that the percentage of value in each syntactic has increased from each meeting, except in the second syntactic, namely the *evaluation of information,* in this syntactic the percentage value has decreased from a percentage of 93.33% to 78.57%. According to researchers, this is due to the issue factor created in the form of an article in a student worksheet, where the issue in the first student worksheet is simpler

and easier to have a difficulty level, so students. it is easier to evaluate social science issues in such worksheets. Meanwhile, in the worksheet, students are met second where there are two issues in the worksheet where the issues presented are higher in difficulty so that students are more difficult to evaluate social science issues in the worksheet. However, in other syntactics students are able to do well so that there is an increase in the percentage of grades. By the time the presentation is completed from each group, each representative of the group is always there to put forward different rebuttals and arguments against the statements and *Evidances* that the other group gives. This shows that one of the indicators of scientific argumentation, namely *Rebbutal* (providing a rebuttal to other arguments) is also carried out, although it has not shown good arithmetic.

Here's the group 1 argument about cigarette production if stopped: "cigarette production cannot be stopped, because the profit from the sale of cigarettes has a great effect on state taxes."

The argument received a rebuttal from group 3, namely: "we agree but don't really agree if cigarette factories and cigarette production are stopped. This is because we see from various aspects related to the establishment of a cigarette factory. in terms of health, we strongly agree that cigarette production is stopped given the dangers of cigarettes to the health of active smokers and even passive smokers. But when viewed in terms of the income of state expenditure money, which we know the biggest income of the country is from the cigarette tax, apart from tu in terms of the welfare of cigarette factory owners, the work of cigarette factories and even tobacco farmers whose lives depend on cigarette factories, if cigarette production is stopped their welfare will be disrupted."

According to the researcher, the rebuttal given by group 3 is very good, where the argument contains a clear Claim and the data as the reason given also shows the impact from various sides so as to be able to strengthen the *Claim* that has been given. Here's another example of an argument from group 5 about whether it's true that air pollution was the cause of Ella Kissi's death in the article: *" That's right, Ella kissi died from asthma that recurred by air pollution, where air pollution is a triggering factor for asthma."*

The argument received a rebuttal from group 4, namely: *"yes, that's right, in the article it is explained that Ella Kissi died as a result of her asthma that recurred by dirty air pollution. Air pollution is indeed one of the triggers for asthma, but it is possible that the asthma suffered by Ella Kissi has caused complications, as stated earlier that acute asthma can trigger various complication diseases such as Pnemonia, damage to the lungs, respiratory failure and so on. So that complication caused Ella Kissi to die."*

According to researchers, the rebuttal given by group 4 is very good, where the rebuttal of the argument contains a clear Claim and is strengthened by various theories such as asthma triggering factors and the impact of asthma so that it can strengthen the *Claim* that has been given. The rebuttals/arguments given by groups 3 and 4, according to the researchers, are sufficiently representative of *the Rebbutal* indicators, have been achieved. *Rebbuttal* is one of the indicators of scientific argumentation. Where *Rebbutal* is a statement of rebuttal to an argument or rejection of the argument of another group.

According to Lewellyn (2013) argues or gives rejection of other groups' arguments is a process of discussion. In the learning process, both at the first meeting and the second meeting, on the student worksheet that is the subject of student discussion , namely sociointific issues. Sociosintific issues used by researchers can help students in the learning process, especially in improving the ability of scientific argumentation. According to Zeildler et,al., (2005) Learning with SSI (*Socio scientific Issues*) involves problems or issues that develop in society that are closely related to science. The use of SSI can help students in the learning process, especially in improving students' science literacy and argumentation skills.

Here's a recap of the average percentage of student worksheets in two meetings:

