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Jigsaw in teaching circulatory system: a learning activity on elementary science classroom

Marleny Leasa*[1], Yakub Lalyolik Sanabuky[1], John Rafafy Batlolona[2], Javier Julian Enriquez[3]

[1] Elementary Teacher Education, Faculty of Teacher Training and Education, Universitas Pattimura, Indonesia
[2] Teacher Professional Education Program, Faculty of Teacher Training and Education, Universitas Pattimura, Indonesia
[3] Polytechnic University of Valencia, Spain

*Corresponding author: marlenyleasa3@gmail.com

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ABSTRACT

Jigsaw type cooperative learning is explored again to train students from an early age to become a small expert to reveal the effects it has on the cognitive achievement of elementary students. The study was conducted at one of the public schools in Ambon City, preceded by a placement test on the classes used. The cognitive learning achievement test instrument was developed with a cognitive load reaching C4 and has met the instrument quality prerequisite tests. The results of the study prove that there were differences in student learning outcomes in learning with Jigsaw and Example Non-Example (ENE) types. The corrected mean score showed that the treatment group was 25,856 points higher than the control. This means that Jigsaw is superior in improving student cognitive achievement compared to ENE. Thus, Jigsaw can be used in other learning in elementary school because it has the potential to enhance student learning outcomes. Further studies are needed to uncover the potential of Jigsaw to empower various types of learning outcomes and other thinking skills.

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INTRODUCTION

Education is one of the main pillars of national progress. Without qualified education, a person cannot do many things. One of the primary responsibilities of the education program is creating people who are intelligent and having good character. Several countries in the world have shown excellent performance in the field of education, including Finland, the United States, Singapore, China, and Japan. In the scientific and mathematical groups in terms of PISA and TIMMS, their ranks are better than Indonesia (Leong & Tan, 2014; Komatsu & Rappleye, 2017; Rautalin, 2018). Since education is an asset in human development (Stewart, 2019), educational institutions are currently required to prepare graduates profiles that have relevant expertise following the demands of the times (Medina & González, 2019).

Several thing that become the problem of education in Indonesia are the low comprehension in science (Zahara & Atun, 2018), mathematics (As'ari, Mahmudi, & Nuerlaelah, 2017), low facilities and infrastructure (Warju, Prawiro, Soenarto, & Hartmann, 2017), professional training for teachers in their fields (Sulisworo, Nasir, & Maryani, 2016), and the acquisition of fast and integrated information sourced from the internet (Ammade, Mahmud, Jabu, & Tahmir, 2018). All of these are the main factors that support the continuity of the actual implementation of education. Some teachers at this time, still feel afraid if students are not well directed in their learning. Consequently, when the students are unproductive at a high level of education. Therefore, the teacher's attention is critical in teaching students; one of them is learning biology science that requires intensive assistance from the teacher. Education experts offer other things that good learning is a learning colored by students as a center of learners, which includes training students' emotional intelligence (Kassem, 2018), creativity thinking (Batlolona, 2019), critical thinking (Mahanal, Zubaidah, Sumiati, Sari, & Ismirawati, 2019) and improve student cognitive achievement (Kumaraswamy, 2019).

The development of education from time to time hopes to bring students to the peak of glory in the form of better student cognitive achievement. Some main factors that can improve students' learning outcomes better are the students themselves, the teacher as a guide, relevant teaching materials, adequate learning facilities, integrated classroom management, and a comfortable and safe learning environment (Regina, 2014). Cognitive instruments that are generally trained by teachers to students in learning seem to only trained the lower level of cognitive achievement, including C1, C2, C3, and C4, while C5 and C6 levels most rarely found (Leasa, Talakua, & Batlolona, 2016). As a result, the knowledge formed in students is rated too low, so it is unable to stimulate thinking at a higher level. All cognitive information is neatly stored in the brain's memory and released under certain circumstances to answer the problem at hand. If the brain's memory only keeps simple things, then when faced with problems at a high level, the brain is required to work faster, such as the processing of cognitive information shown in Figure 1 (Khalil & Elkhider, 2016).

