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The correlation between scientific argumentation with viruses learning outcomes of senior high school student

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ABSTRACT

This study aims to determine the correlation between scientific argumentation with learning outcomes of Senior High School students. This research was quantitative descriptive correlation analysis. The population of two classes from X science class of senior high school were used as research sample with Saturated Technique. The number of students were 47. The learning achievement data collection instrument was twenty multiple-choice questions with four answer choices. The instrument of scientific argumentation ability was a test item in the form of a three questions description. Data was analyzed for Pearson Correlation test or Product Moment correlation (SPSS 23). The results showed that the learning outcomes of students based on a test item has good category while writing scientific arguments of students has fair category. The average results of students' scientific arguments based on Toulmin's Argument Pattern (TAP) have a level 2 argumentation quality category namely 0.033 shows that there was low correlation between the two variables with a correlation coefficient of 0.311. The positive coefficient indicates the direction of a positive relationship, that is, two variables are directly proportional.

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INTRODUCTION

National education functions to develop capabilities and shape the nation's character and civilization with dignity in order to educate the life of the nation, aiming at developing the potential of students to become human beings who believe in and fear God Almighty, have noble, healthy, knowledgeable, capable, creative, independent , and become a democratic and responsible country (Law no 20 of 2003 chapter 2 article 3 of the national education system). The curriculum is a way to realize national education goals. One of them is the application of the 2013 curriculum.

The 2013 curriculum requires students to be active, creative and innovative in the learning process as well as the presence of competencies in accordance with the demands of the functions and objectives of national education (Kurniasih and Bani, 2014). Related to the existence of these competencies, every graduate of primary and secondary education units must have competencies in three aspects namely cognitive, affective, and psychomotor (Hamdani, Prayitno, & Karyanto, 2020; Kemendikbud, 2016). These three dimensions can be achieved through the learning process (Fajar et al., 2020).

The ability of scientific argumentation is one of the outcomes on the learning process from the psychomotor aspect. Scientific argumentation is also an important component in scientific literacy, because it is not only knowledge but also processes data, analyzes and communicates the results of the analysis verbally and in writing (Ristanto, Zubaidah, Amin, & Rohman, 2018). Argumentation has an important role in many disciplines, one of which is in the field of science (Deng & Wang, 2017). In the field of science, argumentation can be useful as a dialogic and interactive process, so students can develop skills, enhance understanding of concepts and improve student performance (Faize, et al., 2017).

Scientific arguments also underlie students in learning on how to think, write, act and communicate (Probosari, et al., 2016). One form of communication in learning that occurs in schools is the interaction between teachers and students or between students. The interaction can be expressed ideas or rebuttal about a material being discussed. The idea or rebuttal that is submitted must have components that are able to support the argument, so that the argument conveyed can be accepted by others. In addition, the ability to argue can be used to overcome differences of opinion, as well as to influence someone taking action or not taking action (Lazarou, et al., 2016).

Based on this description, scientific arguments are very important in the learning process and interact with other people and the allegations will affect the learning outcomes. The ability of argumentation in science knowledge will exercise responsibility and make students' learning outcomes more meaningful (Rahmawati, 2014). In line with the greater the communication skills (listening, reading, speaking and writing), the greater the learning outcomes (Desta, 2011). The ability of scientific argumentation is the ability to communicate that is obtained from the learning process. Students who are able to express their opinions are equipped with data, evidence, understand the topic discussed and can be said to have good learning outcomes. The application of Toulmin's Argument Pattern (TAP) in learning is supported by the assumption that the more TAP elements in a dialogue, the better the quality of argumentation. Claims are supported by reasons including data, warrant, backing, rebuttal and qualifer considered to represent a more complex argument (Simon, 2008).

