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# Comparison of snowball throwing and jigsaw learning models on science learning outcomes regarding human blood circulation in elementary schools

**Fika Habib Kurniawan[1], Lilik Bintartik[2], dan Surayanah[3]**
**[1,2,3] Primary School Teacher Education Study Program, Faculty of Education, Universitas Negeri Malang, Malang, Indonesia**

Corresponding author's e-mail: fikahabib02@gmail.com

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*jigsaw; snowball throwing; learning model; learning outcomes; human blood circulation*

**Abstract**

*Science learning is currently considered less interesting so students are less enthusiastic about participating in learning and this affects their learning outcomes. This research aims to compare the cognitive learning outcomes of students who use the Snowball Throwing and Jigsaw learning models. The research used quasi-experimental, non-equivalent control group design. The research was carried out at SDN Kayen Kidul in class V with 32 students divided into 2 groups. This research took samples using saturated sampling techniques. Research data was obtained through test instruments. The data was then analyzed using the Independent Sample T Test and the N Gain Score Test. Based on the Independent Sample T-Test, the significance value was 0.512, meaning that there was no significant difference in the learning outcomes of students who used the Snowball Throwing and Jigsaw models. Based on the N Gain Score test, it is known that the Snowball Throwing model is more effective than the Jigsaw model, because the N Gain Score value for the Snowball Throwing class is greater than 0.6465, compared to the value for the Jigsaw class 0.5835. Based on the two test results above, it is known that the Snowball Throwing learning model is more effective in influencing student learning outcomes compared to the Jigsaw learning model on the main subject of human blood circulation in elementary schools, as well as being a novelty in this research. The results of this research can serve as guidance and recommendations in developing strategies or policies in relevant fields.*

## INTRODUCTION

### Background of the Study

Learning requires an evaluation to find out the level of success. To evaluate the existing education system in the world, a study called PISA was conducted. This study assesses the education system in various countries in the world through the academic performance of students aged 15 years in the areas of science, reading, and mathematics skills. The PISA study is carried out every 3 years with the last study being carried out in 2022 and 81 countries participating. Based on the 2022 PISA results, it is known that Indonesian students in the field of science obtained an average score of 383. This score is a decrease compared to the average science score for students in 2018, namely 396 (OECD, 2023).

Science is one of the many subjects studied at the elementary school level. At this level, science is still studied in an integrated manner between Biology, Physics, and Chemistry with material that is still simple, namely relating to the surrounding environment and oneself. Natural sciences are studied from the elementary school level because they contain essential material about life. Apart from that, it is important to teach science in elementary school because it can teach students to communicate by conveying facts found in the learning process (Untari et al., 2022).

Science is a subject that teaches students not to take facts for granted. Science studies nature and the surrounding environment systematically (Julia Agustin et al. (2019); Setiowati (2019). Pratama & Widodo (2023) revealed that science learning students are taught about facts, concepts, principles, laws, theories, process skills, and scientific attitudes. Therefore, to gain as much knowledge as possible, students must prove the truth for themselves using scientific methods. Aslach et al. (2020) revealed that in science learning students must be active in acquiring their knowledge.

Learning results are angles that can be utilized to degree the degree to which learning destinations have been accomplished after learning exercises have been carried out. According to Yandi et al. (2023), learning outcomes are a description of the learning process that students go through. Learning outcomes are the final stage in the learning process because learning outcomes are obtained through evaluation activities to determine the level of students' understanding of the material that has been studied. This is in line with the opinion of Mahajan & Singh (2017):

> *"Learning outcomes such as navigation (GPS). After the destination is fed to the device, the GPS guides the driver along the way and takes the driver to the properly stated destination. Likewise, learning outcomes are guiding*

*tools that guide students for the desired results from learning activities that have been planned for learning objectives."*

Based on the description above, it can be concluded that learning outcomes are an indication of student success in achieving a learning goal. Indicators of success can be expressed in the form of numbers, letters, or even sentences. There are 3 aspects of learning outcomes, namely cognitive, psychomotor, and affective. To obtain learning outcomes, teachers need to carry out evaluation activities after learning is completed. According to Suardipa & Primayana (2023), evaluation aims to determine the level of achievement of learning objectives based on the planned program. The benchmark used for learning outcomes is the KKM set by the school. Learning outcomes are an illustration of how well the learning has been experienced by students, one of which is also related to the suitability of the learning model used by the teacher in teaching the material.