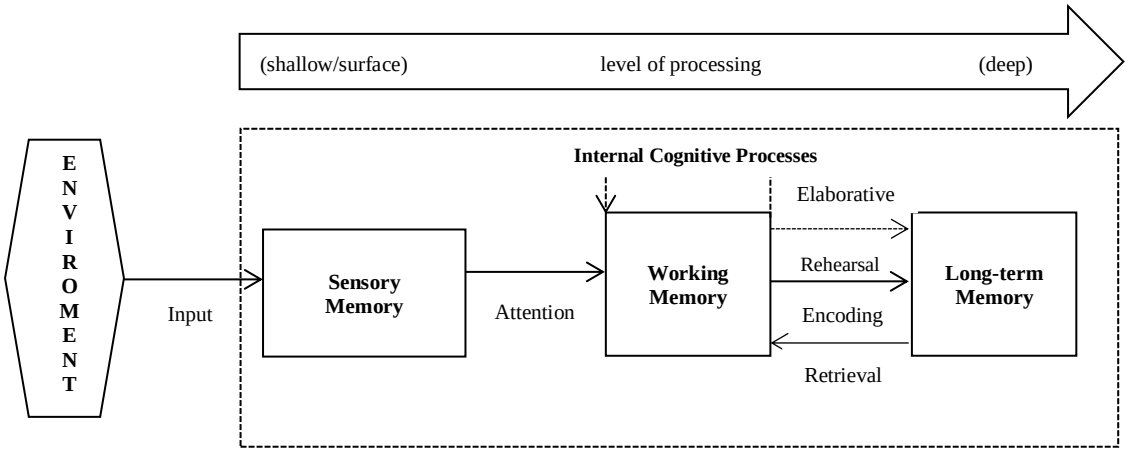

Figure 1. Cognitive Information Processing

The results of scientific studies in several countries find learning problems in the form of relatively low cognitive achievement. The result of TIMMS American students' pieces of evidence it has begun to decline when compared with China and Singapore because students spend more time in school to learn rather than increase creativity outside of learning. Eventually, students feel bored in their learning (Kang, 2016). The Portugal country provides other information that the student learning achievement is low due to family and social factors (Alves, Gomes, Martins, & Almeida, 2017). The Australian country give another information that student motivation largely determines students' cognitive achievement (Ross, Chase, Robbie, Oates, & Absalom, 2018). Besides, another crucial element is the application of learning models so that students are active in their learning and improve student learning achievement (Liang, Chen, Hsu, Chu, & Tsai, 2018). One learning model recommended to be applied in improving cognitive biology achievement of elementary school students is cooperative learning.

For centuries, future research has focused on cooperative learning in various fields. These fields include accounting (Opdecam & Everaert, 2018), socio-cultural in schools (Hennebry & Fordyce, 2018), teacher education (Jolliffe & Snaith, 2017), Civics (Erbil & Kocabaş, 2018), and technical fields (2018) Kirschner & Peltan, 2019). All studies are directed to improve student cognitive achievement. For more than 60 years, cooperative learning has been one of the most successful practices implemented in education. However, in its implementation, teachers, and researchers have changed and switched to the latest learning models. Cooperative learning has also become the basis for learning experts to develop various other learning models such as PBL, PjBL, Inquiry, Discovery, so that research activities and cooperative learning begin to decrease (Johnson & Johnson, 2009). However, cooperative learning has been proven to contribute individually to mutual success (Deerfield, 2019).

A meta-analysis of 65 studies proved that cooperative learning had a positive impact on students' cognitive achievement (Kyndt et al., 2013). In other words, cooperative learning is one of the strong foundations for improving student learning outcomes. Cooperative learning is seen as learning in small groups in reconstructing students' thinking skills. In cooperative learning, students work together in small heterogeneous groups, and each group member is responsible for learning from other groups (Slavin, 2015) to achieve group goals. These goals encourage groups to learn together and build strong social cohesion so that it has a positive impact on motivation and relationships between students.