Based on the previous explanation, the ability of scientific argumentation is related to learning outcomes. Argumentation facilitates the understanding of cognitive abilities activities in building scientific knowledge, so that the empowerment of argumentation abilities will have an impact on students' cognitive abilities (Viyanti, et al., 2016). In line with the research which states that practicing argumentation skills means training students' cognitive abilities (Sampson & Gerbino, 2010; Erduran & Maria, 2008). The results of observations and interviews with Biology class X teachers at SMA also showed that the quality of scientific argumentation of

the students was not yet known. In fact, the ability of scientific argumentation is related to learning outcomes.

The ability of scientific argumentation is not only seen verbally, but it can also be seen from how someone writes their argument (Handayani & Sardianto, 2015). The teacher can see whether students who are able to argue verbally or in writing have good learning outcomes or vice versa, students are able to argue but the learning outcomes are not good. Therefore, scientific argumentation in writing can be a benchmark of the extent to which the ability of scientific documentation and student learning outcomes in learning biology, especially virus can be achieved.

In this material, not only discussing concepts but also related isososiosaintik. In the development of diseases caused by viruses as well as products such as MR vaccines, a lot of controversy occur in the community. Material that is a isososiosaintik is material that can explore students' argumentative abilities (Osborne, 2005; Chang & Chiu, 2008; Dawson & Venville, 2009). The ability to argue on isososiosaintik can be explored because students argue from various points of view, not only from a scientific, but also social, economic, political, and ethical (Osborne, 2005).

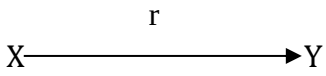
Scientific argumentation provides way to increase students' conceptual understanding and the ability to express opinions on scientific grounds. Students' low mastery of concepts means that they also show low argumentation skills and vice versa (Noviyani, et al, 2017). In their research, it was found that students get higher scores because of the discussion and argumentation activities (Mercer et al. 2004). The results of previous research using the ABSI model show a very weak correlation between argumentation skills and learning outcomes (Visensia, 2018). In addition, research conducted using the TAP pattern can improve students' understanding of concepts (Eliana & Admoko, 2020). In line with the statement that the model can be used as a tool to analyze an argument.

Based on the information obtained, is there any correlation between scientific argumentation (which includes writing argumentation and the quality of argumentatioin based on TAP) with learning outcomes of senior high school student ?. Based on the formulation of the problems presented previously, the purpose of this study is to determine The Correlation between Scientific Argumentasion with Learning Outcomes of Senior High School Student.

METHODS

Research Design

This research was descriptive quantitative with correlational analysis. The purpose of correlational analysis was to see the relationship between two or more variables, namely the relationship between variations in one variable and variations in other variables. When the study was conducted in September-December 2018 The research design used in this correlation study was as follows:



(Prasetyo and Jannah, 2005)

Information:

X : Independent variable (*independent*) the ability of scientific argumentation
Y : Dependent variable (*dependent*) learning outcomes
r : Correlation coefficient

Population and Samples

In this study, the population of two classes from the X science class of senior high school wereused as a research sample with saturated sampling technique. The number of student were 47.

Instrument

The instrument for collecting data on learning outcomes was a multiple choice test item with four answer choices in 20 questions. The instrument of scientific argumentation ability was a test item in the form of a description in 3 questions with answers referring to Toulmin's Argument Pattern (TAP), namely claim, data, warrant, backing, rebuttal and qualifer. This test instrument was tested for validity and reliability using ANATES 4.09.

Procedure

This research procedure consists of three stages, namely the preparation, the implementation, and the completion stage. The preparation stage the researcher interviews the teacher to determine the sample. Next, compile instrument that will be used in research such as questions. The implementation stage is observation of learning and giving test questions. The completion stage is done to analyze the data that has been obtained so that it can draw conclusions.