Malik & Afandi (2020) revealed that learning models are techniques used by educators in learning. In the learning model, there is a learning flow that educators must follow during the learning process. There are many types of learning models, therefore their use is adjusted to the material and students' learning characteristics. There are 2 types of learning models, namely teacher center and student center. However, currently, the dominant learning model used is student-centered with cooperative learning techniques or group learning. According to Surayanah & Karma (2023), group learning can optimize student learning outcomes. Group learning models, for example, the Snowball Throwing and Jigsaw learning models.

The Snowball-Throwing learning model is a learning model that uses sheets of paper containing questions which are then rolled into a ball and thrown alternately (Sudana, 2019). In implementing the Snowball-Throwing learning model, communication is essential because there is interaction with peers. The Snowball-Throwing learning model makes learning interesting because it is fun and challenging (Purba, 2019). In this learning, the teacher only plays a role in facilitating and directing learning. Students' ability to communicate information from the teacher to other group members is a challenge for this learning model.

The Jigsaw learning model is a model that divides students into groups with different characters (Simaremare & Thesalonika, 2021). The group division in this model is carried out randomly. When applying the Jigsaw learning model, students will hold discussions in 2 groups, namely the home group and the expert group. Yuliani (2019) explained that using the Jigsaw learning model can help train students'

sense of responsibility. With the Jigsaw learning model, it is hoped that students will be more motivated to learn because they have a sense of responsibility to teach the material to other friends.

## Problem of The Study

Based on the results of interviews and observations at SDN Kayen Kidul, it is known that in science learning there are still obstacles experienced. Students still encounter obstacles in learning some material and are still lacking enthusiasm for learning. Students are less active in answering or asking questions. There are still 75 percent of students with scores above the KKM in the human circulatory system material.

## Study's State of the Art

So far there have been various studies related to the Snowball Throwing learning model, the Jigsaw learning model, or comparing the two learning models. Mursid et al., (2021) conducted a study that resulted in the conclusion that the Snowball Throwing learning model in science learning had a significant effect on the learning outcomes of class V students at MI Al-Mursyid. This is based on the average score of MI Al-Mursyid's pre-test results of 57.60, while the average score of post-test results is 81.55. Apart from a study related to the influence of the Snowball-Throwing learning model, there is also a study on the influence of the Jigsaw learning model. This study was conducted by Mahfudh (2023) which shows that the implementation of the Jigsaw-type cooperative learning model can improve social studies learning outcomes on demand and supply material for class VII B students at SMP Negeri 1 Candimulyo, even semester, academic year 2021/2022. The study conducted by Mursid and Mahfudh was carried out to determine the influence of each learning model. This is different from a study conducted by Purba (2019) which compared student learning outcomes using the Snowball Throwing and Jigsaw learning models on human digestive system material in class VIII. The results of this study indicate that the Snowball-Throwing type cooperative learning model is more effective than the jigsaw-type cooperative learning model in the material on the human digestive system in class VIII of SMP Negeri 7 Pematangsiantar.

This research has similarities when compared with the research described above, namely to determine its effect on students' cognitive learning outcomes. However, this research focuses on finding out which Snowball-Throwing learning model or Jigsaw learning model is more effective in influencing science learning outcomes, especially on material about the human circulatory system. This research

also explains why this learning model is more effective than other learning models. Starting from comparing the steps in each learning model, problems in implementing each learning model, to student responses during learning.

### Novelty, Study Gap, & Objective

In this research, learning using the Snowball Throwing model experienced slight changes in the steps. In general, one of the steps in the Snowball-Throwing learning model is that the teacher explains one of the students in each group. Next, the student must explain to the rest of his group. With this activity, there is a big potential for students to make mistakes or be less able to explain the material to other group members. Therefore, in this research, this step was replaced by the teacher presenting the material to be studied, and students discussing the material in groups. The changes in the steps in the Snowball Throwing learning model differentiate this research from other research. The goal of this change is to reduce one of the drawbacks of Snowball Throwing. Meanwhile, in the Jigsaw learning model, no changes have been made.

