

Application of the STAD-Type Cooperative Model Assisted by Wordwall to Enhance Students Critical Thinking Ability

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Abstract: An advanced nation begins with individuals who are able to compete with other individuals based on the standards of ability needed by the world community, which are known as 21st-century abilities, one of which is the critical thinking ability. The application of the STAD-type cooperative model assisted by Wordwall aims to describe students critical thinking abilities and find differences in critical thinking abilities between control and experiment classes. The research design used nonequivalent post-test only control group. This research included all students in class X of MIPA SMA Muhammadiyah 1 Pekanbaru as a population. A sample of 66 students consisted of X MIPA 1 as control class and X MIPA 5 as experiment class. After the research was carried out, a critical thinking abilities post-test was given, which consisted of 12 multiple-choice questions as an instrument for data collection. Post-test results were analyzed using descriptive analysis and inferential. The results of the descriptive analysis showed that the experiment class was in the very good category with score 80.99, and the control class was in the good category with score 61.03. Then, in the inferential analysis, it is known that there are significant differences between experiment and control class.

Keywords: Critical Thinking; STAD; Wordwall

Introduction

Education is a basic thing and an important factor that should be obtained by every individual in a country. With adequate education, each individual can improve their quality and be able to compete in the era of globalization and the 21st century (Redhana, 2019). A national education system that has the goal of achieving the nation's ideals as a developed country that can compete with and live side by side with developed countries in the world requires quality human resources (Tiantong & Teemuangsai, 2013). Human resources that want to be enhanced refer to 21st-century abilities, which are the ability to think critically, creatively, based on research, based on initiative, informative, systematic, communicative, and reflective. (OECD, 2016). The ability to think critically is a method that encourages students to be able to carry out an in-depth analysis of an existing problem and then be able to develop solutions based on their own assessment (Pebriyani, 2020). In the process of analysis and assessment, it is

based on various information that has been obtained, which has previously been ascertained to be accurate by understanding, analyzing, evaluating, and explaining this various information (Ningsih & Wulandari, 2022).

The ability to think critically is one of the main factors in achieving the goals of the national education system because it has a major effect on improving the quality of students and education itself. It's just that student learning outcomes are still found in certain subjects in schools that have low scores due to students' low critical thinking abilities (Samsuri & Firdaus, 2017). School is a formal educational institution that plays an important role in organizing effective learning activities so that every student gets the same opportunity to be guided and directed toward the national education system's goals, as previously described (Hamalik, 2014). There are several branches of science that are studied at the high school level, such as one of the compulsory subjects, namely physics. Physics is a subject that seeks to explain phenomena in the universe that are defined by a concept in the form of a law or theory. In this case,

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students are expected not only to master the concept but also to be able to maximize the concept understood to be utilized in such a way that they can solve various problems in physics with detailed analysis (Laparere, Pasaribu, & Kendek, 2017).

Based on the facts in the field, teachers often find students who have difficulty working on physics questions. Students tend to use formulas that they memorize rather than analyze the questions first. This resulted in students having difficulty solving complex questions. The difficulties experienced by students are influenced by the learning model taught by the teacher, which is still conventionally based and teacher-centered; that is, the teacher only explains the problem of mathematical calculations, not attempt to teach students so they can understand the subject matter thoroughly (Azizah, Yuliati, & Hanifah, 2015). Therefore, process renewal is needed in the classroom learning model by switching to student-centered learning models, namely by applying cooperative learning models.

The cooperative model is a model that focuses on making students work in small groups when learning and exercising by establishing cooperation among group members (Wijaya & Arismunandar, 2018). One of the cooperative learning models is the STAD (Student Teams-Achievement Divisions) type, which has the goal of creating a useful and enjoyable learning atmosphere. In this case, students will facilitate each other and provide support for understanding learning. With a team, it will encourage students to win their team by comparing each answer they get, then students will hold discussions and agree on the most relevant answer to use (Nisa & Sari, 2019). Wulandari (2022) added that in the STAD-type cooperative learning model there are six steps, namely: 1) Forming groups of students of approximately four-five people heterogeneously, 2) The teacher delivers lessons; 3) The teacher gives students group assignments; 4) The teacher gives a quiz; 5) The teacher gives a final evaluation of the learning material being taught; and 6) Conclusion.