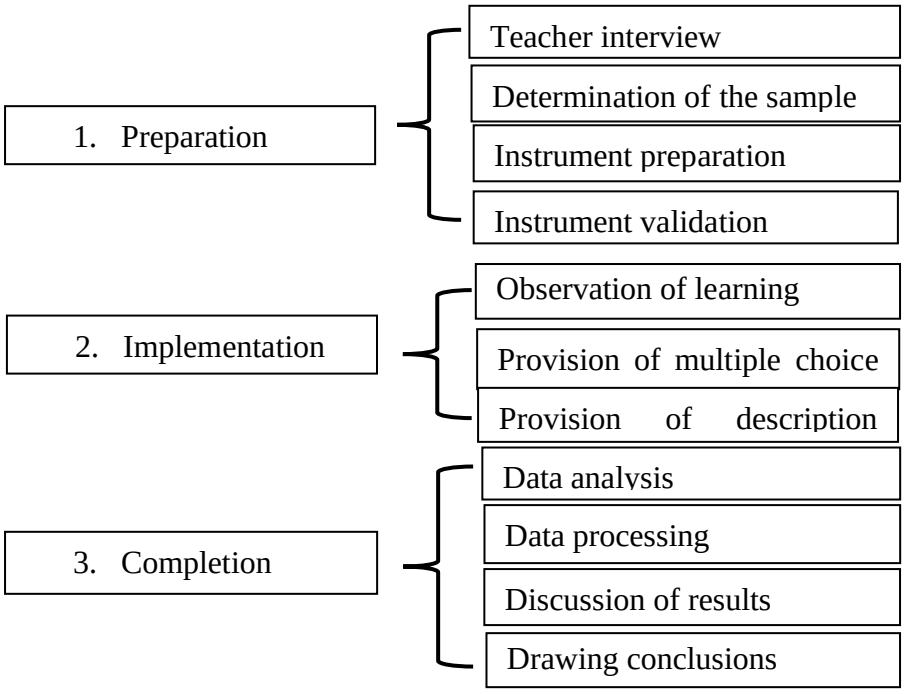


Figure 1. research procedure chart

Data Analysis Techniques

The data analysis technique used in this research was descriptive statistics using SPSS 23. The analysis was conducted to describe the relationship between the ability of scientific argumentation and learning outcomes. The final test scores were obtained to see the learning outcomes and the quality of students' scientific arguments, which were then categorized according to the standard values (Sudijono, 2013; Arikunto, 2013). After that, the two variables were tested for their correlation with product moment.

RESULTS AND DISCUSSION

The findings obtained from this study were basedon several research questions that have been prepared previously. Data from this study were the scores of students' argumentation skills and student learning outcomes.

Student Learning Outcomes on Virus Topic

Student learning outcomes obtained from the final test through an objective test. The percentage of the final test of student learning outcomes was categorized as good (Table 1). Average overall learning outcomes obtained by 73.72 with good criteria. The process of learning data is influenced by students and the readiness of teachers in teaching. This is in line with research conducted by Saleh, et al. (2017) that the teacher's teaching style will affect student learning outcomes. This means that both students and teachers will influence the learning process.

Table 1.
Percentage of Learning Outcomes Category of Student

	Percetage	Category
Biology Learning Outcomes	17 %	Fair
	19%	Less
	15%	Good
	49%	Very good
Average	73,72	Good

Scientific Argumentation

The average ability of scientific argumentation which includes writing argumentation and Toulmin Argument's Pattern (TAP) is 52.02 with sufficient criteria.

Write Arguments

The assessment of writing arguments based on 5 aspects, namely cohesion and coherence, the effectiveness of the sentence, the truth of the concept, the criticality of analyzing problems and solving problems with a rating scale of 1-4. The results of writing scientific arguments for students can be seen in Table 2.

Table 2.
Ability to Write Scientific Arguments for Students

Number of Students	Assessment Aspects	Good	Fair	Less	Very Less
47	Cohesion and Coherence	34%	23%	32%	11%
	Sentence Effectiveness	23%	32%	34%	11%
	The Truth of Concepts	11%	34%	15%	40%
	Critical Analyzing Problems	11%	6%	26%	57%
	Problem solving	-	13%	47%	40%

The value obtained from writing scientific arguments is used to determine the extent to which students' abilities in recording, reporting, convincing, describing, and even influencing others. Based on the percentage acquisition, the aspects of cohesion and coherence as good as the effectiveness of the sentence are in the criteria very less is lower than the aspect of the truth of the concept, critical analysis of problems and problem solving. Table 2 shows that students were still low in writing scientific arguments. Previous research also stated that students were not yet skilled in writing scientific arguments (Muslim and Suhardi, 2012). This is because the

learning process has not emphasized the way to write arguments. In addition, students who do not understand the concepts that have been explained and are not accustomed to provide relevant examples in analyzing problems, were unable to develop their opinions and connect opinions with problems. The average writing of scientific arguments can be seen in Table 3.