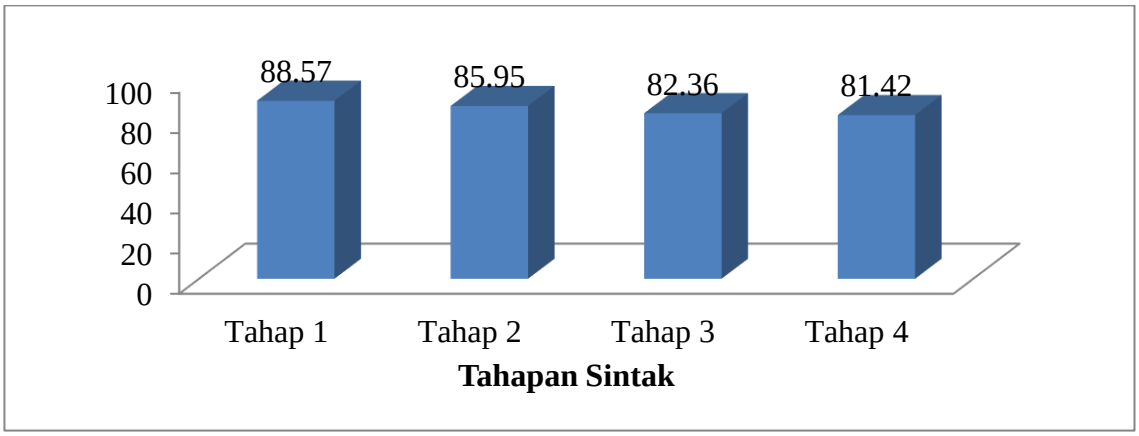

Figure 2. Diagram of the average percentage of student worksheet scores (per syntact) in two meetings using *socio scientific issues* learning strategies.

Description of the stages:
1: scientific background
2: evaluation of information
3: local, global and national dimention
4: decision making

Based on (figure 3.2) the percentage of implementation of the stages of the *Socio scientific Issues* learning strategy in the two meetings shows the percentage of the implementation of the *scientific background > evaluation of information > local, global and national dimention > decision making.* According to researchers, this is explained at the *scientific background* stage students only have to explain and give a forecasting statement on the existing issue from a scientific point of view, this will not be too difficult for students because expressing a statement on an issue can be based on the student's own knowledge and can be logically. Meanwhile, in syntactic *evaluation of information* and *local, global and national dimention* where students must identify problems in an issue, present data and the impact of problems in the local, national and global domains related to the problems of an issue. Little knowledge or insight will make it difficult for students to provide scientific data and their impact from various domains, even a minimal understanding of biological concepts in learning can make it difficult for students to provide scientific data to support a statement. And in *decision making* syntax where students must present solutions or decisions of the problems of the issues presented. This

will be difficult for students to do if students do not master the concepts and theories of biology well. Based on the results of research obtained on the application of socio scientific issues learning strategies using student worksheets from the first and second meetings at each syntactic of their learning strategies in the experimental class tends to increase, where the percentage of implementation *of the scientific background stage > evaluation of information > local, global and national dimention > decision making*.

Student Learning Activities at Each Meeting Based on Each Indicator

In the process of measuring or assessing the results and learning process of students used observation techniques. The observation of student learning activities carried out at this first meeting includes 5 indicators, namely students give statements that answer a problem, students give statements of attitudes towards a problem, students explain scientific data that supports a statement, students present examples as real facts and evidence to support a statement, students submit a rebuttal or argument against a statement statements or arguments of other groups in the discussion and presentation of student worksheets. The learning process always gives rise to varied student activities or activities. This activity is known through observation in each student using five indicators. The data obtained for each meeting can be seen in the following diagram:

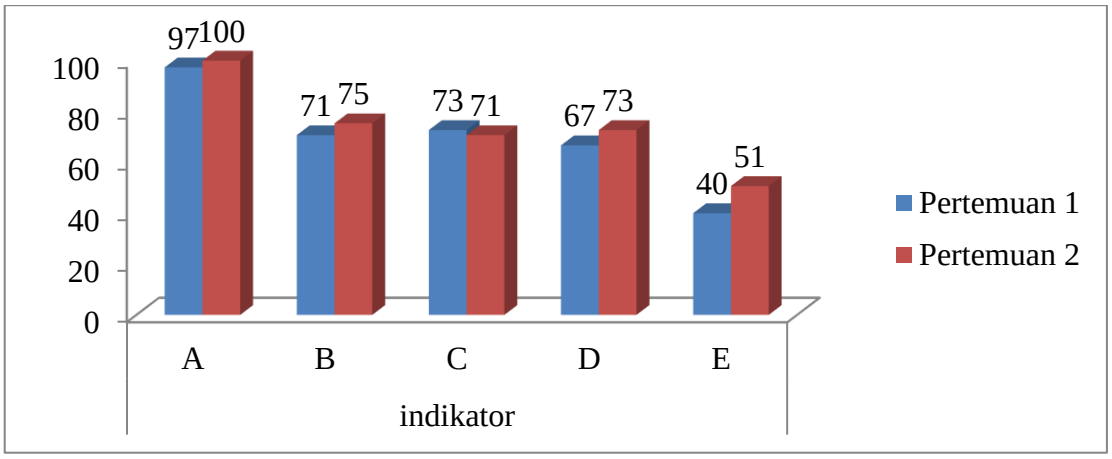

Figure 3. Diagram of student learning activities at each meeting per indicator

Description of the indicator:

A : the student gives a statement that answers a problem
B : students give a statement of attitude towards a problem
C : the student explains the scientific data that supports a statement
D : students present examples as real facts and evidence to support a statement
E : the student submits a rebuttal or argumentation of resistance to a statement or argument of another group

Based on the results of the research on (Figure 3.3) student learning activities at the second meeting have increased in each indicator. The achievement of the criteria in each

indicator is very good, good and less. Indicators that obtain excellent criteria and have increased are the first indicators, namely providing statements that answer a problem, while indicators that have good criteria are the second, third and fourth indictors, namely providing a statement of attitude towards a problem has good criteria, students explain scientific data that supports a statement and students present examples as real facts and evidence for support a statement. And the fifth indicator is that students submit a rebuttal or argument against a statement or argument of another group in the discussion and presentation of worksheets of students who obtain the criteria of lack of the first meeting have very less criteria. This shows an increase in student activities in giving statements, providing attitude statements, explaining scientific data and examples as evidence and submitting rebuttals to other groups' arguments. According to researchers, the increase in criteria on each indicator of student activity occurred due to the factor of the discussion method with the material discussed more about the content of the facts of daily life close to them than at the first meeting where there were still many theoretical and antusism of students was increasing. Subiantoro (2017) mentioned that SSI is a strategy that aims to stimulate intellectual, moral, and ethical development as well as awareness regarding the relationship between science and social life. *Socio Scientific Issues* (SSI) is a new strategy in science learning. This strategy emphasizes social issues that develop in society, can be studied scientifically to be able to develop thinking skills, improve good morals, and student ethics. *Socio Scientific Issues* can also train students to think at a high level including analyzing a problem, synthesizing, evaluating information, expressing arguments rationally well, honestly, and ethically, and being able to make decisions. Based on research data from student worksheets and observation sheets, the application of *the Socio Scientific Issues* learning strategy can be carried out very well and the *Socio Scientific Issues* strategy is effective to be applied in biology learning.

Differences in Students' Argumentation Ability Between Experimental Class And Control Class

Improving students' scientific argumentation skills can be known through the results of pretests and posttests in each class both in general and in each aspect of scientific argumentation ability. The followingis a comparison of the average scores of students' scientific arguments obtained from *pretests* and *posttests* in experimental classes and control classes can be seen in figure 4

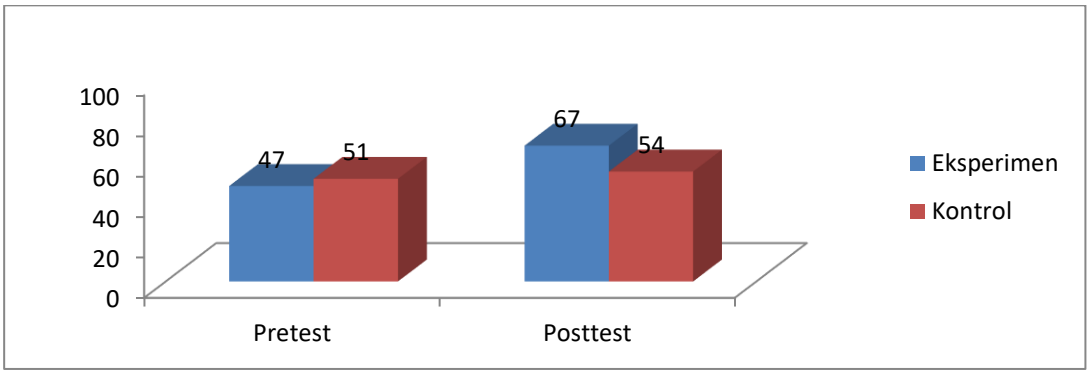

Figure 4. Diagram of the average value of the pretest-posttest of the student's scientific argumentation ability between the experimental class and the control class in general