Given that the 21st-century is closely related to technological advances, especially in the flow of information that is easily obtained via the internet, of course, the use of technology will play a major role in helping teachers implement learning models. So, one of the media that can be used to assist the STAD-type cooperative model is Wordwall. Wordwall is an online application that can be used as an interesting assessment tool for students (Sari & Yarza, 2021). The assessment tool referred to in Wordwall is in the form of a quiz with a time span so that it can spur students' critical thinking abilities by analyzing all the information that has been obtained during learning when completing the quiz (Handarini *et al.*, 2020).

The work and energy material in the revised 2013 curriculum is one of the subjects in class X, senior high school, even semester. According to Basic Competency 3.9 in class X senior high school, namely "Analyzing the concept of energy, work, work relations, and energy changes, the law of conservation of energy, and its application in daily life". Work and energy is one of the physics learning subjects that requires a process of understanding concepts and critical thinking abilities to find solutions to work and energy problems, both in the form of theory or calculation problems that require solving using mathematical equations. So to grow and improve students' critical thinking abilities, especially in terms of effort and energy, an appropriate learning method is needed.

The description that has been described previously shows that the role of a teacher is to be able to apply appropriate methods to improve students' critical thinking abilities in the learning process. For this research, the method in question is the STAD-type cooperative method assisted by Wordwall. Therefore, this research, entitled "Application of the STAD-Type Cooperative Model Assisted by Wordwall to Enhance Students Critical Thinking Ability", attracts the interest of the author to be researched.

Method

This research uses a quantitative experiment research design, which means that researchers carry out direct observations in the field to collect data (Hidayat, 2017). The use of Quanti Experimental is based on the consideration that the implementation of research on learning will take place naturally. This will create a more real atmosphere so that it can contribute to the level of validity in research (Junaedi, 2013). The design of this research used the research type Nonequivalent Post-test Only Control Group Design with the aim of determining differences between experiment and control class to students' critical thinking abilities, who can be seen on Table 1 (Setyosari, 2016). To make the research flow clearer, see Figure 1.

Table 1. Nonequivalent Post-test Only Control Group Design

Class Group	Treatment	Post-test
Experiment	X	O ₁
Control	-	O ₂

This research was held at Muhammadiyah 1 senior high school in Pekanbaru. As for the research time, namely in the 2022/2023 academic year, specifically in the even semester. All students of class X Muhammadiyah 1 senior high school in Pekanbaru are included on this research, totaling 168 students. The

sample consisted of 66 students, X MIPA 1 as the control group class and X MIPA 5 as the experiment group class. The sampling technique was carried out using the simple random sampling technique, with the condition

that the randomly selected population must be homogeneous and normally distributed.

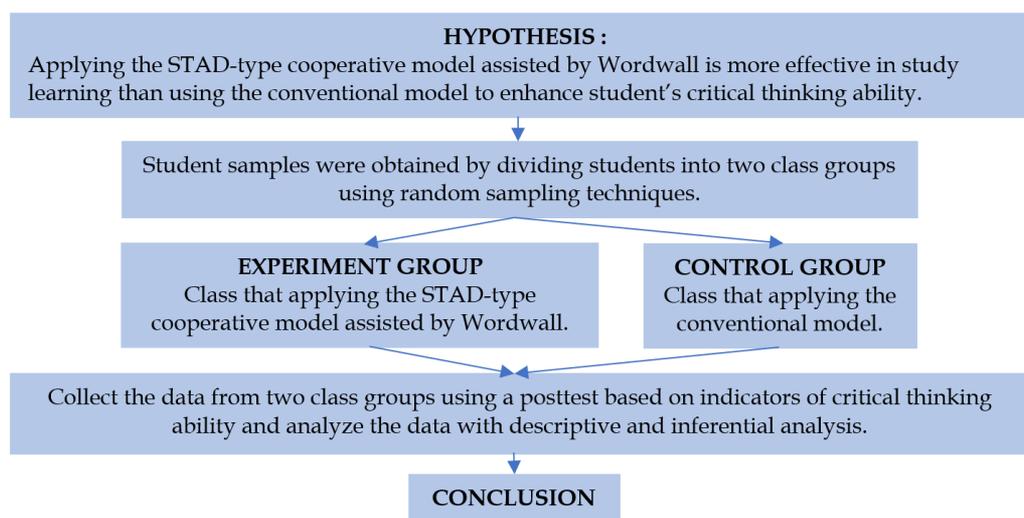


Figure 1. Research Flow

The post-test was used to collect data after implementing the learning method in each class group. The test instrument provided consisted of 12 multiple-choice questions made by the researcher based on 12 indicators of critical thinking ability, which are derivatives of the five main aspects of critical thinking ability. Instruments for critical thinking ability that have been designed by researchers be in view at Table 2.