The problem in this research refers to the learning model used which is still not able to make students actively involved in learning, and there is material that is difficult for students to understand. If we refer to the analysis of PISA results, the action that can be taken is to make learning interesting for students. Following the problems and solutions that have been explained, an appropriate learning model is needed so that students are interested in participating in learning with the hope that student learning outcomes can be maximized became the research gap in this research. This research aims to compare the cognitive learning outcomes of students who use the Snowball Throwing type and Jigsaw type cooperative learning models in the science subject material on the human circulatory system for class V elementary school.

## METHOD

### Type and Design

The study was carried out using a quantitative approach. The quantitative approach uses numbers to process statistical and experimental data. The study design used was a quasi-experimental type with a pre-test and post-test non-equivalent control group design. This study design uses 2 classes that are determined randomly. One class applied the Snowball Throwing learning model, while the other class used the Jigsaw learning model. The two classes were given the application of different

learning models to compare the cognitive learning outcomes obtained by students. The learning outcomes that are compared are the post-test scores carried out by students after being given treatment. For more details, this study design is listed in the following table.

**Table 1.** Study Design

| Group | Pre-test | Treatment | Post-test |
|---|---|---|---|
| Experimental Group 1 (Snowball Throwing) | $O_1$ | $X_1$ | $O_2$ |
| Experimental Group 2 (Jigsaw) | $O_3$ | $X_2$ | $O_4$ |

Information:

X1: Snowball Throwing type cooperative learning model

X2: Jigsaw-type cooperative learning model

$O_1$: Snowball Throwing group pre-test

O2: Snowball Throwing group post-test

O3: Jigsaw group pre-test

O4: Jigsaw group post-test

## Data and Data Sources

The research sample was taken using a non-probability sampling technique. More specifically, the technique used is saturated sampling. Thus, all members of the class V population of SDN Kayen Kidul were sampled. This research involved 32 fifth-grade students at SDN Kayen Kidul consisting of 2 groups. Each group consists of 16 students.

The study variables used are the Snowball Throwing and Jigsaw learning model (X) and learning outcomes (Y). The material used in learning is the human circulatory system. This material was chosen because students still have obstacles in learning it. In this study, the material will be studied using the Snowball Throwing and Jigsaw learning models in 2 meetings.

## Data Collection Technique

Research data was obtained using test instruments. The test in this study was carried out twice, namely at the beginning before being given treatment using the Pre-test and at the end after being given treatment using the Post-test. The pre-test and post-test consist of questions that refer to learning outcomes regarding the human circulatory system. The questions that have been prepared are 25 multiple choice questions and then go through validation by the validator. After that, the questions were revised according to the validator's suggestions, and trials were carried out in class with almost the same criteria as the research subjects. Trial data

is analyzed through tests of validity, reliability, level of difficulty, and distinguishing power to determine the suitability of the questions. After carrying out the various tests, 15 questions were taken with a division of difficulty levels, 7 questions at the understanding level (C2), 4 questions at the application level (C3), and 4 questions at the analysis level (C4) for the questions. Post-test.

### Data Analysis

Data is processed and analyzed when all research data has been collected. The data analysis used in the data collected is descriptive and inferential statistics. Data were analyzed with the help of SPPS 25 software for Windows. Pre-test and post-test data for both learning models were analyzed using Normality and Homogeneity tests. To conclude the objectives of this research, the N Gain Score test and the Independent Sample T Test were used.

## RESULTS

### Snowball Throwing Class Data Display

The data presented includes pre-test and post-test scores. Pre-test scores were obtained after students completed 10 multiple-choice questions before implementing the Snowball Throwing learning model, while post-test scores were obtained after students completed 15 questions at the end of the treatment. The Snowball Throwing class data is presented in the following table.