One of the recommended cooperative learning is the Jigsaw type that is designed to increase the sense of responsibility towards oneself and even others. Students not only learn the material provided but must also be prepared to give and teach the material to other groups. Logically this is very difficult to do, especially in elementary school students who act as experts. Therefore, the teacher must always give encouragement and praise to students. In this way, students feel protected, brave, and enthusiastic to get ideas out. In learning that uses a Jigsaw cooperative learning model, students are given the freedom and opportunity to gather information related to learning material from sharing learning resources.

Jigsaw technique is one of active learning which is used to achieve learning objectives. This technique relies on sharing effective ways, including materials neatly arranged in a study, learning objectives, and adequate time between students in a group. By doing this, students will benefit from being able to socialize, be responsible, and be independent (Badri, Nuaimi, Guang, & Rashedi, 2017). The Jigsaw cooperative model is an appropriate approach to be applied to learning because natural science has comprehensive learning material so that cooperation in learning is needed. Based on the description, the purpose of this study was to determine the effect of cooperative learning model type on student' cognitive achievement.

METHODS

Research design

The type of research used in this study was a quasi-experiment to determine the effect of a treatment on the characteristics of the subjects studied, so it is not possible to control all relevant

variables. The research design used was the pretest-posttest non-equivalent control group design, as shown in Table 1.

Table 1
Research Design

Group	Pre-Test	Treatment	Posttest
E_1	X_{EI}	X_1	Y_{E1}
E_2	X_{E2}	X_2	Y_{E2}

Note:
E_1 = Experiment group
E_2 = Control Group
X_{E1} = Pretest of Experiment group
X_{E2} = Pretest of Control Group
Y_{E1} = Posttest of Experiment group
Y_{E2} = Posttest of Control Group
X_1 = Jigsaw Learning Type
X_2 = Learning Type used by teachers in the school (*example non example*/ENE)

The independent variable is the learning model, which consists of 2 levels, namely the Jigsaw type of cooperative learning model and the example non-example type. The dependent variable in this study is cognitive achievement.

Procedure

The research procedure consisted of several steps. The first step was taken to determine the experimental group and the control group. The second step was to give the same pretest to the experimental as well as control group. The questions given had been categorized as valid; they had been tested on 50 grade VI students in Ambon City. The number of questions was 16 numbers consisting of multiple choices with an average category level of analysis. Examples of pretest and posttest questions are:

1. Afi and her laboratory learning group take blood samples, then examine them in their school. From the results of the laboratory learning, they concluded that blood has the following functions.
   1) Act as a body's defense.
   2) Plays a role in blood clotting.
   3) Plays a role in the distribution of nutrients.
   4) Plays a role in spreading oxygen.

   In your opinion, from the results of the Afi group, which included in the function of white blood cells and platelets …...
   a. 1 and 2
   b. 1 and 3
   c. 2 and 4
   d. 3 and 4
2. Dirty blood in birds is not pumped directly to the heart but instead flowed into the lungs. If the bird's lungs are damaged, the result is ….
   a. Dirty blood is not available.
   b. Dirty blood will be circulated throughout the body.
   c. Dirty and clean blood circulates.
   d. There is no bird blood circulation process.

Then, the experimental group and the control group were given different treatments. Experimental group was applied by Jigsaw type cooperative learning models, and the control group was given an example non-example (ENE) as the learning treatment often used by teachers in the school. The

material taught to students was the circulatory system of humans and animals. After that, both groups were given the same posttest.

Samples

This research was carried out at Elementary School 5, Ambon. Sampling was done randomly by taking samples in the form of classes that have the opportunity to be sampled. This was done because sampling in schools can only be done by selecting classes that are then used as an experimental group. Based on this technique, samples were randomly selected, namely two classes. The selected samples were Class 5a and Class 5b with 28 and 26 students, respectively.

Instrument

The main instrument used in this study was the cognitive learning achievement test instrument. Other supporting instruments were in the form of students' worksheets that have been validated and used to measure student activity in each meeting, sheets of Jigsaw and ENE learning outcomes, sheets of student responses to Jigsaw and ENE, and interview instruments to confirm student answers.