Table 3.
Percentage of Write Arguments Category of Student

	Percetage	Category
Write Arguments	9 %	Excellent
	11%	Good
	21%	Fair
	26%	Less
	33%	Very Less
Average	55,02	Enough

Based on Tabel 3 students' ability to write scientific argumentation obtained 9% excellent category, 11% good category, 21% fair category, 26% poor category, and 33% very poor category. The average ability to write scientific arguments for students is 55,02. It shows that the ability to write scientific arguments student in SMA class *X* is in enough category.

Quality of Scientific Arguments Based on Toulmin's Argument Pattern (TAP)

The ability of scientific argumentation is obtained from the final test scores of 3 descriptive questions with 47 students. Assessment of the ability of scientific argumentation refers to Toulmin's Argument Pattern (TAP) which includes 6 aspects of claim, data,warrant, backing, rebuttal and qualifer. The percentage of the ability of scientific argumentation based on TAP can be seen in Figures 2 and 3.

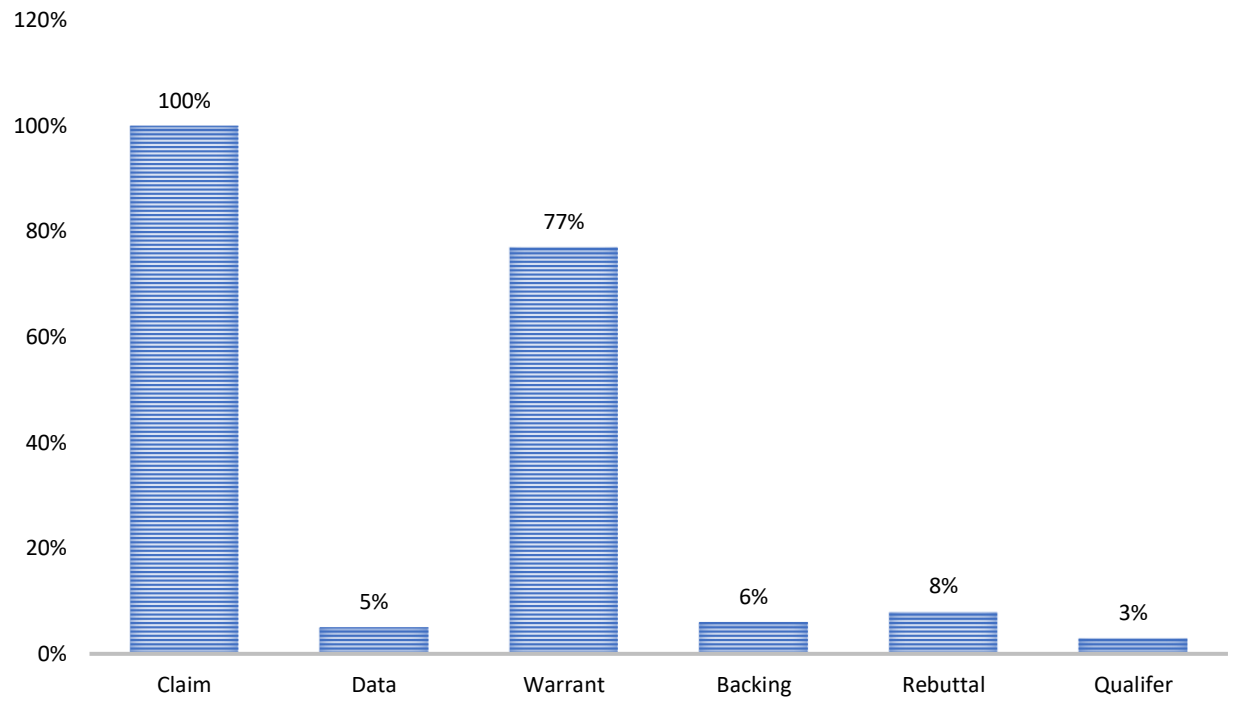


Figure 2. Percentage of Scientific Argumentation

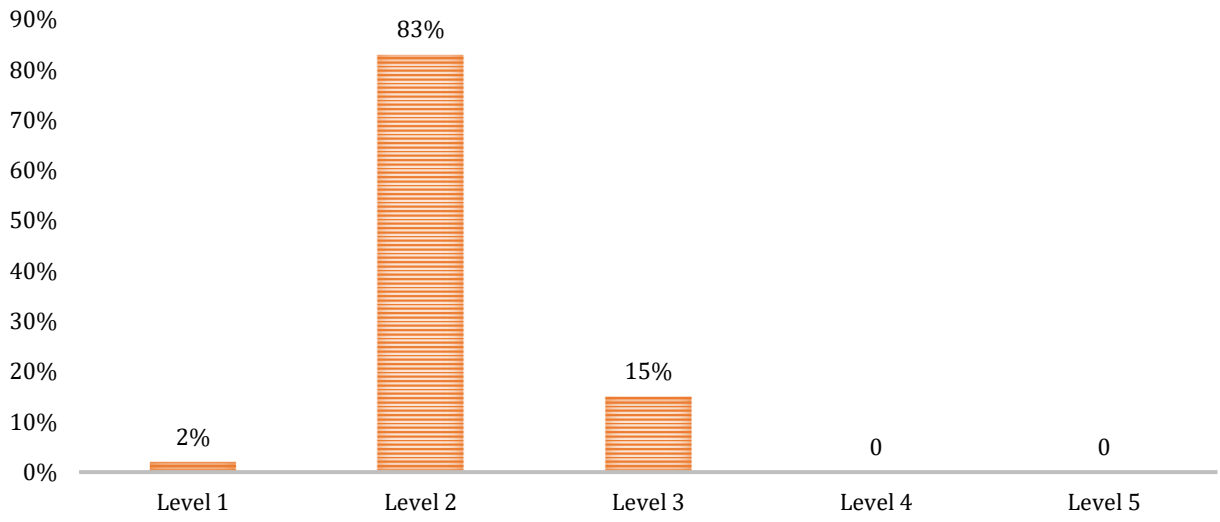


Figure 3. Percentage of Quality of Scientific Argumentation

The assessment of the ability of scientific argumentation refers to Toulmin's Argument Pattern (TAP) covering 6 aspects, namely claim, data, warrant, backing, rebuttal and qualifer. In Figures 2 and 3 it can be seen that the claims and warrant aspects are higher than the data, backing, rebbutal and qualifer aspects. This means that students are only able to convey statements and reasons, but some students have not been able to submit data, guarantors, supporters, rebuttal and conclusions in delivering arguments. Then it also determined that most students are at Level 2, students are only able to submit claims on the grounds without backing or refutation. This research is support by