**Table 2.** Data on Learning Outcomes for Students in the Snowball Throwing Class

| Data | Students | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Pre-test | 16 | 35 | 73 | 53 | 11,506 |
| Post-test | 16 | 60 | 100 | 82 | 11,008 |

Information on the average score in the Snowball Throwing class Pre-test is shown in table 2, namely 53. This score was obtained from 16 students with the smallest score being 35 and the highest score being 73. Meanwhile, the average post-test score for students was 82 with a score of the smallest value is 60 and the maximum value is 100. The standard deviation of the pre-test results for the Snowball Throwing class is 11.506, while the standard deviation of the post-test results is 11.008.

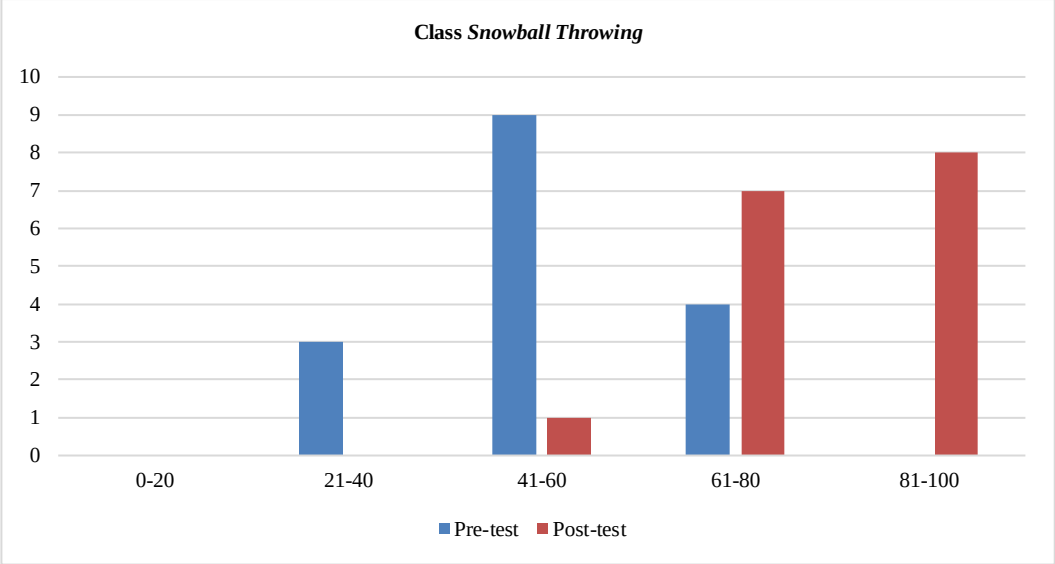


**Figure 1.** Data on student learning outcomes

Figure 1 presents the distribution of student score data in interval form. Referring to the picture above, information on the pre-test scores of dominant students is in the 41-60 interval, while the post-test scores of dominant students are in the interval 81-100. More specifically, 0 students obtained scores in the 0-20 interval on both tests. In the 21-40 interval there were 3 students in the Pre-test, while for the Post-test there were 0 students. For the 41-60 interval 9 students got scores in this interval on the Pre-test and 1 student on the Post-test. The number of students who got scores in the interval 61-80 in the pre-test was 4 students and 7 students in the post-test. There were 0 students in the Pre-test who obtained an interval score of 81-100 and 8 students in the Post-test.

The results of the Normality test and Paired Sample t-test analysis of the pre-test and final data using the SPSS program are as follows.

**Table 3.** Normality Test and Paired Sample T Test of Snowball Throwing Class Data

| Data | Shapiro wilk | | Paired Sample T Test |
|---|---|---|---|
| | Students | Signifikansi | |
| Pre-test Snowball Throwing | 16 | 0,520 | 0,000 |
| Post-test Snowball Throwing | 16 | 0,435 | |

Table 3 shows the significance values in the pre-test and final are 0.520 and 0.435 respectively. Both of these values are greater than 0.05. So it can be concluded that the data from the two tests is normally distributed. The data was then tested using the Paired Sample T Test. The results of this test show a significance value of 0.000<0.05, which means there is a significant difference in the average student

learning outcomes. Thus it can be concluded that the Snowball Throwing learning model influences student learning outcomes.