Data analysis technique

The data obtained were analyzed based on data analysis techniques, which included descriptive analysis, assumption test or analysis prerequisite test, and hypothesis testing. After being tested for normality and homogeneity, then the average difference was done for initial achievement in each experimental group was carried out. This was conducted to find out whether there were differences in the average for the first achievements of the two groups. The test used was the analysis of covariance (ANCOVA) at significance level of 0.05 on SPSS 17.00 Software.

RESULTS AND DISCUSSION

Before conducting the learning process in class, the first thing to do was to carry out a placement test to find out whether the two classes were equal or not. The placement test results showed that for normality of data, the sig value was 0.614 > alpha 0.05, it means that the equality test data was spread normally. Whereas for homogeneity test, the sig value showed 0.446 > alpha 0.05, it means that equality test data were homogeneous. After proving that data were normal and homogeneous, and then ANOVA test was then performed to ensure equality in the two groups, namely Jigsaw and ENE. ANOVA results indicated the value of Sig (0.00) < alpha (0.05). it means that there was no difference in learning achievement between the two groups of students in Class 5a and Class 5b, or both were equivalent.

Validity and Reliability Test of Test Instruments

Validity test was carried out on 20 items of cognitive achievement. The test results showed that four items were declared invalid, or 16 items were valid with a validity value of 0.658. Furthermore, the reliability test was done to find out the reliable test instrument, to obtain the results of the reliability test with the formula Cronbach's Alpha 0.795. Thus, the test instrument was reliable and had high-reliability criteria.

Hypothesis Prerequisite Test

The prerequisite tests that must be met are the normality and homogeneity tests of the data. The normality test was used to find out whether the test result data that was carried out was normally distributed or not using One-Sample Kolmogorov Smirnov. Homogeneity test was conducted to prove whether the pretest and posttest data were homogeneous or not, using the Leven's Test of Equality of Error Variances in SPSS 17.00 Software. The results of the prerequisite test data are presented in Table 2. The normality and homogeneity tests of the data were carried out in two groups, namely the experimental group and the control group.

Table 2
Summary of Test Results for Normality and Homogeneity of Bound Variable Data

Variable	Prerequisite Test	Significance (2-tailed)		Alpha
		Pretest	Postest	
Cognitive Achievement	Normality Homogeneity	0.058 0.108	0.051 0.092	0.05

The data normality test results showed that pretest data had Sig (0.058)> alpha (0.05). It means that pretest data were spread normally in the experimental and control groups. The same results were also shown for posttest data, where the value of sig (0.051) > alpha (0.05). It means that the posttest data were spread normally. Homogeneity test results obtained Sig value of (0.108 and 0.092)> 0.05 alpha, meaning that both data were homogeneously distributed. Based on the results of the analysis prerequisite test conducted, it could be stated that the research data for the pretest and posttest results were normally distributed, and the variance between the experimental group and the control group was homogeneous. Therefore, data analysis can proceed to the next test, namely the hypothesis test.

Hypothesis testing can use the pretest/covariate value of cognitive achievement of students in the experimental group with the Jigsaw type cooperative learning model treatment and the control group with the ENE type cooperative learning model. The purpose of this hypothesis test was to find out the differences between Jigsaw and ENE type cooperative models on student cognitive achievement. The results of the statistical analysis of ANCOVA variables related to cognitive achievement can be seen in Table 3.

Table 3
ANCOVA Test Results of Differences in Cognitive Achievement in Jigsaw and ENE Cooperative Learning Models

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	12442.844[a]	2	6221.422	82.650	.000
Intercept	11726.664	1	11726.664	155.786	.000
Pretest	1251.588	1	1251.588	16.627	.000
Model	8237.971	1	8237.971	109.439	.000
Error	3838.985	51	75.274		
Total	312578.125	54			
Corrected Total	16281.829	53			

ANCOVA test results showed a significance value of 0,000 <0,05 alpha so that Ho was rejected, and Ha was accepted. This means that there are differences in student learning outcomes by using a Jigsaw and ENE cooperative learning model. Based on the data obtained, there were differences in cognitive achievement in Jigsaw and ENE cooperative learning. The Least Significant Difference (LSD) advanced tests or T-test did not need to be conducted because there were only two treatment groups. However, information about the corrected mean was needed to compare the significance of the treatment between the two types of cooperative learning, as shown in Table 4.

