The effect of physics learning with the use of gasing and boat toys media on student learning outcomes

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Abstract. This study aimed to determine whether or not there was an effect of learning physics with the media of top games and boat games on student learning outcomes in Junior High School 2 Sigi. To see the success of this study, a pretest was held to determine the students' abilities. After that, the experimental class was given treatment using the top game media and boat games and the control class did not use games. After learning was complete, both classes were again given a posttest to test the results. Based on the results of the two classes, the mean scores of the experimental class and control class were 9.93 and 11.06 for the pretest respectively, while for the posttest the average scores were 22.5 and 19.10. This study used a quasi-experimental research type. The population of this study were all students of class VIII Junior High School 2 Sigi and the sample in this study were class VIII A and VIII B which were divided into experimental class and control class. The research sample was selected using purposive sampling technique which determined the sample with certain considerations. The instrument used was an essay Test.

1. Introduction
Physics is the study of the universe that occurs in everyday life [1,2]. Physics is presented in a simple form that is translated into mathematical language and can be understood and obtained from the results of research, experiments, measurements, mathematical presentation [3]. In learning science, especially learning physics, the process of building knowledge for students is very important. Students will only understand seriously and have competition in the field of physics when they are active in learning, processing, digesting, and formulating it in their own minds [4].

Games according to Bettelheim (in Hurlock [5]) are activities characterized by mutually agreed and externally determined rules or requirements to carry out activities in a purposeful action. Children learn through play. Enjoyable play experiences with materials, objects, other children, and adult support help children develop optimally [6,7].

Traditional games are one of the community cultures of an area or area of residence. There are traditional games which utilize tools or equipment and some do not. In addition, there are games which are competed and there are games that are not contested. In traditional games, there are also several games that are closely related to the concept of learning physics, one of which is the game of top and banana boat which is related to the concept of physics, namely the concept of pressure [8].

In today's life, there are still many people who do not know that physics learning also has a connection in everyday life, one of the examples is related to traditional games, namely the top game and boat games on pressure material. Gasing games are related to physical matter, such as the concept of rigid body balance.
and the concept of pressure, especially on the pressure of solid substances. In this case, the *gasing*, or in English, the top, uses a strong wood so that it is not easily broken. The top has a bottom shape with pointed surface and the top has a large surface. Here, the hand muscles function as a force generator as they can push and pull a rope which has been wrapped around the top. In this traditional game, players compete with each other for strength and endurance of the tops. But this time, players will also use 2 types of *gasing*, namely using a *gasing* with a pointed bottom and a *gasing* with a blunt bottom, so that it can be compared to the other *gasings* whose surface is tapered deeper than a *gasing* with a broad or blunt surface. This is due to the influence on the pressure of solids, where the wider the surface area of an object, the smaller the resulting pressure, and vice versa [9].

Boat toys also contain the concept of pressure, especially on liquid pressure. In this case, the player can produce a boat made of banana leaves and float it on the water, which then turns out that the boat does not sink. This is due to the influence of Archimedes' law, where an object can either float or sink, depending on the magnitude of its gravity and buoyancy. "If an object is immersed in a liquid, it will have an upward pressure equal to the weight of the liquid being pushed by the object" [10] or if the buoyancy force is greater than the gravity, the object will float. Conversely, if the buoyancy force is smaller than gravity, the object will sink. If the maximum buoyancy is equal to the object's weight, the object will float.

In learning physics, so many students do not like physics lessons itself, for that as a teacher we can link physics material in everyday life, one of which is traditional games because nowadays many people have forgotten traditional games and switched to modern games (electronics) like gadgets even though modern games have many negative effects, one of which is addiction to fatal consequences. The application of top games and boat games arouses students' curiosity to carry out investigations so that they can improve thinking skills and express their ideas clearly; it also increases student activity which in turn can improve student learning outcomes.

In the field research, the use of the spinning top and boat games did not run well due to the students' lack of knowledge in playing the game of *gasing* and the boat that only used traditional tools made of wood and banana stems. The advantage of this top game and boat game is that it can increase student activity. In this case, students are directly involved in finding the concepts themselves studied, training students to think more actively in learning, encouraging students to discover new concepts, giving students the opportunity to learn using scientific methods.

The learning model used in this study was a guided inquiry learning model. Guided inquiry learning is a learning model in which the teacher provides or gives broad instructions/guidance to students. In guided inquiry learning model, the teacher has provided instructions regarding the materials taught to students as needed. These instructions can be in the form of questions to encourage students in finding or seeking their own information about these questions or actions given by the teacher that must be done to solve problems [11–14]. The inquiry learning process provides opportunities for students to have real and active learning experiences, so that students are trained in solving problems while making decisions [15].