### Jigsaw Class Data Display

The data presented includes pre-test and post-test scores. Pre-test scores were obtained after students worked on 10 multiple-choice questions before applying the Jigsaw learning model, while post-test scores were obtained after students completed 15 questions at the end of the treatment. The Jigsaw class data display is presented in table form below.

**Table 4.** Description of Learning Outcomes Data For Jigsaw Class Students

| Data | Students | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Pre-test | 16 | 32 | 80 | 54 | 13,923 |
| Post-test | 16 | 53 | 100 | 80 | 10,826 |

Information on the average score in the Jigsaw class Pre-test is shown in Table 4, namely 54. This score was obtained from 16 students with the smallest score being 32 and the highest score being 80. Meanwhile, the average post-test score for students was 80 with a score of the smallest value is 53 and the highest value is 100. The standard deviation of the Pre-test results for the Jigsaw class is 13.923, while for the Post-test results the standard deviation is 10.826.

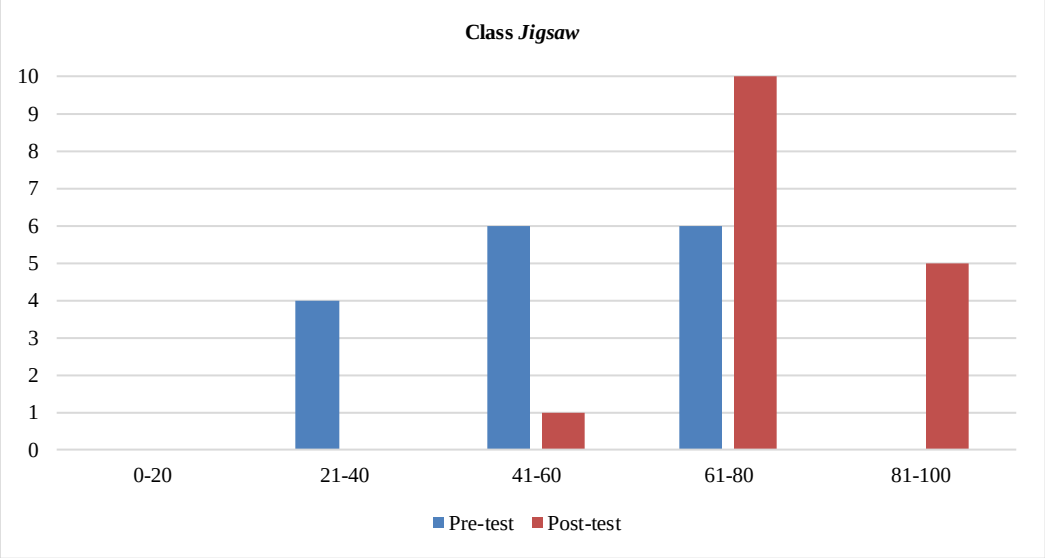


**Figure 2.** Student Learning Outcome Data

Figure 2 presents the distribution of student score data in interval form. Referring to the picture above, information on the pre-test scores of dominant students is in the interval 41-60 and 61-80, while the post-test scores of dominant students are in the interval 61-80. More specifically, 0 students obtained scores in the 0-20 interval on both tests. In the 21-40 interval there were 4 students in the pre-test,

while for the post-test there were 0 students. For the 41-60 interval 6 students got scores in this interval on the Pre-test and 1 student on the Post-test. The number of students in the pre-test in the 61-80 interval was 6 students and 10 students in the post-test. There were 0 students in the Pre-test who obtained an interval score of 81-100 and 5 students in the Post-test.

The results of the Normality test and Paired Sample t-test analysis of the pre-test and final data using the SPSS program are as follows.