Table 2. Test Instrument of Critical Thinking Ability

Aspect of Critical Thinking	Indicator	Number of Question
Basic Clarification	Focus on question	1
	Analyzing argumen	1
	Asking and answering questions of clarification	1
Basic Support	Judging the credibility of a source	1
	Observing and judging observations reports	1
Advanced Clarification	Define terms and judge definitions	1
	Identifying assumptions	1
Strategy and Tactics	Deciding on action	1
	Interacting with others	1
Inference	Deducing and judging deductions	1
	Inducing and judging deductions	1
	Making and judging value judgements	1
Number of Question		12

Then the results of the post-test data that had been obtained from the two class groups after the research was executed will be analyzed with descriptive and inferential analysis. Descriptive analysis is a technique for analyzing data by describing or describing data that has previously been collected and obtained by researchers as they are without intending to make general conclusions (Sugiyono, 2018). The post-test score obtained by each student is to find out or measure the extent to which students' critical thinking abilities can be identified by their level of ability by using the reference in the category table for the level of critical thinking abilities developed by Arikunto in Rahayu et al. (2018), which can be seen in Table 3.

Tabel 3. Category Level of Students' Critical Thinking Ability

Category	Percentage (%)
Very Good	80 < x ≤ 100
Good	60 < x ≤ 80
Enough	40 < x ≤ 60
Less	20 < x ≤ 40
Very Less	0 < x ≤ 20

Inferential analysis is one of the data analysis techniques used to find out the population based on the existing sample by analyzing and interpreting data; thus, the research sample is subjected to inferential analysis with the aim of testing the research hypothesis and drawing conclusions from a research that has been carried out (Eldanto, Hoendarto, & Willay 2018). So, in inferential analysis, a prerequisite test is carried out,

namely the normality test with the Kolmogorov-Smirnov test technique, which is used to find out whether the data is normally distributed or not, and the homogeneity test with the Levene test technique, which is used to find out whether the sample distribution is homogeneous or not. After both conditions are met, a hypothesis test is carried out using the Independent Sample T-Test (t-test) technique. These three tests will be conducted with version 25 of the SPSS application.

Result and Discussion

The research entitled "Application of the STAD-Type Cooperative Model Assisted by Wordwall to Enhance Students Critical Thinking Ability" has two variables, namely the independent variable is the STAD-type cooperative model, which will affect the dependent variable, namely critical thinking ability. The research process took place with the application of different learning models for each class. X MIPA 1 as the control class applied the conventional model and X MIPA 5 as the experiment class applied the STAD-type cooperative model assisted by Wordwall.

The learning process that has been going on for three meetings is then closed by giving a post-test using the same questions for both class groups. The post-test aims to see how far the critical thinking ability of students from each class group are. The results of the assessment of critical thinking ability that have been carried out using a post-test are then presented with a descriptive analysis. Table 4 displays a descriptive analysis of the data on each aspect of critical thinking abilities.

Table 4. A Descriptive Analysis of Critical Thinking Ability in Every Aspect

Aspect of Critical Thinking	Experiment Class		Control Class	
	Average Score	Category	Average Score	Category
Basic Clarification	81.25	Very Good	65.69	Good
Basic Support	87.50	Very Good	60.30	Enough
Advanced Clarification	70.31	Good	50.00	Enough
Strategy and Tactics	90.63	Very Good	58.82	Enough
Inference	77.08	Good	65.68	Good
Average Class	80.99	Very Good	61.03	Good

The average score of the experiment class was higher than that of the control class, as shown in Table 4. Based on all these aspects of critical thinking ability, it seems that most of the test results of an experiment class fall into the very good and good categories. Then most

of the control class test results fall into the good and enough category. Therefore, it can be concluded that the class average value by applying the STAD-type cooperative model is 80.99 with a very good category, while the class average value by applying the conventional learning model is 61.03 with a good category, meaning that there is a difference of 19.96. Figure 2 shows a comparison of the average scores on each aspect of the indicator of critical thinking abilities from the experiment and the control class. Figure 2 shows that overall, the average score on each aspect of critical thinking abilities for the experiment class dominates because the average value shows the control class always being lower than the experiment class. A more complete explanation regarding Figure 2.