previousstudy, that students' explanations generally only use warrant to support the claim, not by backing. Some students also use data to support their claims (Bell and Linn, 2000). In addition, that the ability of students' argumentation is only at level 1 and level 2 with claims or claims which accompanied by data (Devi, et al., 2018). The quality of students' scientific argumentation abilities is at level 1, 2 and 3, there is no level 4 and 5. Whereas the material and problems discussed are related to issues in daily life. Socio-scientific issues related to learning and problems if integrated can improve the quality of scientific argumentation of students, but the success of the discussion on sociocultural issues depends on the readiness of students and teachers (Maknun, 2014; Dani, 2011). In addition, the quality of scientific argumentation is at level 1, 2 and 3 because students use arguments based on limited data. Learners do not understand how to solve the questions given, so they choose to use data that is limited to the questions or knowledge they have. The ability of scientific argumentation of students is very important in the learning process both verbally and in writing, with the increased ability of scientific argumentation also increases the cognitive abilities of students. In this study there were alsoimprovement on student learning outcomes, but the ability of scientific argumentation was low. This contradicts the previous statement. The difference is caused by several factors, one of which is some students do not participate in group discussions. In addition, students tend to memorize the theory without understanding the concept so that it impacts the ability of scientific argumentation. It is clarified, that students did not develop the knowledge they had while at school. Nevertheless, there is a relationship between the two variables (Anwar, et al., 2019).

