The Application of Traditional Game *Rorodaan* as Learning Tool in Physics Subject: Force and Movement to Improve Learning Results

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**Abstract.** Nowadays, Active Learning Method (ALM) in Physics learning have received much attention in attempt to increase student motivation and comprehension. Including local values into ALM has become national curriculum demand in Junior High School in Indonesia [1]. *Rorodaan* is one of traditional games from West Java. We used it as a learning tool in force and movement subject. Classroom Action Research (CAR) was conducted to figure *Rorodaan* game in improving student comprehension showed by comprehension test scores. Student interest and motivation were valued by self-assessment questionnaire and ranged from negative (not interested and motivated at all) to positive (very interested and motivated). From this research, most of students tended to show positive interest and motivation to engage force and movement learning. This research also reported positive engagement in learning activities. Student’s comprehension test score increased 15.55% after *Rorodaan* was used as a learning tool.

1. Introduction

Physics learning in junior high school has become challenging in science subject. Mostly, students thought that Physics is complicated, so they felt less motivated to engage the subject. For the teachers, an important aspect of motivating student in the class to learn the subject is to encourage the student to have a positive attitude toward the subject. There is evidence to support the idea that a student’s attitude toward Science (even positive or negative attitude) will affect how well the student achieves in science classes [2]. Teachers need to remember that the other important thing is “liking Science [is] correlated with achievement in Science” [3]. The information illustrate for the teachers the importance of researching teaching method to increase student motivation to learn science (physics). So that, they have to modify physics learning method to cope with the problem.

Active Learning Method (ALM) has been chosen in attempt to attract student attention and increase student comprehension. ALM is adjustable to student condition, such as delivering learning subject in concrete ways, interesting presentation, and giving student chances to participate more in class [4]. The increasing of student motivation is expected from active learning method, so they can have better learning engagement and comprehension. In this research, *Rorodaan* game was carried out to the students in Physics learning subject. The Classroom Action Research (CAR) was reported in this paper how *Rorodaan* game as ALM for increasing student comprehension in force and movement subject is.
2. Method

Rorodaan is a traditional game from West Java. Basic material of Rorodaan is made from bamboo. Figure 1 shows the design and construction of Rorodaan. Rorodaan is played by driven. Two children are required to play Rorodaan. One child is as a driver, the other as a booster. Rorodaan as a learning tool contains local values, near to students daily lives, children’s favourite traditional game, and considered as a right demonstration to present the dynamic of force and movement subject. Force and movement subject is basic concept in physics. Movement or motion is about the changing of position or location. Motion requires a force to cause that change. Basically, force is just a word for pushing or pulling. Force makes things/object move or change their motion. In this subject, we learn about implementing of Newton’s Laws in force and motion (first, second, and the third of Newton’s Laws show in equation 1). Rorodaan could be applied in explaining the subject to the students clearly.

\[
\begin{align*}
F &= 0 \\
F &= m \cdot a \\
F_{\text{action}} &= -F_{\text{reaction}}
\end{align*}
\]

Where,

\[F = \text{force (Newton)}\]
\[m = \text{mass of object (kilogram)}\]
\[a = \text{acceleration (m/s}^2)\]

Figure 1. The design and construction of Rorodaan.

This project, Rorodaan was played by all of students. Technically, they were divided into two groups. Every group had to reach finish line by using Rorodaan. For additional situation in the competition, teacher gave some special rules and requirements to the students. After all, evaluation was carried out. The evaluation was to examine the effect of Rorodaan activities on student understanding and motivation.

Previously, there were two steps for completing this research. First, understanding concept of the subject. On the first day of the project, information was presented about force and movement in lecture
format. The Subject had been delivered to the students using slideshow. The lesson was teacher-centred. The concept of force and movement was explained, and some pictures were drawn on the white board to provide some visual aids for the explanation. No questions were posed to the students nor were they required to be actively involved in any way. Thereafter, the first test was given to students for initial evaluation.