This study was different from previous research which only looked at students' motivation when learning to use games such as research from Lestari. The results of his research stated that implementing traditional children's games could increase children's learning motivation [16], whereas in this study we can see the effect of learning physics with the media of top games and boat games on student learning outcomes and the results stated that students were very interested in learning by using traditional games themselves so that student learning outcomes could increase.

This study aimed to determine the effect of learning physics with the media of *gasing* and boat toys on the student learning outcomes at Public Junior High School 2 Sigi. This research was also expected to provide benefits for various parties involved in the world of education. The benefits that can be obtained through this research are: 1) it can increase the knowledge of SMP Negeri 2 Sigi students regarding the relationship between playing *gasing* and boat toys with physics learning and as input for teachers to always...
present physics material related to *gasing* games and boat toys in order to enhance student learning outcomes.

2. Method

This research utilized a quasi experimental design (quasi experimental design). The research design was "The Equivalent Pretest-posttest Design" which utilized existing classes as a group by selecting classes that were expected to have the same conditions / conditions. The design form is presented in Table 1.

| Class       | Pre-Test | Treatment | Post-Test |
|-------------|----------|-----------|-----------|
| A (Experiment) | O₁      | X₁         | O₁        |
| B (Controlled)  | O₁      | -          | O₁        |

Note:
A : experiment class
B : controlled class
X₁ : Treatment using Traditional Games
O : Pretest/Postest

This research was conducted at Public Junior High School 2 Sigi in the 2018/2019 academic year. The population of this study were all students of Public Junior High School 2 Sigi for the 2018/2019 academic year, while for the sample of this study were only the grade VIII students of Public Junior High School 2 Sigi.

The research sample was selected using purposive sampling technique by determining the sample with certain considerations. The determination of this sample was based on the recommendations of the subject teachers who thought that the class was good for research. The sample in this study was class VIII A and VIII B which were divided into experimental class and control class. The determination of the sample was based on the consideration that the two classes were considered to have the same understanding of the concept.

The instrument used in this study was a test to examine student learning outcomes. The test was used to determine the effect of students' physics learning outcomes in the classes which were the research sample. The test was in the form of an essay totaling 10 question numbers. The test given to the controlled class was the same as the test given to the experimental class. The data obtained from this study were further processed using statistical tests in the form of a normality test (Chi-Square), Homogeneity test, N-Gain test [17] and hypothesis testing (two-party t-test) [18].

3. Findings and Discussion

3.1 Research Findings

3.1.1 The Results of Physics Learning Test Outcomes

The success of a study can be measured by observing the process of learning activities which take place in class and the student's ability test which is carried out at the end of the class when the learning materials were discussed as a whole. The posttest was carried out with the aim of knowing the extent of the influence of the physics learning model using the *gasing* and boat toys media given to the experimental class and those without games in the controlled class on student learning outcomes. The results of the students' post-test obtained a score of 22.5 for the experimental class, with a standard deviation of 5.14 and for the controlled class, the score obtained was 19.10 with a standard deviation of 5.50 as shown in the following Table 2.
Table 2. Learning outcomes test scores on experiment and controlled classes

| Aspects             | Pretest |               | Post-test |               |
|---------------------|---------|---------------|-----------|---------------|
|                     | Exp.    | Controlled    | Exp.      | Controlled    |
| Samples             | 23      | 23            | 23        | 23            |
| Minimum score       | 2       | 4             | 13        | 11            |
| Maximum score       | 20      | 21            | 31        | 29            |
| Average score       | 9.93    | 11.06         | 22.5      | 19.10         |
| Standard deviation  | 5.79    | 4.90          | 5.14      | 5.50          |

3.1.2 Normality Test Results
The test of data normality on the pretest and posttest in this research was carried out using Chi-Squared with the accepted criteria as \( \chi^2_{hitung} < \chi^2_{Tabel} \), and the significant level of \( \alpha = 0.05 \) and the degrees of freedom \( df = f-3 \).

Table 3. Normality distribution on the post-test at experimented and controlled classes

| Class      | Value of \( \chi^2 \) Count | Value of \( \chi^2_{Table}(\alpha = 0.05) \) | Decisions   |
|------------|-------------------------------|---------------------------------------------|-------------|
| Experimented | 4.25                         | 5.99                                        | Normally distributed |
| Controlled  | 3.25                         | 5.99                                        | Normally distributed |

As seen on Table 3, the value of \( \chi^2_{hitung} \) in the experimented class and the controlled class was smaller than the value of \( \chi^2_{Tabel} \). This indicates that the post-test data on both experiment and controlled classes was distributed normally.