The first aspect, namely basic clarification, is the ability of students to focus their minds on a problem in an effort to solve it. In the process of providing simple explanations, students are expected to be able to utilize previously acquired knowledge and relate it to the problems they face (Fliegel & Holland, 2013). The indicators included in this aspect are focusing questions on item number 4, analyzing arguments on item number 6, and asking and answering clarifying questions on item number 10. The average critical thinking ability of students in experiment class in this aspect was 81.25%, so that falls into the very good category. Meanwhile, the control class was 65.69%, so that falls into the good category. The higher experiment class average is influenced by the first steps of the STAD-type cooperative model, namely conveying goals and motivation, which makes it student easier to understand the subject, which will be studied systematically so that they can present a simple explanation as the solution to a related problem. (Sundari, Parno, & Kusairi, 2018).

The second aspect, namely basic support, is the student's ability to assess the credibility of an observation made directly or based on an observation report. This ability will make students think by connecting related variables in a problem that is supported, and with a deep understanding of concepts, they can solve problems (Nugraha & Kirana, 2015). The indicators included in this aspect are considering the credibility of a source in question number 7 and observing and considering the observation report on problem number 2. In the experiment class, the average student's critical thinking ability in this aspect was 87.50% so that falls into the very good category. Meanwhile, the control class was 60.30%, so that falls into the good category. The higher experiment class average is influenced by the second steps of the STAD-type cooperative model, namely the delivery of information that makes students independently and with their study groups add knowledge through other references. This will encourage students to get used to

choosing information by paying attention to the credibility of the source, thus helping them solve problems (Susanto, 2013).

