e-ISSN: 2721-1274
p-ISSN:2721-2718

# THE ANALYSIS OF GROUP DIVISION IN THE THINKING ALOUD PAIR PROBLEM SOLVING (TAPPS) LEARNING MODEL

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## ABSTRACT

*This research objective (1) Find out the effect of the group division in the TAPPS learning model of students' ability to solve problems; (2) Determine the improvement of students' problem-solving ability after group division in the TAPPS learning model is applied; (3) find out the effect of group division in the TAPPS learning model on students' learning outcomes; (4) Determine the improvement in the students' learning outcomes after group division in the TAPPS learning model applied. The subjects of this research were students at SMA Islam Al Ulum Terpadu Medan consisting of two classes. X MIA 1 consists of 28 students who will be divided into 3 group divisions with different numbers of members. X MIA 2, formed of 30 students will also be divided into 3 group divisions with different numbers of members. The type of research was a true experiment to determine the effect of group division in the TAPPS model for the subject. The data collection instrument used in this research consisted of a problem-solving test with 10 essay forms that had been validated by three experts. The data analysis techniques used in this study are quantitative. The results of this study (1) There is an effect of group division in the TAPPS learning model on students' problem-solving ability on momentum and impulse topics. (2) The improvement can be seen from the one-way ANOVA that was used to see the significant difference in the average score between all pairs in the pretest and all pairs in the posttest. The p-value in both correctors is smaller than 0,05 (0,000 < 0,05) (3) There is an improvement in students' problem-solving ability, to the improvement of students' learning outcomes. (4) The improvement can be seen from the n-Gain test was used to see the difference between pretest and posttest final values in every group division. The interval of n-Gain between group divisions is 0,32 – 0,40. this value is included in the medium category, which is (0.30 ≤ n-Gain ≤ 0.70). so, based on these results, the group division in the TAPPS learning model can improve student learning outcomes on momentum and impulse topics.*

*Keywords: Group Division; TAPPS Learning Model; students' problem-solving ability, students' learning outcomes*

## INTRODUCTION

The learning process occurs in many ways and takes place all the time toward a behavior change in learners. The change is in the form of knowledge, understanding, skills, and habits that are acquired by the learners. Physics as one of the natural sciences is in the spotlight in the development of education, especially in school learning related to various scientific concepts, some of which are applied to improve problem-solving thinking skills that can be found in various occasion. (Maison et al., 2018;) Physics is a subject that is considered difficult and avoided by some students because it is very challenging, sometimes frustrating, and requires perseverance, thoroughness, and a lot of practice so not many students like physics (Abbas et al., 2018; Astalini, Kurniawan, & Putri, 2018; Putra et al., 2019). According to Anwar (2014), Attitudes towards science have gained great interest in science education, especially from the teaching and learning perspective. It has been noticed that students consider science to be a very difficult and boring subject. Students' interest decreases as they move into the upper classes of education.

The student's responses to physics subjects at Al Ulum Terpadu Islamic High School in Medan can be seen based on the initial observation data which are still low. Out of a total of 58 students in class X MIA 1 and X MIA 2, there were 59.5% of students still had low scores in physics lessons, 59.5% of students still had difficulty understanding physics lessons, 66.7% of students were not motivated in learning Physics, 47.6% of students feel bored when learning takes place, and 54.5% have difficulty doing assignments given by the teacher. This is following the results of interviews with physics teachers at SMA Islam Al Ulum Terpadu Medan. This means that most students are still less interested and still have difficulty in learning physics. One of them is because the learning model used by the teacher still uses the old method which makes students still lack mastery of physics subject matter. The use of learning media is monotonous and does not vary. Another cause is the lack of motivation of the students themselves to study Physics because there is a kind of mechanism of thinking that Physics is difficult.