Table 4
Corrected Average Cognitive achievement in Both Groups of Cooperative Learning Types

Types of Cooperative Learning	X. HBK	Y. HBK	Difference	Corrected Average
Jigsaw	38.3929	87.9464	49.5535	60.667
Example non-example (ENE)	32.4519	59.1346	26.6827	86.523

Table 4 informs that the treatment group had a higher corrected average of 25,856 points than the control group. Therefore, it was concluded that students learned with the Jigsaw cooperative model had higher cognitive learning achievement outcomes than the ENE type cooperative learning

model. The results of N-Gain, as in Figure 2, showed that the increase in the highest cognitive achievement from the pretest to posttest was seen in cooperative learning with Jigsaw.

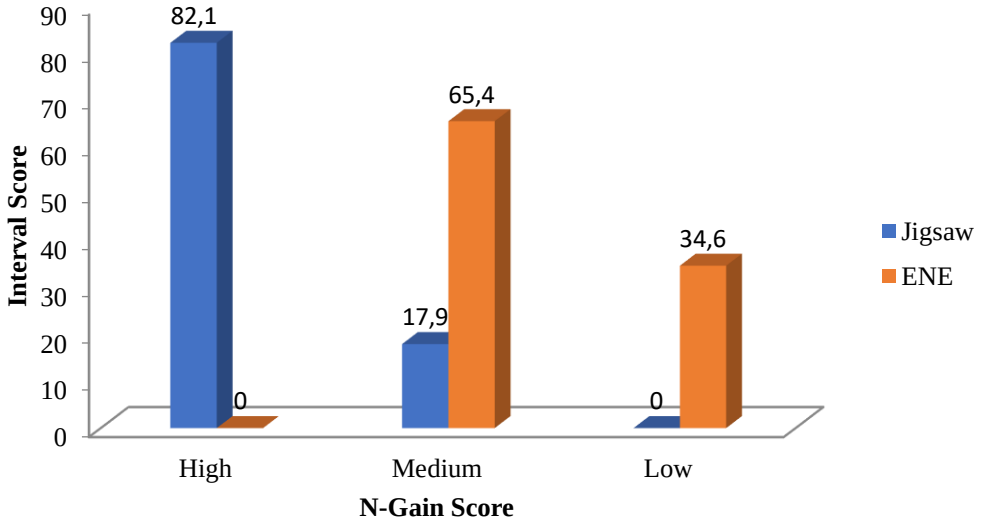

Figure 2. Student N-gain for Jigsaw and ENE Type Cooperative Learning Models

The study results informed that the cognitive of students in the Jigsaw group was more significant than the ENE group because students had many opportunities to express ideas, improve understanding and communication skills in the jigsaw group, while students in ENE type cooperative learning models were not included in the syntax of the model so students were not active or students are not confident in expressing opinions in front of his friends and teachers. The proof of research results that the Jigsaw type cooperative learning model has a more significant impact on cognitive achievement, compared to ENE can be assessed through the work of students in the expert group in Table 5.