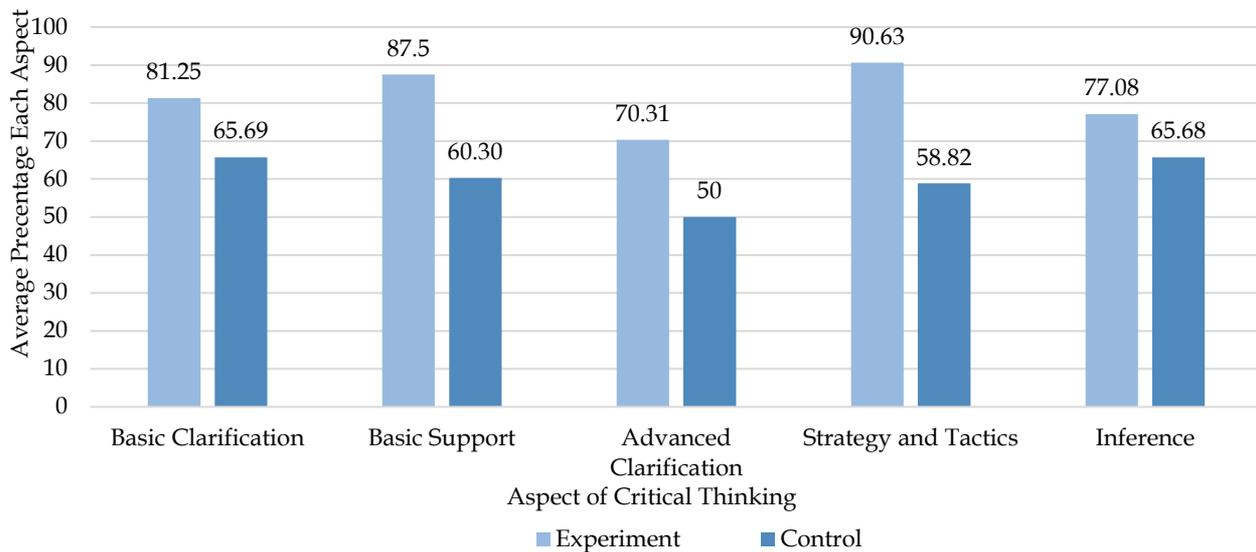


Figure 2. Average Comparison of Each Aspect of Critical Thinking Ability

The third aspect, namely advanced clarification, makes students identify various assumptions and make connections between these assumptions. The relationship between each assumption is then used by students in finding solutions to problems, while assumptions that are not appropriate will be rejected by students and other assumptions that are more appropriate in solving problems are sought (Sundari, Parno & Kusairi, 2018). The indicators included in this aspect are defining a term and considering a definition in question number 1 and identifying assumptions in problem number 3. The average critical thinking ability of students in experiment class in this aspect was 70.31%, so that falls into the good category. Meanwhile, the control class was 50%, so that falls into the enough category. The experiment class has a higher average because there is a third phase in the STAD type cooperative model, namely organizing students in study groups so that students are used to considering definitions that can be used as a reference when solving problems, besides that accompanied by identifying various assumptions from each group will direct students in finding definitions with the right relationships between assumptions to solve problems (Susanto, 2013).

The fourth aspect, namely managing strategy and tactics, makes students can determine effective and efficient actions to find a solving from the problem (Sundari & Sarkity, 2021). The indicators included in this aspect are determining actions in question number 5 and interacting with other people in problem number 9. The average critical thinking ability of students in

experiment class in this aspect was 90.63%, so that falls into the very good category. Meanwhile, the control class was 58.82%, so that falls into the enough category. The experiment class has a higher average due to the fourth phase in the STAD-type cooperative model, namely group study and work guidance, which makes students careful when determining actions that are supposed to be a way out of the problem, and interaction between students during study groups will make each student complement each other's knowledge (Adnyana, 2020).

The fifth aspect, namely inferring or concluding, is the student's ability to make a rational and acceptable conclusion. In the inference process, students will collect various pieces of information relevant to the problem, accompanied by an understanding of the correct concept (Nurazizah, Sinaga, & Jauhari, 2017). The indicators included in this aspect are inducing and considering the results of induction in item number 8, deducing and considering the results of deduction in question number 12, and making and determining the value of judgment in question number 11. The average critical thinking ability of students in experiment class in this aspect was 77.08%, so that falls into the good category. Meanwhile, the control class was 65.68%, so that falls into the good category. The experiment class has a higher average due to the fifth and sixth phases in the STAD cooperative model, namely evaluation and rewards. In this phase, when the lesson will be end, the teacher gives an evaluation test in the form of a quiz assisted by Wordwall media, which is carried out online so that it is more efficient.

The purpose of the evaluation is to measure the extent to which each student is capable, so when the quiz is done independently and is no longer part of a group. With the provision of knowledge and information that has been obtained during group study, Wordwall's interesting features, because it utilizes technology, will encourage students to be serious and enthusiastic in answering questions. What's more, the existence of a group reward system, which is an accumulation of quiz scores for each student in their respective groups, will encourage students who want to be in the group with the highest scores, while learning will provide mutual understanding of knowledge so that each group member has good knowledge and produces good quiz scores high (Khoiriyah, 2017).

The results of this research are in line with relevant research studies conducted by Ningsih and Wulandari (2022), who examined the effect of the STAD-type cooperative model on students' critical thinking abilities. That research result showed average percentage value of 82.97% on experiment class and the control group had 67.55%, so the difference is 15.42%. Then Lapasere, Marungkil, and Yusuf (2017) also examined the same learning model based on mind mapping and obtained the results of the control class with an absorption power of 62.04% in the moderately critical category, while the experiment class obtained an absorption power of 74.44% in the critical category, a difference of 12.04%. This means that the two studies show, based on average percentage, that the experiment class is higher than the control class in critical thinking ability.

The difference in the average values obtained by the two previous studies when compared with the difference in the average values obtained by this research is a difference of 4.54% and 7.92%, respectively. That showed the difference in mean scores between the two class groups in this research was higher than in the two previous studies. So, that mean, even though in the same learning model, but because this research received the help of educational game learning media Wordwall, which was used during the evaluation phase, it means that there is influence to make learning activities more attractive to students and spur students to find their knowledge even better so that students can get high marks.