In general, physics learning in the classroom is carried out independently/individually, some are taught in groups. Students study independently because the teacher instructs them to do so, and not all students can apply independent learning. There are various techniques that teachers can use in grouping students, such as applying cooperative learning. Cooperative learning refers to a collection of targeted strategies aimed at promoting collaboration among students during the learning experience. By engaging in cooperative learning, students can support one another in comprehending educational content and tasks, as well as enhancing their problem-solving skills. Isjoni (2009) describes cooperative learning as a model where students work together in small groups consisting of five members, formed with a diverse mix of participants. This approach to group learning adheres to specific guidelines. The fundamental concept of cooperative learning is that students create small groups in which they teach each other in pursuit of shared objectives.

There are various cooperative learning models that can be utilized in the educational process. Each model possesses distinct characteristics that can be tailored to specific learning environments or situations. For instance, the Jigsaw learning model is frequently employed when there are numerous topics to cover in a limited amount of time, allowing students to study in small, heterogeneous groups of 4-6 members. There are many other cooperative learning models as well, including Student Team Achievement Division (STAD), Number Head Together (NHT), Group Investigation (GI), Think Pair Share (TPS), and others. All these types of learning models have group members of 4-6 students, meaning there are 12-30 directions of information that must be considered in the group. This results in the possibility of miscommunication due to the lack of material that can be

e-ISSN: 2721-1274
p-ISSN:2721-2718

processed by students from the many directions of information heard and seen. As well as the emergence of student apathy in the group.

To address the limitations of the conventional cooperative learning approach, the TAPPS (Thinking Aloud Pair Problem Solving) model was proposed as a solution. The TAPPS model represents a form of cooperative learning that encourages students to engage actively in problem-solving. Initially introduced by Claparade, this model was subsequently utilized by Bloom and Bronder to analyze the problem-solving processes of high school students. Arthur Whimbey and John Locchead further developed this model for instructing students in Mathematics and Physics. In the TAPPS model, educators guide students to solve problems collaboratively in pairs, while also teaching them to think critically and articulate their reasoning during the problem-solving process. The objective of this model is to help students conceptualize how to tackle a problem and articulate their ideas and thoughts toward finding solutions.

The TAPPS method offers an advantage over other approaches by requiring problem solvers to articulate their reasoning, leading to more organized thought processes. Engaging in TAPPS dialogue fosters the necessary contextual framework that enhances student comprehension, enabling them to practice concepts, connect them to established frameworks, and develop a more profound understanding of the subject matter. This approach allows each student within the group the opportunity to reflect independently, articulate their views clearly, and speak with confidence without the worry of being interrupted or judged by peers. Hartman, in Collaborative Learning Techniques (Barkley, 2012), describes TAPPS as a collaborative learning strategy where two to four students work together to address a problem. Each member of the group has specific responsibilities, while the teacher is advised to guide students according to the established procedures.