Based on (Figure 3.4) the average pretest score of the scientific argumentation ability of students of the experimental class and the control class, where in the control class it is greater than the experimental class. The experimental class obtained an average score of 47 with the medium category while the control class obtained a score of 51 with the medium category. Meanwhile, in *the posttest*, the average score of students' scientific argumentation ability in the experimental class and control class increased. The increase obtained by the experimental class was higher than that of the control class, where the experimental class obtained a grade average score of 67 in the high category, while the control class increased with the average score of class 54 with the medium category. The difference in the average value of students' scientific argumentation ability between the experimental class and the control class can be described and observed in more detail in figure (3.5) Here is a graph of the average value of *the pretest-posttest* of each indicator of scientific argumentation:

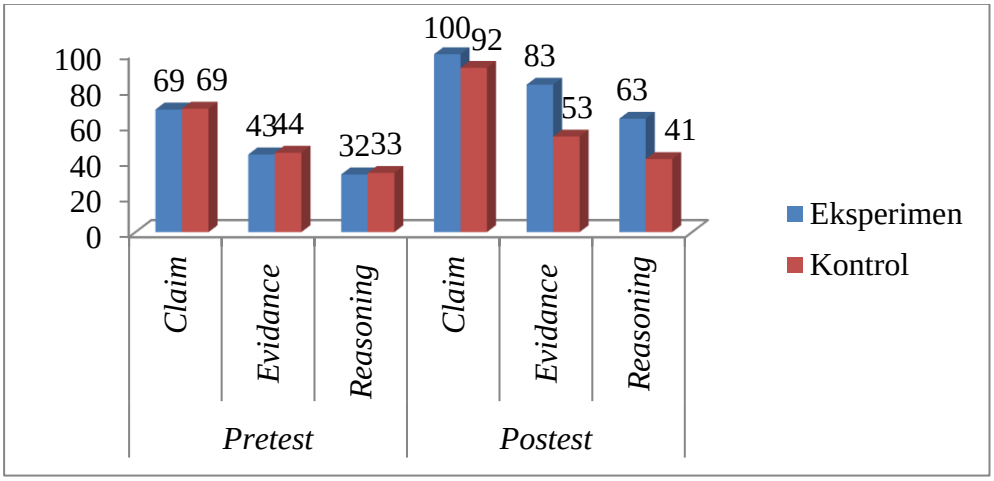

Figure 5. Diagram of the average value of the pretest-posttest per-indicator of the student's scientific argumentation ability between the experimental class and the control class

Information:

Claim : The first statement that answers a problem

Evidanve : Scientific data that supports a statement referring to the theory

Reasoning : Evidence supporting a *Claim* and *Evidence*

Based on (figure 3.5) the control class *pretest*, *the Claim* indicator obtained the highest average value, while the *Reasoning* average value was the lowest *pretest* value . Thus the average value of the pretest of the control class can be written with *Claim* > *Evidanve* >*Reasoning* . Also, the experimental class of the highest *pretest* average value lies in *Claim* while the lowest *pretest* average value is found in *Reasoning*. So it can be concluded that the average value of the experimental class pretest for each aspect of Scientific

Argumentation is *Claim* > *Evidanve* > *Reasoning*. After following the learning process (Posttest value), there is an increase in *posttest* scores both in general and per indicators of student scientific argumentation. Aspects of scientific argumentation ability according to Mc.Neill and Krajick (2006) include *Claim, Evidence, Reasoning* and *Rebuttal*. Based on the results of the study, the *Claim* aspect obtained the highest percentage of the average value compared to other aspects. According to the researcher, this is because the *Claim* aspect is a disclosure of a statement on a problem. Where students are expected to be able to express their concerns about an issue or a problem, this will not be too difficult for students because expressing a statement on an issue can be based on the student's own knowledge and can be logically. in addition, the *Claim* that must be given by the student is a brief statement or *Claim*. But students are not encouraged to originate in giving their statements, because *claims* are underlying *Evidence* and *Reasoning*. If *the Claim* is wrong, then *the Evidence* and *Reasoning* are not necessarily true. According to Fisher (2009) the ability of scientific argumentation, especially *Claim*, is the foundation of logical and critical thinking which involves the ability to express opinions with the addition of argumentation, which is a reason. Supported by Keraf (2007) scientific argumentation is a statement supported by some evidence or fact. Furthermore, the *Evidence* aspect is the second aspect that obtains the second highest percentage after the *Claim* aspect. Where students are required to present scientific data both from the theories they have learned in learning and scientific data derived from what students know from various media and even practicum. Little knowledge or insight will make it difficult for students to provide scientific data, even a minimal understanding of the concept of biology in learning can make it difficult for students to provide scientific data to support a *Claim*. Khun (2010) states that a person's argument is not only in the form of a theory but must be proven to be true either by providing examples of real facts or research results from experts.