**Table 5.** Jigsaw Class Data Normality Test

| Data | Shapiro wilk | | Paired Sample T Test |
|---|---|---|---|
| | Jumlah siswa | Significance | |
| Pre-test *Jigsaw* | 16 | 0,540 | 0,000 |
| Post-test *Jigsaw* | 16 | 0,316 | |

Table 5 shows the significance values in the pre-test and final are 0.540 and 0.316 respectively. Both of these values are greater than 0.05. So it can be concluded that the data from the two tests is normally distributed. The data was then tested using the Paired Sample T Test. The results of this test show a significance value of 0.000<0.05, which means there is a significant difference in the average student learning outcomes. Thus it can be concluded that the Jigsaw learning model influences student learning outcomes.

## Effectiveness and Significance

The effectiveness of the Snowball Throwing and Jigsaw learning models was compared through the scores obtained by students in the Pre-test and Post-test. The following image depicts the distribution of student scores.

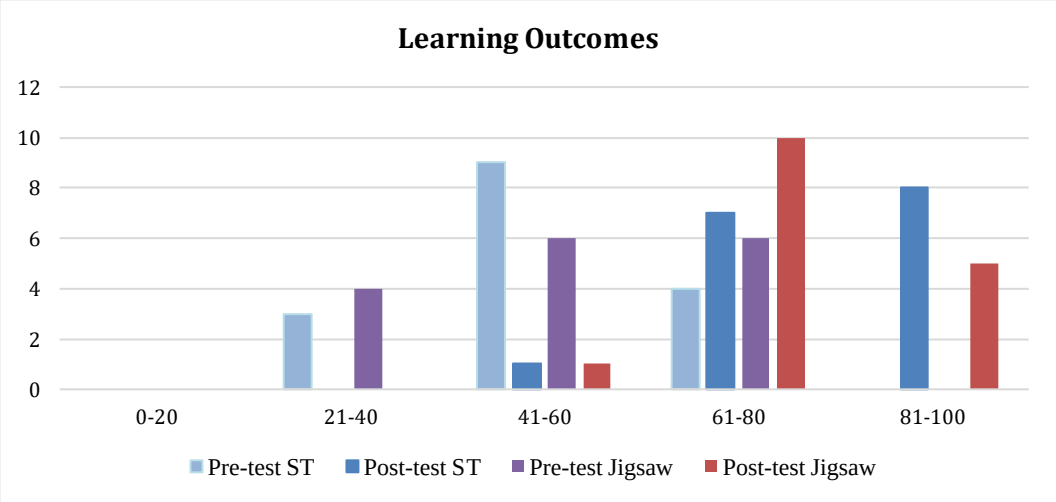


**Figure 3.** Effectiveness and Significance

Students' understanding of the human circulatory system has increased after implementing the Snowball Throwing and Jigsaw learning models. The average student learning outcomes with the Snowball Throwing learning model increased by 29 points, while with the Jigsaw learning model, there was an increase of 26 points. This shows that the increase in student learning outcomes with the snowball-throwing learning model is greater than the Jigsaw learning model.

The calculation results of the N Gain Score test, Homogeneity test, and Independent Sample T Test significance using SPSS software are as follows.

**Table 6.** Results of the N Gain Score Test and Independent Sample T Test

| Data analysis | N Gain Score | Homogeneity | Independent Sample T Test | |
|---|---|---|---|---|
| | | | Pre-test | Post-test |
| Snowball Throwing | 0,6465 | 0,578 | 0,956 | 0,512 |
| Jigsaw | 0,5835 | | | |

Table 6 shows the significance value in the homogeneity test for the initial and final tests, namely 0.578. This value is greater than 0.05. So it can be concluded that the data is homogeneous. The data was then analyzed using the Independent Sample T Test.

The results of the Independent Sample T Test in the initial test are shown in Table 6, namely that a significance value of 0.956 was obtained, this value is greater than 0.05, which means ho is accepted and ha is rejected. So it can be concluded that there is no significant difference in the initial test results of students in the Snowball Throwing and Jigsaw classes. In the Independent Sample T Test results in the final test, a significance value of 0.512 was obtained. This value is greater than 0.05, meaning ho is accepted and ha is rejected. Thus it can be concluded that the final test results of students in the Snowball Throwing and Jigsaw classes are not significantly different.