## RESEARCH METHODS

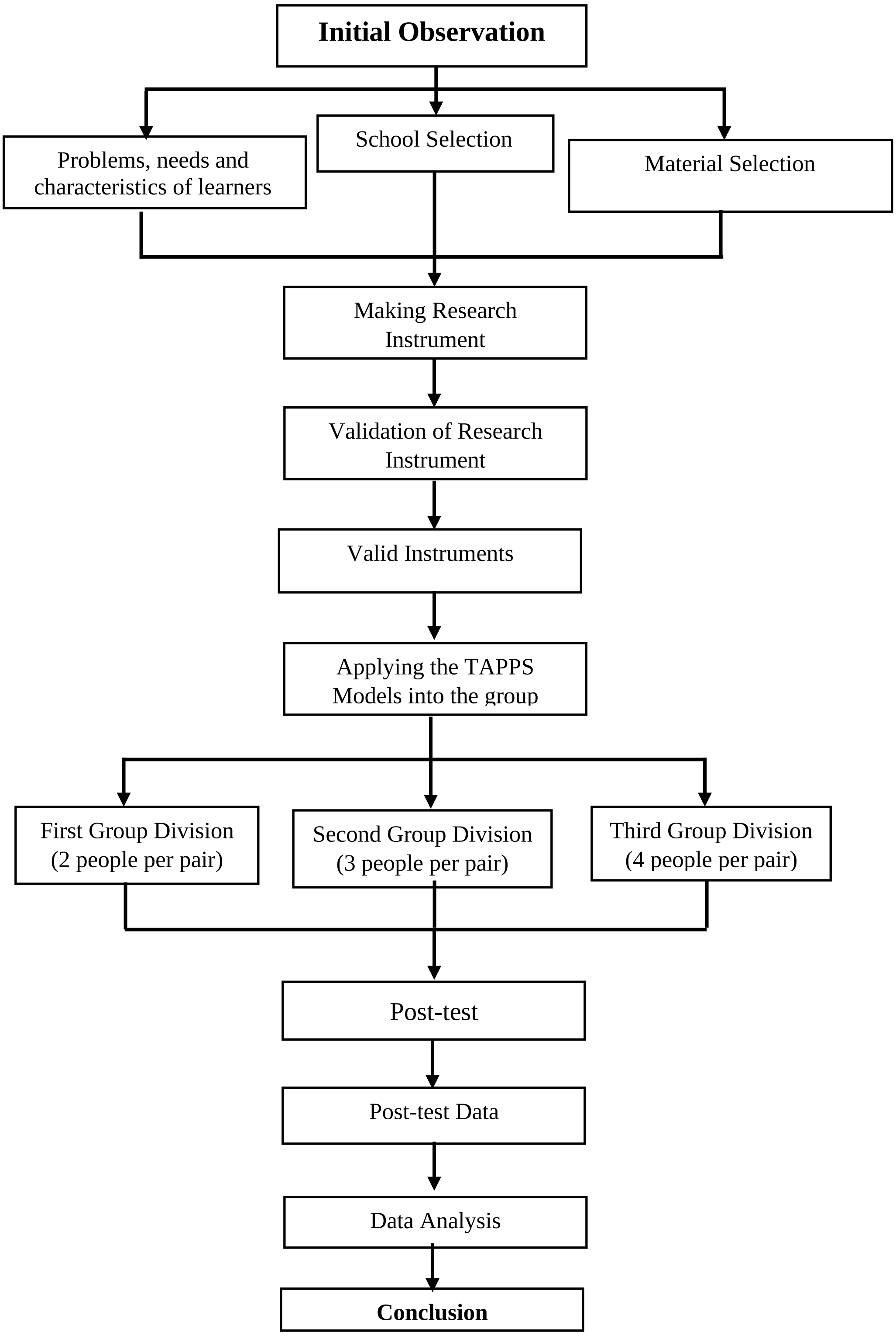
### A. Research Methods

This research was conducted using a true-experimental method with a posttest-only control design. The implementation of the study will involve the sample being divided into three kinds of group divisions. The methods for analyzing data employed in this quantitative research. The techniques for gathering data include the use of questionnaires, observations, instruments test, and documentation. This research will be conducted at SMA Islam Al Ulum Terpadu Medan which is located at Jl. Tuasan No.35, Sidorejo Hilir, Kec. Medan Tembung, Kota Medan in even semester 2022/2023 academic year from Mei to November 2023. The research population is all students of class X MIA SMA Islam Al Ulum Terpadu Medan. The research sample consisted of two classes that are X MIA 1 and X MIA 2 which was randomly selected, totaling 58 students.

To test the cause-and-effect relationship between some factors that are wanted to be studied, it is carried out through true-experimental research. It is called true-experimental because, in design, research can control all the eternal variables that affect the course of the experiment. This true-experimental design uses a posttest-only control design. In this design, the experimental class were formed by a random procedure, so that both can be considered equivalent (R1 : R2 : R3). The effect of the treatment is (O1 : O2 : O3 ).

e-ISSN: 2721-1274
p-ISSN:2721-2718

In general, this research is divided into three stages, namely the Preparation stage, Implementation Stage, and Final Stage. The research procedure carried out is described in flowcharts below:




Charts 1. Research Flowchart

e-ISSN: 2721-1274
p-ISSN:2721-2718

**1. Test Instruments**

**a. Validity**

Validity is an essential quality of a reliable learning outcome assessment. It refers to a measure that indicates whether the variable being assessed is indeed the one that the researcher intends to investigate.