Table 5
Footage of Expert Group Work Results on Jigsaw Learning

Indicators of Competency Achievement	Expert Group	Question Form	Student Answers	Level Cognitive
Mention abnormalities in the human circulatory system	Anemia	After learning about anemia, conclude why someone has anemia?	Because eating patterns of lacking specific vitamins and intestinal disorders.	C2
	Leukemia	Ani has had leukemia since she was three years old. His body looks very thin and weak. Why do you think Ani has leukemia?	Because white blood cells are excessive that they not only eat red blood cells, so the body has severe anemia.	C4
	Hemophilia	Ifan and Irma made a kite using a sharp knife; finally, their index finger was cut off and bleeding. Ifan's blood is continuously flowing so that he is short of blood, while Irma's blood that flows then immediately clots. Which one do you think is worse? Give your explanation about the differences in abnormalities that occur in Ifan and Irma!	Ifan has a more severe illness than Irma. Irma has no hemophilia, while Ifan has. Hemophilia is a disease where blood is difficult to clot, and the slightest injury can cause blood to flow so that sufferers suffer from lack of blood, even causing death.	C5

The learning of science was based on competency achievement indicators that are mentioning abnormalities in the human circulatory system. The formulation of learning objectives to be achieved was by reading various abnormalities in the circulatory system; students could distinguish the various types of abnormalities in the circulatory system. In question 1, which includes the cognitive level of understanding, students were asked to conclude why someone has anemia? Student answers confirmed two leading causes of anemia, namely lack of vitamins and intestinal disorders. Students had an understanding that anemia is closely related to the availability of vitamins found in the human body if a vitamin deficiency reduces the production of red blood cells. Besides, students also understood that intestinal disorders or certain diseases could trigger anemia. The students' understanding was considered not entirely following the question about the causes of anemia.

Anemia is a blood disorder, where the number of red blood cells decreases or they do not have enough hemoglobin. Hemoglobin responsible for carrying oxygen from the lungs to all parts of the body. If someone is suffering from anemia, his blood does not contain enough oxygen to be carried throughout the body. Anemia can occur in a person when the body lacks much blood, for example, due to certain diseases that much blood excreted (such as bleeding), the human body experiences problems in the production of red blood cells, and they break down faster or die before reproduced. Students have explained that vitamin deficiencies cause anemia. However, they not specifically mentioned specific vitamins. Anemia can also occurs because the body lacks vitamin B12, which functions to make red blood cells and keep the nervous system healthy. This type of anemia is easily experienced by someone whose body has difficulty absorbing vitamin B12. Another factor that causes anemia mentioned by students was disease or intestinal disorders. Indeed, certain diseases can inhibit the human body to produce red blood cells, including kidney disease, so people who suffer from kidney disease often suffer from anemia. Suffering this disease, make the body can not produce enough hormones, which are signals for the body to produce red blood cells. Besides, the iron contained in red blood cells will be lost during dialysis (Judd, 2010).

The next question discussed by the leukemia expert group included the level of analysis, namely Ani, who had leukemia since the age of 3 years. Her body looks very thin and weak. Why do you think Ani has leukemia? Students' answers showed that leukemia causes excessive white blood cells, thus eating red blood cells, resulting in patients suffering from severe anemia. This student's answer referred more to the understanding of leukemia and had not provided more detailed information about the causes of leukemia. This shows that the information stored in student memory was related to the understanding or description of leukemia, students did not have clear information about the cause of someone who has leukemia, especially in children under the age of five as experienced by Ani.

Ani has Acute Lymphocytic Leukemia (ALL), which is a type of blood cancer experienced by children under the age of 5 years due to changes in a single cell in the bone marrow or changes in healthy cells. This causes the genes that control cells to multiply, grow, and die changed. The presence of leukemia causes abnormal growth or accumulation of white blood cells in the bone marrow and peripheral blood, which increases the number of white blood cells. However, the cause of why these cells become abnormal can not be known with certainty. Until now, there is no apparent certainty about the leading causes of leukemia, but lifestyle and environmental factors are predicted to trigger leukemia (Judd, 2000). Risk factors that cause leukemia include 1) genetic syndromes in the form of Klinefelter's syndrome and histiocytosis in Langerhans cells, 2) environmental factors, and styles 3) lifestyle factors. Environmental factors include ionizing radiation such as radon experienced by the mother, when she is pregnant, exposure to electromagnetic fields (EMF) imposed on children, and the reproductive history of a mother. Historical reproductive factors are related to the age of the mother when giving birth to her child, where the age of 35 years and over is considered at risk of giving birth to children who are likely to experience leukemia, due to the epigenetic mechanism at the time of the genetic mutation of oocyte cells. Other lifestyle factors that trigger leukemia include the consumption of alcohol, cigarettes, radiation, and other toxic substances during a mother's pregnancy (Reaman & Smith, 2011).