The N Gain Score test results shown in Table 6 obtained a value of 0.6465 in the Snowball Throwing model and a value of 0.5835 in the Jigsaw model. These two values are in the quite effective range. So it can be concluded that the Snowball Throwing and Jigsaw learning models are quite effective in influencing student learning outcomes. Even so, the Snowball Throwing model can be said to be better than the Jigsaw model because the N Gain Score value of the Snowball Throwing model is greater than the Jigsaw model.

Based on the results of the Independent Sample T-Test, it is known that the two learning models have a significant effect on student learning outcomes. Even so,

the significance value in the snowball-throwing learning model is greater than the significance value in the Jigsaw learning model. This indicates that the snowball-throwing learning model is more effective in influencing student learning outcomes than the Jigsaw learning model. This is also confirmed by the results of the N Gain Score test, where the N Gain value in the Snowball Throwing learning model is greater than in the Jigsaw learning model.

## DISCUSSIONS

### Effectiveness of Snowball Throwing and Jigsaw Learning Models on Science Learning Outcomes for Fifth-Grade Elementary School Students

The application of the Snowball Throwing and Jigsaw learning models both show a significant influence in influencing students' science learning outcomes. This is in line with research by Mursid et al., (2021) regarding the Snowball Throwing learning model and research by Laisnima & Zulfiani (2021) regarding the Jigsaw learning model. Even though both show a significant influence, there are differences between the two during learning activities. This is because the steps in the two learning models are different.

The application of the Snowball Throwing and Jigsaw learning models did not show a significant difference in students' cognitive learning outcomes. However, it can be seen that the Snowball Throwing learning model in influencing the learning outcomes obtained by students is more effective than the Jigsaw learning model. This statement is based on the pre-test results in the Snowball Throwing class which were lower compared to the Jigsaw class and then changed to higher in the post-test results. Apart from that, the N Gain Score test results for the Snowball Throwing learning model have a greater value than the Jigsaw learning model. The greater the N Gain Score value of a learning model, the more effective it is in influencing student learning outcomes. The research results of Sopiyatun & Wulandari (2020) also show that learning that applies the Snowball Throwing model is more effective in influencing student learning outcomes compared to the Jigsaw learning model.