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2].[N\sum Y^2 - (\sum Y)^2]}} \text{.....................} (1)$$

**b. Reliability**

According to Ghozali (2009), reliability serves as a means to assess a questionnaire, which acts as an indicator for variables or constructs. Measurements that demonstrate high reliability are capable of producing trustworthy data.

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum \sigma_i^{\,2}}{\sigma^2{}_t}\right) \text{.............................................} (2)$$

**c. Difficulty of Question**

This aims to find out easy, medium, and difficult questions. To find out the difficulty level, the following formula can be used:

$$P = \frac{R}{T} \text{..............................................................} (3)$$

**2. Analysis Requirements Test**

**a. Average**

The average of the posttest was calculated using the following formula:

$$\bar{X} = \frac{\sum X_i}{n} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots .. (4)$$

**b. Standar Deviation**

The formula for calculating the standard deviation is as follows:

$$S^2 = \frac{n\sum X_i^2 - (\sum X_i)^2}{n(n-1)} \dots\dots\dots\dots\dots\dots\dots\dots .. \dots\dots\dots\dots\dots\dots\dots\dots (5)$$

**c. Normality Test**

Criteria of the test are:

- L count < L table, then the sample is normally distributed
- L count > L table, then the sample is not normally distributed (Sudjana, 2005)

**d. Homogeneity Test**

There are some equation until the criteria

Criteria of the test are:

- $X^2$ count < $X^2$ table then the sample is homogeneous
- $X^2$ count > $X^2$ table then the sample is not homogeneous

**3. Hypothesis Test**

**a. Analysis of Test Instrument Results on Students' Problem-Solving Ability**

Initially, it's essential to establish the grid for the questions and the corresponding questions for the student's responses. The score assigned to each question on the student's written assessment is derived from the evaluation criteria. Following that, it computes the overall test score for each facet of the learning outcomes through a specific formula:

$$NP = \frac{R}{SM} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

**b. Initial test or the pretest using One way - Analysis of Variance (one way - ANOVA)**

The foundation of the ANOVA Test involves evaluating the variability of the data into two sources: variation within groups and variation between groups. When the variations within and between groups are similar (the ratio of the two variances is close to one), it indicates that the intervention had no differing impact; in simpler terms, there is no disparity in the mean values being compared. Conversely, if the variation among groups is larger than that within the groups, it suggests that the intervention produces varied effects, indicating that the means being compared reveal a significant difference.

- Value sig. P-value < 0.05, then it can be concluded that there is a significant difference
- The value of sig. P-value > 0.05, then it can be concluded that there is no significant difference

**c. Improvement in Student Learning Outcomes**

The outcomes were evaluated based on the results of descriptive posttests to monitor student advancement. The improvement in students' learning outcomes was determined using the Hake equation:

$$g = \frac{S_f - S_i}{100 - S_i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

## RESULT & DISCUSSION

### A. RESULT

### 1. Data of Student's Pretest and Posttest

To observe the progress in students' problem-solving capabilities, refer to the frequency distribution of the class presented in the table below:

**a. Pretest Data**

The pretest for every class was administered through group division utilizing the TAPPS learning model. The Table 1 below illustrates the comparison of the pretest results in each class:

**Table 1.** Frequency distribution pretest data of class X MIA (all pairs)

| X MIA 1 | | X MIA 2 | |
|---|---|---|---|
| **Value interval** | **Frequency** | **Value interval** | **Frequency** |
| 62 – 64 | 4 | 60 – 64 | 4 |
| 65 – 67 | 5 | 65 – 69 | 6 |
| 68 – 70 | 2 | 70 – 74 | 14 |
| 71 – 73 | 6 | 75 – 79 | 5 |
| 74 – 77 | 11 | 80 – 84 | 1 |
| **n** | **28** | **n** | **30** |
| **Sum ($R_{11}$)** | **1979** | **Sum ($R_{12}$)** | **2131** |

According to Table 1, the pretest scores in classes X MIA 1 and X MIA 2 show varying frequencies for the highest scores.