The next question was included in the category of evaluating cognitive, where students were asked to assess the situation experienced so that they can decide the best method of solving the problem. In the case, there were two different cases related to blood disorders. Namely, Ifan had hemophilia, while Irma did not experience the disease. Then, based on this information, students were asked to decide in assessing the difference in illness between the two cases. Students' answers snippet shows that students were able to find the keyword of the disease experienced in the case, namely hemophilia, although students were still unable to provide a more detailed explanation of the differences between sufferers and non-sufferers of hemophilia. Students seem to understand well what hemophilia is, and the information is used to explain.

Hemophilia is a genetic disorder that occurs in the blood and is caused by the body's inability to make the proteins needed for blood to clot. When someone with hemophilia is injured, blood will clots very slow or sometimes do not clot at all. This can cause excessive and painful bruising. Someone with hemophilia tends to experience bleeding. As a genetic disease, hemophilia can be passed on from generation to generation. This disease is sequenced on the X chromosome so that a woman has a higher chance than men to experience it. Inheritance is included in the mechanism of cross inheritance, where fathers pass on to daughters, while mothers pass on to sons (Britton, 2003; Raabe, 2008). A more detailed explanation that hemophilia is a genetic disease arranged on the X link chromosome had not been conveyed in elementary school learning; the information was only conveyed to the introduction about hemophilia.

Jigsaw was emphasizing teamwork consisting of 4-6 students with relatively different student knowledge, as shown in Figure 3. The application of this learning model in its syntax can be divided into origin groups and expert groups. In the original group, students were initially given material so that the group discussed together.

Furthermore, students in the original group who have gotten the material, gather as a group of experts to discuss and work on the material/worksheets. Each student who was in the expert group returns to the original group to teach other members about the material being learned in the expert group. The explanations above show that in Jigsaw learning, students have the opportunity to learn master concepts through discussion in expert groups. After the discussion in the original group has finished, all students are reevaluated individually about the material that has been learned.