3.1.3 Homogeneity Test
Homogeneity test on this research was carried out using the statistical test F with the significant level of \( \alpha = 0.05 \). From the displayed data, it can be seen that the F coefficient < Ftable, and thus the Homogeneity test is performed to examine whether the data came from the same variants or not.

Table 4. Homogeneity post-test results on the experiment controlled classes

| Aspects             | Post-test |               |
|---------------------|-----------|---------------|
|                     | Experiment| Controlled    |
| Variance Values     | 29.09     | 29.39         |
| VariancesCount      | 0.98      |               |
| Value of \( F_{Table}(\alpha = 0.05) \) | 2.05 |
| Decision            | Homogeneous |          |

The results of the homogeneity test can be seen in Table 4 above with a significant level of 0.05. From these data, it can be seen that \( F_{count} < F_{table} \), so based on the decision-making criteria, it can be concluded that there was no difference in variance between the experimental class and the controlled class, or in other words, the variance between the experimental class and the controlled class was the same or homogeneous.

3.1.4 N-Gain Test Results

Table 5. The results of n-gain test on the experiment class and controlled class
Based on the average N-gain value in Table 5, the experimental class obtained an average N-gain of 63.90%, whereas the controlled class received an N-gain of 44.08%. The experimental class was categorized in the moderate category, where g > 30 and similarly, the controlled class was also categorized in the moderate category, where g > 30. Both of these classes experienced improvements, but the greater increase occurred in the experimental class.

3.1.5. Hypothesis Test (t-test)

After the normality and homogeneity tests are fulfilled, then a test on the mean differences (2 parties) or t-test was performed. The t-test was carried out as accordance to the post-test data results obtained.

Table 6. Mean differences test results (two parties) based on the post-test results of the experimental class and the controlled class

| Class           | Average score | \( t_{hitung} \) | \( t_{table} \) (\( a = 0.05 \)) | Decisions       |
|-----------------|---------------|------------------|-------------------------------|-----------------|
| Experimental    | 22.5          | 2.09             | 1.68                          | \( H_0 \) is accepted |
| Controlled Class| 19.10         |                  |                               |                 |

As seen on Table 6 above, it is known that \( t_{count} > t_{table} \) or 2.09 > 1.68. This indicates that the value of \( t_{count} \) is around the area of rejection of the \( H_1 \), which meant that the \( H_0 \) is accepted.

3.2 Discussion

This research discussed the effect of learning physics with gasing and boat toys on student learning outcomes. This was observed from the results of data analysis obtained from the two classes, that the experimental class had the treatment with the gasing game and boat games, and resulted in a higher score than the controlled class.

This research utilized the media of gasing and boat toys games. The gasing game itself contains concepts in physics, namely the concept of pressure, limited on solid matter pressure, whereas the boat toys also contain the concept of pressure, specifically on liquid pressure [19].

The learning outcomes of students who used the top game media and boat games were greater than students who did not use games. This was supported by the use of the game media itself, where each group had the opportunity to do practicum using the tools and materials that have been prepared with the instructions on the LKS to prove the truth of each concept. In the end, students must have been able to conclude the practicum that has been done, understand the concepts of physics, and find the concepts they know. Whereas the control class received treatment without games which caused students to be less active and made students less understood of the material compared to the experimental class.

Similar to research from Arif which examined the effect of games in learning physics on students' learning motivation. The results of his research stated that the implementation of the game in physics learning was very good and suitable for use in the learning process. This was seen from the average results of student learning motivation and also the results of the t-test conducted. Therefore, in an effort to increase the motivation to learn physics for students, teachers have the option of using games in learning [20]. And also like Ashar's research regarding the effect of learning caologium discussion based on crank games on physics learning outcomes, the results of his research stated that the description of the physics learning outcomes of students of class VIII SMPN 1 Mappili was in the high category so that there was an influence.
on the learning outcomes of physics taught using caolugium discussion learning based on crank game where there was an influence in the form of an increase in physics learning outcomes so as to achieve a KKM value $> 70$ [21]. From the two previous studies it can be seen that when physics learning is associated with games it can increase student learning motivation and student learning outcomes also increase.

4. Conclusions

Based on the results of statistical data analysis using the two-party t-test, the value of $t_{count} > t_{table}$ or $2.09 > 1.68$ was obtained at a significant level ($= 0.05$ which meant that the hypothesis was accepted. As of the boat games, which obtained a score of 22.5, was definitely bigger when compared to the score obtained by the controlled class without using games, which was 19.10. It can be concluded that there was an effect of learning physics with the media of gasing and boat toys on the learning outcomes of Grade VIII students of Public Junior High School 2 Sigi.

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