Furthermore, the Reasoning aspect that obtains the lowest percentage of the average value. According to the researcher, students are able to give their arguments in writing but are not accompanied by examples of facts that support their arguments. The results of this study support Sandoval's (2005) research that shows that students often do not use sufficient evidence or try to justify their statements or the use of evidence in the resulting arguments. *Reasoning* aspect is a reason or justification as evidence that can be in the form of examples of facts or scientific that have occurred or are still in the form of a theory. Where the student is required to present a reason, for example as evidence that justifies *the Claim* and *Evidence* at the beginning. *Reasoning* is an important aspect because *both Claim* and *evidence* cannot be proven if the evidence is not able to be presented. This will be difficult for students to do if students do not master the concepts and theories of biology well so that students cannot provide supporting evidence. According to Khun (2010) argumentation is not only limited by theory but students must be able to prove their truth. The *Rebuttal* aspect as an additional aspect that can be measured by discussion and presentation. *A rebuttal* is a statement of rebuttal to an argument or rejection of another group's argument. According to Llewellyn (2013) argues or gives rejection to the arguments of other groups is a process of discussion. Here's an *N-Gain* graph of the Scientific Argumentation ability between the control class and experimentation in general:

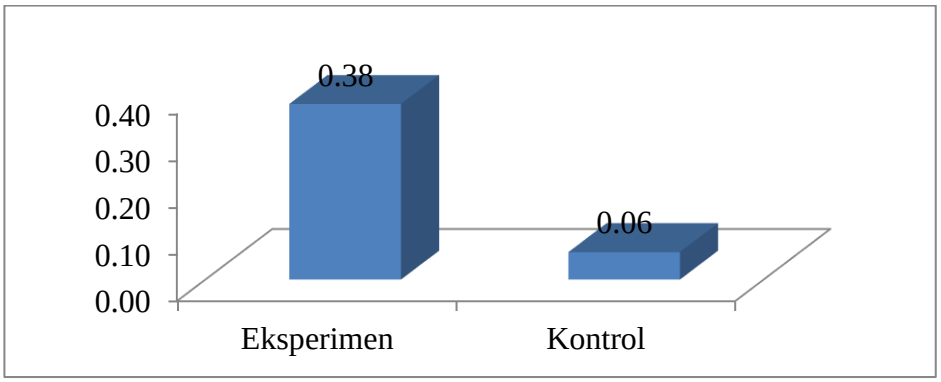

Figure 6. *N-Gain* Value Diagram of Scientific Argumentation Ability Between Experimental Class and Control Class in General

Based on figure 6, it shows that the experimental class has a higher increase in scientific argumentation ability compared to the control class. The experimental class obtained *an N-gain* of 0.38 with a medium N-gain value category, while *the control class's N-gain was* only 0.06 with a low N-gain value category. These results are then analyzed with statistical tests that include pre-ground tests and hypothesis tests.

Table 1. hypothesis test results

Data	Hypothesis Test	Sig.	Ket.
N-Gain	Mann Whitney	0,000	Significantly differs

Based on the results of the hypothesis test with the Mann Whitney test (table 3.1) *the N-gain* data showed a significance value of 0.000 which that Ho was rejected and Ha was accepted. Based on these data, it can be concluded that there is a significant difference in improving students' scientific argumentation ability between the experimental class and the control class. Differences in the improvement of students' scientific argumentation skills showed significant results. This can be recorded with an example of the answer pretest number 6 from Rosdiana one of the students in the experimental class*:*

" active smokers should not be shunned. Since everyone has their own right to their lives, we just need to respect each other without staying away from or even excommunicating. Cigarette smoke is indeed harmful to us passive smokers, but that doesn't mean we should stay away from active smokers, we just need to use a mask. And our attitude towards cigarettes yes should stay away from them but towards passive smokers should not stay away from them."