As for after being divided into groups, here in the Table 2 below:

**Table 2.** Frequency distribution of pretest data on the problem-solving ability of each group division

| First group division (Pair 2) | | Second group division (Pair 3) | | Third group division (Pair 4) | |
|---|---|---|---|---|---|
| **Value interval** | **Frequency** | **Value interval** | Frequency | **Value interval** | **Frequency** |
| 60 – 61 | 2 | 70 – 72 | 4 | 70 – 72 | 3 |
| 62 – 63 | 3 | 73 – 75 | 9 | 73 – 75 | 8 |
| 64 – 65 | 5 | 76 – 78 | 5 | 76 – 78 | 7 |
| 66 – 67 | 6 | | | 79 – 81 | 2 |
| 68 – 69 | 4 | | | | |
| **n** | **20** | **n** | **18** | **n** | **20** |
| **Sum ($R_{A1}$)** | **1298** | **Sum ($R_{B1}$)** | **1320** | **Sum ($R_{C1}$)** | **1490** |

According to the table 2 above, the highest score in the pretest data in every group division has a different frequency and interval.

**b. Posttest Data**

The posttest for each group division was given by applying group division using the TAPPS learning model can be shown in Table 3 below:

**Table 3**. Frequency distribution of posttest data (all pairs)

| X MIA 1 | | X MIA 2 | |
|---|---|---|---|
| **Value interval** | **Frequency** | **Value interval** | **Frequency** |
| 81 – 83 | 1 | 84 – 86 | 2 |
| 84 – 86 | 7 | 87 – 88 | 6 |
| 87 – 89 | 8 | 89 – 90 | 6 |
| 90 – 92 | 9 | 91 – 92 | 12 |
| 93 – 95 | 3 | 93 – 95 | 4 |
| **n** | **28** | **n** | **30** |
| **Sum ($R_{21}$)** | **2476** | **Sum ($R_{22}$)** | **2698** |

According to Table 3, the highest score recorded in the posttest results for both class X MIA 1 and class X MIA 2 falls within the same score range, yet has varying frequencies. Therefore, it can be determined that both classes exhibit differing post-test scores and have shown improvement compared to their pretest results.

As for after being divided into groups, here in the Table 4 below:

**Table 4.** Frequency distribution of posttest data on the problem-solving ability of each group division

| First group division (Pair 2) | | Second Group Division (Pair 3) | | Third group division (Pair 4) | |
|---|---|---|---|---|---|
| **Value interval** | **Frequency** | **Value interval** | **Frequency** | **Value interval** | **Frequency** |
| 82 – 84 | 2 | 85 – 87 | 4 | 88 – 90 | 4 |
| 85 – 87 | 8 | 88 – 90 | 12 | 91 – 93 | 12 |
| 88 – 89 | 7 | 91 – 93 | 2 | 94 – 95 | 4 |

e-ISSN: 2721-1274
p-ISSN:2721-2718

| | | | | | |
|---|---|---|---|---|---|
| 90 – 93 | 3 | | | | |
| **n** | **20** | **n** | **18** | **n** | **20** |
| **Sum ($R_{A2}$)** | **1743** | **Sum ($R_{B2}$)** | **1589** | **Sum ($R_{C2}$)** | **1829** |

Based on Table 4 above, the highest posttest scores are as are in the different intervals and frequencies. Group divisions in pair 4 have the highest score with only one student. While the group division in pair 3 and pair 2 get the lowest interval than pair 4. This also goes to the lowest post-test score as well. The interval value gets higher when the pair is bigger.