Inferential data analysis in this research, it is necessary to carry out the prerequisite tests on the post-test data first, namely homogeneity and normality. The normality test using the Kolmogorov-Smirnov technique, a significance value of ≥ 0.05 was obtained, which means that the two-class data were normally distributed. Then, in the homogeneity test using the Levene Test technique, it was found that both class groups based on the mean output had a significance value of ≥ 0.05 , which means that the data is homogeneous of the two classes. After

that, a hypothesis test was carried out, which in this research used the Independent Sample T-test. The results of the hypothesis test found that the significance value (sig. 2-tailed) in both class groups was 0.000, which was based on decision-making; if ≤ 0.05 , then H_a was accepted and H_o was rejected.

The results of this research are in line with relevant research studies conducted by Falebita & Salami (2021) and Nair & Mogana (2018), which examined the effect of applying the STAD-type cooperative learning model to students' understanding of learning during the learning process in class and found that between students in the control and experiment classes, there was a significant difference, which respectively obtained significance values of 0.035 and 0.000. Then it is also supported by research conducted by Yulianto, Warsono, and Rendy (2020), with the same learning model and assisted by educational game learning media and obtained a significance value of 0.03. So, if the three previous research results are compared with this research, it can be seen that after the t-test, they both obtain a significant value of ≤ 0.05 , which means that at the time of decision-making, H_a is accepted and H_o is rejected.

From the explanation of the inferential and descriptive analyses, it was concluded in the level of student's critical thinking ability there were significant differences between the experiment class that applied the STAD-type cooperative learning model assisted by Wordwall and the control class that applied the conventional learning model. That means the experiment class has a positive effect on students' critical thinking abilities and is more capable of improving them during the learning process. The characteristics of the STAD type in the group reward phase, make students in each group are more motivated to get the best ranking for their group (Adnyana, 2020). That way, smart students will ensure that their friends who are lacking in learning can understand learning, and students who are lacking will be more eager to learn because they don't want their group not to get the best ranking award because of them. It was concluded that there was a positive relationship between students, and this affected the post-test results of each student's critical thinking ability to be higher.

Besides that, media assistance namely Wordwall really help the application of the STAD-type cooperative model and give a positive influence on this research. The Wordwall is used as a evaluation at the end of the learning process as an independent to measure the abilities of each student. Students who are very attached to the use of technology will find that Wordwall will change their view of boring conventional quizzes into fun online quizzes that can even be a refreshing vessel for students after studying because of its game-like features while still being educational (Arimbawa, 2021).

In line with the presentation by Handarini, Oktavia, and Wulandari (2020), Wordwall as a medium for carrying out quizzes helps develop students' scientific literacy, understanding of concepts, and critical thinking. So that the educational game method not only teaches concepts to students but also encourages them to improve their critical thinking abilities.

Thus, the phases in the STAD-type cooperative model, especially in the group reward phase, make students more motivated and do not let their group mates not understand learning because, at the end of learning, each student must struggle independently to achieve the highest score on the quiz, which will later be accumulated for the best group rating. Then the help of Wordwall media will make it easier for the teacher to determine the best group, meaning that these two things making student more enthusiasm when participating in the learning process. So, based on this research was concluded that the application of the STAD-type cooperative model assisted by Wordwall was able to enhance students' critical thinking abilities.

Conclusion

The application of the STAD-type cooperative model assisted by Wordwall in the experiment class has a higher average than the control class, which applies the conventional model. It is evident from the post-test scores of critical thinking abilities that the experiment class is in the very good category and the control class is in the good category. Then there is a significant difference in the level of students' critical thinking abilities between the experiment class and the control class. It was proven from the hypothesis test that there were significant results in both class groups. Thus, the STAD-type cooperative model assisted by Wordwall media has proven to be effective and able to improve students' critical thinking abilities in physics subjects, especially in the subject matter of work and energy at Muhammadiyah 1 senior high school in Pekanbaru.

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Author Contributions

Conceptualization: Alivi Lindi Putri, data Curation: M. Rahmad, M. Sahal, funding acquisition: M. Rahmad, M. Sahal, Alivi Lindi Putri, methodology : M. Rahmad, Alivi Lindi Putri, visualization : M. Sahal, Alivi Lindi Putri, writing-original draft : Alivi Lindi Putri, writing-review & editing : M. Rahmad, M. Sahal, Alivi Lindi Putri.

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Conflicts of Interest

No conflict of interest in this research.

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