According to the researcher, according to the researcher, the student was able to provide *Claim* well, but still could not provide scientific data / *Evidence* related to harmful substances in cigarettes as a reinforcement of their initial statement or *Claim*. This is different from the answer to the number 6 prostest question from Rosdiana, one of the students in the experimental class.

" *Yes, if you look at it from the health side, active smokers should indeed be shunned by the cigarette smoke produced when smoking. But if we're not smoking, we don't need to stay away from active smokers. As already explained that the cigarette smoke emitted*

from active smokers is very harmful to us passive smokers, even according to the doktersehat.com present in the arrticle, of the 100 percent danger from cigarette smoke, only 25 percent is felt by active smokers, given the presence of a filter at the end of the cigarette. Meanwhile, 75 percent of the danger is actually obtained by passive smokers because they are exposed to cigarette smoke directly. With the dangers of cigarette smoke, there is no doubt about it. Especially with the victims who died due to direct exposure to cigarette smoke, such as Tika, a housewife who died due to continuous inhalation of cigarette smoke produced by her husband (tribunjogja.com). it is certain that our attitude as a student towards cigarettes is not to use them even a little, because in cigarettes it is addictive substances that can create the opium effect of the user. But our attitude towards active smokers is to keep our distance when smoking only, the rest is not necessary. Even when necessary, we remind each other of the dangers of cigarettes to the body if they are continuously consumed."

This answer is enough to prove that there is indeed an increase in the scientific argumentation ability of students who are singnified in the experimental class. According to the researcher from the answer above, the student has been able to give *a Claim* correctly, present scientific data or *Evidence* related to substances harmful to cigarettes and their impact well even evidence / *Reasoning* as a reinforcement *of Claim* and *Evidence* that has been given. As osborne.J. (2010) argumentation in the field of science focuses on building new knowledge about the world of science through criticism and ideas accompanied by appropriate evidence. In addition, Inch et,al., (2006) explained that the ability to argue is the ability of a person to carry out the process of making a statement accompanied by evidence and logical reasons with the aim of justifying the possibility, attitude or value, maintaining it and influencing others.

Student Responses to Socio Scientific Issues Learning Strategies To Improve Students' Scientific Argumentation Skills

The questionnaire was used to determine students' responses to *the Socio Sciebtific Issues* learning strategy that the researcher had applied as material for evaluation and reflection to be able to provide even better and more quality, so the researcher distributed the questionnaire to an experimental class of 35 students. The questionnaire consists of 14 indicators and 28 statements which contain students' responses to the use of the *Socio Scientific Issues* strategy in the learning process and aspects of scientific argumentation ability in learning using the *Socio Scientific Issues* strategy with a scale of 4, SS (Strongly Agree), S (Agree), TS (Disagree), STS (Strongly Disagree). The following are the average results of the questionnaire on the learning aspect using *the Socio Scientific Issues* strategy which has been analyzed and outlined in the pie diagram.

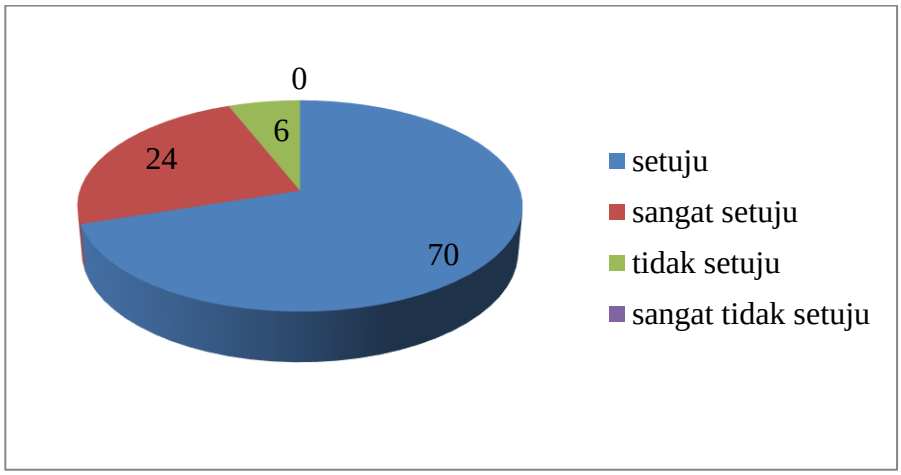

Figure 7. Diagram Persentase Average Student Response to aspects of learning using *the Socio Scientific Issues* strategy