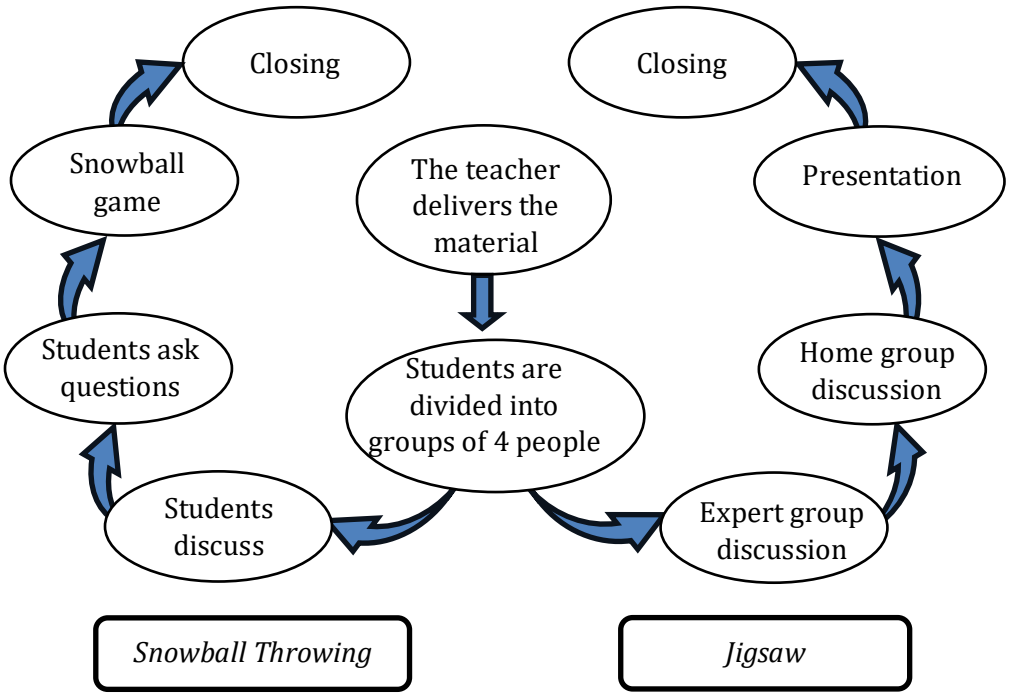


**Figure 4.** Snowball Throwing and Jigsaw Learning Scheme

Based on Figure 4, it is known that the Snowball Throwing and Jigsaw learning models have almost the same implementation flow. The snowball-throwing learning model allows students to learn by discussing and playing, while the Jigsaw learning model only allows students to discuss with their peers. This is what causes the difference in effectiveness between the snowball-throwing learning model and the Jigsaw learning model.

The snowball-throwing learning model can increase student understanding due to increasing student motivation to learn. Students look enthusiastic and enjoy learning. Moreover, when students play snowball-throwing games, students become more enthusiastic and active when learning. Research conducted by Arina (2020) also produced similar results, namely that learning using the Snowball Throwing model can foster students' interest in learning. Increasing students' interest in learning, of course, will also have an impact on students' motivation. This statement is in line with research by Putri & Rifai (2019) that students' interest in learning also influences their motivation.

Student motivation at the elementary school level can be increased by playing. Playing allows elementary school students, who are still children, to participate in learning with enjoyment. This was also shown by students when learning was carried out, students still wanted to continue the ball-throwing game even though if they continued the time for the next activity would not be sufficient. Playing the snowball-

throwing learning model can help students increase their learning motivation. This is shown by research by Mulyani et al., (2021) that the Snowball Throwing learning model can improve student learning outcomes. By playing, students will not get bored with learning and the learning time will not feel long for students. Thus, it can be concluded that the game in the Snowball Throwing learning model can influence students' motivation and learning outcomes.

The Jigsaw learning model increases students' understanding of the material through discussion activities. Discussions enable students to interact and collaborate with their peers. Apart from that, discussions are also useful for making learning more active by increasing student and teacher activity. This statement is in line with Widiarsa's (2020) research which shows that discussions influence increasing students' activities when studying and influencing their learning outcomes. By increasing activity, students will not get bored when participating in the learning process. The interactions that students have with their friends also increase students' enthusiasm for learning. This opinion is also based on the research results of Prastika Damayanti et al. (2021) and Febnasari et al. (2019) that student communication with other students has a positive impact on students' motivation to learn. With the emergence of this motivation, students will be enthusiastic about studying the material provided during learning. Thus, it can be concluded that the Jigsaw learning model influences motivation and learning outcomes obtained by students through discussion activities carried out by students.

In implementing the learning described above, of course, it is not free from problems. In implementing the snowball-throwing learning model, of course, some obstacles arise, including female students in one group being reluctant to join their group because the other group members are male. This problem makes discussions in groups less than optimal and makes the teacher have to visit the group more often so that all group members can discuss well. Apart from that, students' questions in the first lesson still tend to be monotonous and slightly more varied in the second lesson. Meanwhile, the problem with implementing the Jigsaw learning model is that there are female students in two different groups who are reluctant to join their group because the other group members are male. This causes group discussions to be less than optimal and makes the teacher have to visit the group more often so that all group members can discuss well. In the expert group discussion, students were still enthusiastic and enthusiastic in discussing. However, in home group discussions the

teacher had difficulty controlling students who were getting bored and playing alone with their friends.

The problem with both learning models is more or less the same, namely ineffective discussions. This problem can be a concern for teachers when they want to apply Snowball Throwing, Jigsaw, or other group learning models. For future researchers, issues regarding student collaboration and cooperation in implementing the group learning model can be studied in depth.

## CONCLUSION

The research results show that the Snowball Throwing and Jigsaw learning models have quite a big influence on student learning outcomes on the main subject of human blood circulation in elementary schools. However, it can be seen that the snowball-throwing learning model is more effective in influencing student learning outcomes when compared to the Jigsaw learning model on the main subject of human blood circulation in elementary schools.

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