Correlation of Scientific Argument Ability with Learning Outcomes

Correlation test results of the ability of scientific argumentation with learning outcomes can be seen in Table 4.

Tabel 4.
Correlation of The Ability of Scientific Arguments with Learning Outcomes

	Significance of Correlation	Correlation Coefficient	Correlation Interpretation
Pearson Correlation Sig. (2-tailed)	0,033	0,311	Low

Based on the results of the correlation test in Table 4, it is known that the data has a significance lower than 0.05 (Sig <0.05), namely 0.033, indicating that there is a correlation between the ability of scientific argumentation and learning outcomes. Furthermore, the correlation coefficient on the ability of scientific argumentation with learning outcomes is 0.311. This means that the relationship between the two variables is in the low category, then the positive coefficient indicates the direction of the positive relationship, namely the two variables are directly proportional. In this study, the higher the score of the scientific argumentation ability test, the higher the learning result or the lower the scientific argumentation ability test score, the lower the learning outcome test score .One of the factors that causes the low correlation between the two variables is the learning process that is not in accordance with the learning plan. During learning, students are given problems and they are required to solved them through discussion activities, but the discussion only takes place in one direction so it does not emphasize the ability of scientific argumentation. In addition, the low correlation indicates that so far the learning process has not measured the ability of scientific argumentation with the TAP . As a result, the ability of argumentation with cognitive abilities has a low relationship.The low argumentation skills of these students can be improved by applying the TAP pattern in learning, so it is hoped that this application can also improve the relationship between scientific argumentation skills and learning outcomes. It is made clear that the Toulmin's Arguments Pattern (TAP) based learning can improve the ability of scientific argumentation and understanding of concepts (Eliana and Admoko, 2020).

Science learning includes biology learning has 3 domains, they are cognitive, psychomotor and affective that use concepts and abstract presentation (Kristiani, Ristanto, & Lisanti, 2020; Rustaman et al., 2005; Cimer, 2012). In the cognitive aspect, students can understand or interpret the concepts that have been discussed, while learning outcomes in the psychomotor aspect are skills in communicating both orally and in writing. The ability to argue scientifically is part of skills in communication. Students who are able to understand or interpret concepts or theories well have good scientific argumentation skills, because argumentation is an activity that facilitates the understanding of cognitive activities in building scientific knowledge, so that the empowerment of scientific argumentation skills as a whole in the learning process will have an impact on the cognitive abilities of participants students (Viyanti, et al., 2016). In line with research which states that the ability of scientific argumentation can also develop well if students are able to interpret concepts well (Anwar & Susanti, 2019) . So, the ability of scientific argumentation has a relationship with the learning outcomes of cognitive abilities . If the ability of scientific argumentation increases, cognitive abilities also increase and vice versa.

CONCLUSION

Based on the results of research that has been done shows that there is a correlation between the ability of scientific argumentation with student learning outcomes with low category (0.311). The average learning outcomes of students in SMA class X on the viruses topic is 73.72 with good criteria. The results of the average scientific argumentation ability that is 52.02 are in sufficient criteria with the quality of scientific argumentation of students in general

are at level 2. One factor of the low ability of students to communicate is the pattern of interaction between teachers and students or between students who have not optimal during the learning process. In addition, it is hoped that the learning process can apply a two-way interaction pattern and the Toulmin's Arguments Pattern (TAP) so that it can improve the ability of scientific argumentation and learning outcomes of students.

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