Meanwhile, the average results of the questionnaire on the aspects of scientific argumentation on learning using the *Socio Scientific Issues* strategy that have been analyzed andtmoneyed in the following pie diagram:

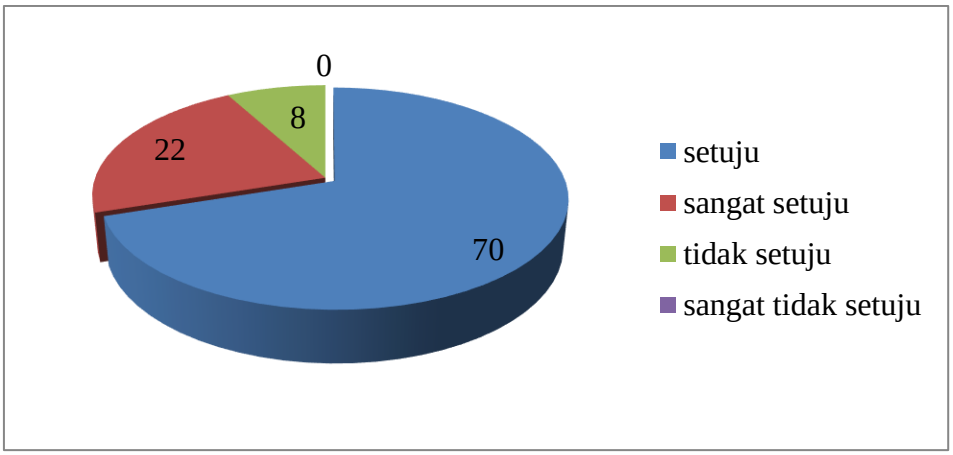

Figure 8. Diagram paverage percentage respon siswa on aspects of scientific argumentation on learning using the *socio scientific issues strategy.*

The results of measuring student responses to learning aspects using the *Socio Scientific Issues* strategy which includes 9 indicators in the questionnaire including 1) encouraging learning, 2) building curiosity, 3) emphasizing time effectiveness, 4) interested in learning with the *Socio Scientific Issues* strategy , 5) build student activity, 6) re-deliver the material, 7) build learning motivation, 8) support understanding of the material and 9) shape students' insights. Based on figure (3.7) the diagram of the percentage of student responses using *the Socio Scientific Issues* strategy in the learning process shows that learning using this learning strategy can produce a positive response from students. Meanwhile, the results of measuring students' responses to aspects of scientific argumentation ability in learning use *the Socio Scientific Issues* strategy which includes 5 indicators in the questionnaire including 1) building students' scientific argumentation skills, 2) identifying problems from an issue, 3) presenting data scientifically, 4) providing solutions / decisions and 5) providing rebuttals. Based on figure (3.8) diagram procentase aspects of scientific argumentation ability in learning using *the*

Socio Scientific Issues strategy, it shows that learning using this learning strategy received a positive response to the improvement of students' scientific argumentation ability. Based on these results, it can be concluded that students feel interested and happy in learning biology using *the Socio Scientific Issues* strategy. According to researchers, this is because in the learning process students are required to be actively involved and students are given examples of sociosaintific issues that occur in everyday life. Sadler (2011) emphasized that it is important for SSI to provide meaningful learning situations for students to be able to apply their biological knowledge to the social atmosphere in the classroom. Meanwhile, according to Yulistiani, et al (2016) the application of *Socio Scientific Issues* in learning is expected to improve mastery of concepts and train students to think critically about the issues presented. In addition, it can improve students' ability to make decisions.

CONCLUSION

The application of *the Socio Scientific Issues* learning strategy in the experimental class can be carried out properly. The first syntactic, namely *scientific background* with a percentage of 88.57%, means it is carried out very well, the second syntactic is *evaluation of information* with a percentage of 85.95% means it is carried out very well, the third syntactic *is Local, global and national dimension* with a percentage of 82.36% means it is carried out very well, and the fourth syntact *decision making* with a percentage of 81.42% means that it is carried out very well. So the implementation of the *Socio Scientific Issues* strategy as a whole can be carried out very well. There is a difference in the improvement of scientific argumentation skills between those who use the *Socio Scientific Issues* learning strategy and students who do not use the *Socio Scientific Issues* learning strategy in biology learning. Students' responses to the application of *the Socio Scientific Issues* learning strategy showed an affirmative response from students and could generate a positive response from students.

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