**2. Data Analysis**

**a. Average and Standard Deviation**

The average for each division within the groups was determined by dividing the total score by the number of students, and the standard deviation for both the pre-test and post-test results was computed for each section of the group pair. The Table 5 below displays the average and standard deviation for the class and group divisions:

**Table 5.** Average and Standard Deviation of All Pair

| No | Class | | Average | Standard Dev. |
|---|---|---|---|---|
| 1 | X MIA 1 | Pretest | 70,68 | 5,03 |
| | | Posttest | 88,61 | 3,20 |
| 2 | X MIA 2 | Pretest | 71,04 | 4,95 |
| | | Posttest | 89,44 | 2,35 |

Based on Table 5, the evaluation regarding the average score of the initial experiment as a pretest in classes X MIA 1 and X MIA 2 shows a minimal difference of only 0.36. The post-test scores for the two classes exhibited a small variation of just 1.52.

As for after being divided into groups, the average and standard deviation are in the Table 6 below:

**Table 6.** Average and Standard Deviation of Group Division

| No | Class | | Average | Standard Dev. |
|---|---|---|---|---|
| 1 | First Group (2-pair) | Pretest | 64,91 | 2,59 |
| | | Posttest | 87,17 | 2,69 |
| 2 | Second Group (3-pair) | Pretest | 73,36 | 1,83 |
| | | Posttest | 88,29 | 1,59 |
| 3 | Third Group (4-pair) | Pretest | 74,75 | 2,55 |
| | | Posttest | 91,46 | 1,80 |

Table 6, indicates that there are variations in the average pretest scores for each group division. In pair 2, the difference between the pretest and posttest averages is as much as 22.26. For pair 3, the difference between the pretest and posttest averages reaches 14.93. In pair 4, the difference in average scores between the pretest and posttest is 16.71. The standard deviation for both the pretest and posttest was calculated for group divisions within the range of 1 to 3.

**b. Normality Test**

The outcomes of the normality assessment for the pretest and posttest data across each group are displayed in the Table 7 below:

**Table 7.** Normality test of Students' problem-solving ability

| No | Class | | Lcount | Ltable |
|---|---|---|---|---|
| 1 | First Group (2-pair) | Pretest | 0,12 | 0,19 |
| | | Posttest | 0,12 | |
| 2 | Second Group (3-pair) | Pretest | 0,17 | 0,2 |
| | | Posttest | 0,14 | |
| 3 | Third Group (4-pair) | Pretest | 0,12 | 0,19 |
| | | Posttest | 0,14 | |

Table 7, shows that all of the group divisions, pair 2, pair 3, and pair 4 have met the criteria the L count < L table. Based on all the pairs, it can be concluded that the pretest and posttest data from the three samples originated from a population that is normally distributed.

**c. Homogeneity Test**

The result of the calculation of homogeneity of pretest and posttest data for of all pairs are shown in the Table 8 below:

**Table 8.** Homogeneity test of Students' problem-solving ability

| No | Class | | Variance | $X^2$count | $X^2$table |
|---|---|---|---|---|---|
| 1 | All pairs | Pretest | 16,60 | 2,50 | 5,99 |
| | | Posttest | 13,03 | 5,71 | |

From table 8, one can conclude that the pretest and posttest for all pairs are uniform since they satisfy the criteria $X^2$ count < $X^2$ table.