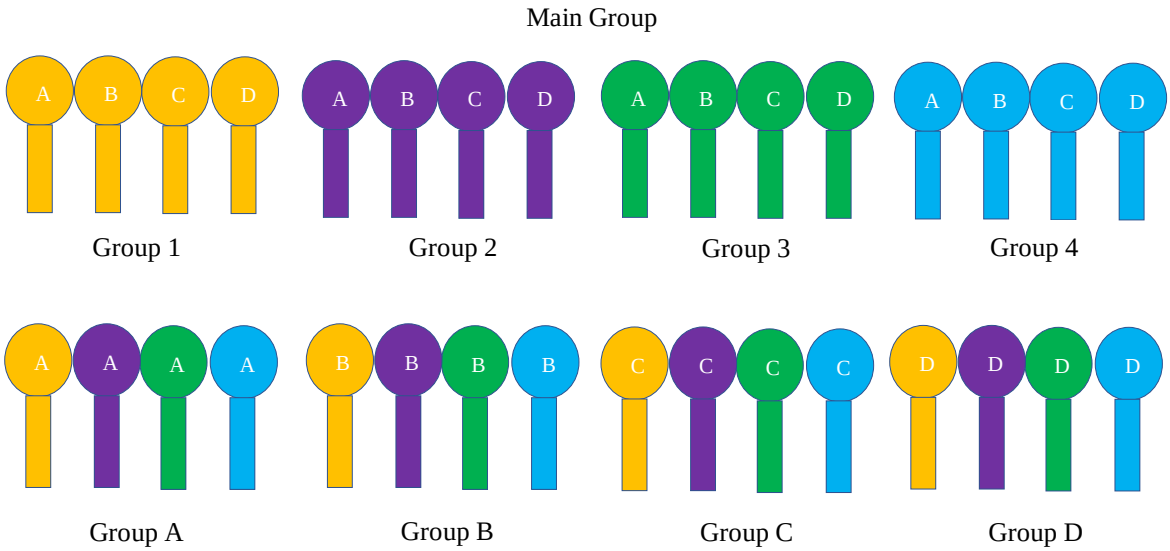

Figure 3. Design of Learning Implementation with Jigsaw

Learning with the Jigsaw motivates students to be more responsible in learning specific material assigned by the teacher and responsible for group performance so that students actively interact in the learning process to express opinions related to the material being studied in their groups, and within groups of students also as a director at his friends. In Jigsaw, the teacher only directs and facilitates students in learning activities. This is in line with the results of the study (Wilson, Pegram,

Battise, & Robinson, 2017), showing that students are highly motivated by the Jigsaw rather than direct learning.

The results of previous studies in the United States for medical students revealed that learning with Jigsaw could increase student learning achievement by 4.12 from a scale of 5 (Buhr, Heflin, White, & Pinheiro, 2014). In Jigsaw, one of the learning processes that can strengthen students' understanding of the material being studied is discussion in the expert group and the original group. This is possible because each group member can grow high curiosity about the material/problem being studied. This curiosity fosters interest and passion for actively seeking accurate and complete information through enthusiastic group work so that each group member seeks to develop his curiosity during discussions both in the original group and experts.

In learning, students feel active, happy, and excited, which will learn together with other friends in the expert group. This learning model also gives students the confidence to build discussions with friends in the group in order to finalize the material that will be delivered to their friends. Each student becomes a group representative, so he feels happy that he has the trust of his group to become a delegate in mastering the material and explain it back to his friends. By applying the Jigsaw cooperative learning model, students are not only trained in acquiring cognitive knowledge, but have skills in interacting with peers who are partners in learning (León del Barco, Mendo-Lazaro, Felipe-Castaño, Polo del Río, & Fajardo- Bullón, 2017; Tarhan, Ayyldız, Ogunc, & Sesen, 2013).

Also, learning done is not entirely derived from teacher information as a learner, because the teacher is assigned as a facilitator in discussion activities both in the original group and expert groups. Therefore, students are more accustomed exploring their knowledge with peer group. This process supports the development of student learning activities that causes more mature understanding and the increasing mastery level of the concept. The mastery of the material possessed by these students was proven from the results of each test at the end of learning with a high category, as shown in Figure 2.

In the ENE that has been widely mentioned and applied by schools in K-13 as written in the design of teacher learning tools, it was found that students' cognitive achievement was less improved. One of the factors considered contributing is that the learning implementation plan made by the teacher did not conform to the syntax of the ENE. This was due to teachers tend to follow the description of learning activities in the teacher's book in designing the learning tools, where the teacher does not pay close attention to the actual ENE syntax and mix it well according to the syntax intended. As a result, students looked passive and not confident in expressing their opinions, so that learning did not run efficiently and directly. In other words, learning did not fit into the core of the learning model written on the design of the learning tools.

CONCLUSION

Based on data analysis and discussion, it can be concluded that the Jigsaw cooperative learning model influences student learning outcomes. This can be seen from the difference in the average of posttest and pretest cognitive achievement of the experimental (learning using the Jigsaw cooperative model) and the control group (learning with the ENE cooperative model), which was 49.5535> 26.6827. This shows that science-biology learning with Jigsaw is significantly different from learning with ENE. It is expected that the results of this research can be developed in a broader scope in the future with other variables of the same type or other learning strategies that are more creative, so that it can add insight and can improve the quality of learning, especially in learning science-biology learning. The implications of this study include: 1) providing information related to the application of Jigsaw cooperative learning models for elementary students in improving student cognitive achievement, 2) providing alternatives to teachers in making learning processes more efficient and meaningful, 3) providing learning experiences in students using the Jigsaw cooperative learning model, and 4) providing contribution and reference for the next writer.

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