**3. Hypothesis Testing**

**a. Analysis of Test Instrument Result on Problem-solving Ability Using One-way ANOVA**

The results of the pretest and posttest average significant test by Corrector I are shown in the Table 9 below:

**Table 9.** Pretest and Posttest Significant Test Using One-way ANOVA

| Class | | P-value | Mean Sig. | Fcount | F table |
|---|---|---|---|---|---|
| | Pretest | 0,0000000000000000009824541 | 0,05 | 96,71 | 3,165 |

| | | | | | |
|---|---|---|---|---|---|
| All pairs | Posttest | 0,00000007823061743537850000 | | 22,36 | |

The significance test for both the average pretest and posttest in Table 9 obtained a F count > F table. In this scenario, the hypothesis supports Ha, indicating that there are significant differences in the average scores of students between the pretest and posttest. The P-value for both the pretest and posttest is less than 0.05, allowing us to conclude that there is a meaningful difference and improvement.

**b. Analysis of Test Instrument Result on Students' Learning Outcomes**

The average n-Gain score reflecting students' learning results is presented in the Table 10 below:

**Table 10.** The average n-Gain Score of students' learning outcomes

| No | Class | Average n-Gain | Criteria |
|---|---|---|---|
| 1 | First Group Division (Pair 2) | 0,40 | Medium |
| 2 | Second Group Division (Pair 3) | 0,32 | Medium |
| 3 | Third Group Division (Pair 4) | 0,37 | Medium |

According to Table 10, the results of the n-Gain assessment for all group divisions fall into the medium category, as the average n-Gain is below 0.7. This indicates that the group division of students into groups does indeed influence their problem-solving ability and overall learning outcomes. The n-Gain test results are available in the appendix.

## B. RESEARCH DISCUSSION

### 1. Students' Problem-solving Ability

The average of students' problem-solving ability of Corrector I can be seen in the Figure 1 below:

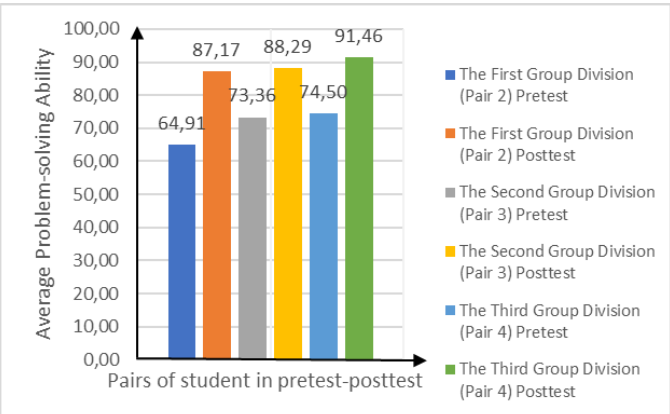



**Figure 1.** Average data bar of students' problem-solving ability

Figure 1, illustrates that the average problem-solving ability of students in group division within the TAPPS learning model has improved from the pretest to the posttest. From the data that has been written above, it can be concluded that the

e-ISSN: 2721-1274
p-ISSN:2721-2718

initial hypothesis has been proven that there is a significant difference between group divisions. Pair 4 has a higher significance of problem-solving ability than pair 3 or pair 2. Pair 3 also has a higher problem-solving ability significance than Pair 2. This is proven by both correctors. The group division of a larger entity, whether it's a group of people, a project, or a dataset, into smaller subgroups offers numerous benefits across various contexts. Dividing a large task allows individuals or smaller teams to focus on specific areas where their skills and expertise are best utilized. The interconnectedness among these components starts with a concentration on shared group objectives or incentives that are grounded in the individual learning achievements of all group members.

**2. Students' Learning Outcomes**

The findings of the pretest and posttest were used to calculate the n-Gain. To see more about n-Gain can be seen in the following Figure 2 below:

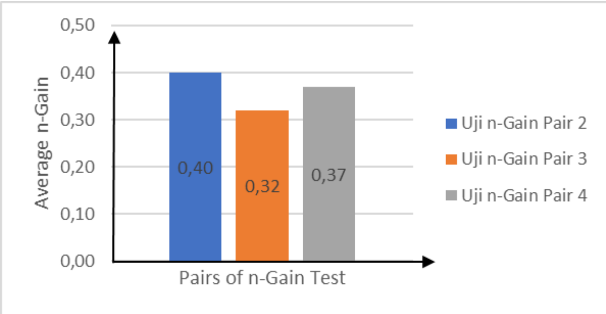



**Figure 2.** N-Gain data bar of students' learning outcomes

According to Figure 2, all pairings remain in the medium category, which means they are still on the 0.3–0.7 scale. According to Kauchak and Eggen (2012), cooperative learning involves students working together in groups to help each other learn academic material and interpersonal skills. Group members are accountable of the group tasks' completion and for the students' comprehension of the material.

In pair 2, it allows for a more in-depth and focused discussion on a topic due to the intense and direct interaction between two individuals. Allows for more personalized communication and a better understanding of each other's nuances and intentions. Individuals who may feel reluctant to speak in front of large groups will be more comfortable participating. Compared to pair 2, pair 3 brings an additional perspective that can break the deadlock or offer a new solution. If two people have opposing views, the third person can act as a mediator or facilitator to reach a compromise. It is more difficult for one person to dominate the discussion than it is for a group of two. Small enough to stay focused yet big enough to generate a good variety of ideas. As for the 4 pairs, it will provide a broader perspective, as well as offer more points of view and experience to enrich the discussion. The more people, the more likely it is that innovative ideas and diverse solutions will emerge. If the discussion is related to several questions, then four people allow for a more even division of tasks. This study was effective, and students' learning outcomes on momentum and impulse content employing group division in the TAPPS learning model have improved, according to the results of findings more thorough statistical tests that support the researcher's hypothesis also support this.

e-ISSN: 2721-1274
p-ISSN:2721-2718

## CONCLUSION AND SUGGESTION

### A. Conclusion

It is possible to draw the following conclusions from the research that was conducted in classes X MIA 1 and X MIA 2 at SMA Islam Al Ulum Terpadu Medan during the 2022–2023 academic year utilizing the Group division in the TAPPS learning model on momentum and impulse materials and the data collected and analyzed:

1. The TAPPS learning model's group division has an impact on students' capacity to solve problems involving momentum and impulse issues. The one-way ANOVA that was utilized to determine the significant difference in average scores between all pretest and posttest pairs shows the effect.
2. The P-value examined by Corrector I and Corrector II shows that students' problem-solving skills have improved. The p-value in the pretest is smaller than sig. 0,05 which is 0,0000000000000000009824541 < 0,05, for Posttest which is 0,0000000782306174353785000 < 0,05. It can be concluded that there is a significant difference and improvement in the average score of the pretest and posttest.
3. The TAPPS learning model's group division has an impact on improving students' learning outcomes. As can be shown, the difference between the pretest and posttest final values was ascertained using the n-gain test.
   - n-Gain for first group division (2 pairs) is in the medium category which is 0,40 or 40,27% with a difference in the average pretest and posttest of 22,26
   - n-Gain for the second group division (3 pairs) is in the medium category which is 0,32 or 31,90% with a difference in the average pretest and posttest of 14,93
   - n-Gain for the third group division (4 pairs) is in the medium category which is 0,37 or 37,12% with a difference in the average pretest and posttest of 16,96

   It can be concluded that there is an improvement in the average score of the pretest and posttest.

### B. Suggestion

Several suggestions can be made to make this research even better. Suggestions for this or related research are as follows:

- Teachers must pay attention to students' abilities if they want to group students the division must be adjusted, such as the ranking of students in class.
- Teachers also need to be more imaginative when creating questions and different formats for questions that are used as assessment tools.
- Teachers must convey that the grades will be divided equally as the average score in the group so that each student will have a sense of responsibility in solving problems together.
- Students are expected to read more information about related materials so that their insight into solving their problems is broader

e-ISSN: 2721-1274
p-ISSN:2721-2718

- Students must also work together in groups, sharing known information so that they will increase the options for problem-solving in the problems they work on together.

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