Next step was a demonstration session. Teacher showed to students how to play Rorodaan and explained the physics concept behind it (the application of Newton’s Laws). Teacher then asked them to try it by themselves, pushing or pulling the rorodaan. They had experienced the Newton’s Laws directly. Students were welcome for asking and giving comments about Rorodaan. Teacher assistance was offered as needed. However, these activities were student-centred; the students were actively engaged in constructing their own knowledge and motivation.

Before the students played together and competed in school yard, teacher gave some important information to them about Rorodaan itself previously; historical value and cultural value about Rorodaan as a traditional game. Hopefully, many good values such as cooperation, mutual help, mutual respect and pride of the culture, could exist in students daily behaviour. Good characters as an objective could be achieved in this learning process.

Figure 2 shows the situation and expression of students when they were competing on Rorodaan game. After the students finished the competition, teacher let them take a rest for a while and then fill in the self-assessment questionnaire. The questionnaire was intended to explore their motivation and interest about the subject. The students began the class by taking 22 questions. The questionnaire asked them to rate how interesting they found subject and how interesting they found the activity on a scale from 1 to 6 (with 6 means the most interesting). Self-assessment is essential to using feedback appropriately [5 - 6]. In the last session, students were asked to accomplish some problems in the second test as a final evaluation. Final evaluation was carried out for exploring student’s understanding.

![Figure 2. The situation and expression of students when they were playing and competing together on Rorodaan project.](image)

3. Results and discussion
The results of this research were obtained from self-assessment questionnaire for motivation (student interest and student engagement); and written test for cognitive evaluation or student comprehension toward subject.
Table 1. The percentage from all respondents (students).

| Student Interest to Force and Movement by using Rorodaan | %  |
|--------------------------------------------------------|----|
| Not interested at all                                   | 0.28 |
| Less interested                                         | 1.99 |
| Mildly less interested                                  | 5.13 |
| Mildly interested                                       | 20.51|
| Interested                                              | 34.76|
| Very interested                                         | 37.04|

| Student Engagement toward Force and Movement by using Rorodaan | %  |
|---------------------------------------------------------------|----|
| Not engaged at all                                           | 0.93 |
| Less engaged                                                 | 1.63 |
| Mildly less engaged                                          | 7.69 |
| Mildly engaged                                               | 23.08|
| Engaged                                                      | 36.60|
| Really engaged                                               | 31.24|

Comprehensive written test was taken twice, as first and second test. It consists of multiple choices and short description. The first test taken before force and movement subject delivered by active learning method but by lecturing method. Maximum score of each test is 60. Mean score from first test was 40.289. The second test taken after Rorodaan as active learning method to the learning subject was applied. The mean score was 46.552 and presented increasing score about 15.55%.

Self-assessment questionnaire consists of two component items: (a) student interest to force and movement subject in active learning method by using Rorodaan, (b) student engagement toward the learning subject. Each component item consists of nine to eleven statement items which evaluated by scale from very disagree to very agree. Table 1. shows the percentage from all respondents (the students).

From the data, most of the students presented positive interest to force and movement subject by using Rorodaan. In student engagement, most students also presented positive engagement in learning activities. Positive interest and student engagement in line with increasing mean score in comprehension test. Rorodaan as an active learning method has succeeded in attracting student attention. They tend to engage in learning activities better than by using regular method like lecturing method.

Rorodaan delivered force and movement learning concretely and gave chances to students to experience dynamic of the theory through the game. The way the students learning might open bigger possibilities to reach learning insight so they could have better comprehension. This learning activities might correlate to increase the mean score in comprehension test. However, the increasing score may be also influenced by learning effects from the first test to the second test. In next similar research, learning effects need to be minimalized, for example using two groups (experiment, non experiment) with different treatment if possible.

4. Conclusion
This project re-emphasized the importance of motivation research in educational settings. Rorodaan games as ALM successfully had a significant effect on student interest levels. The comprehension test scores and self-assessment questionnaire carried out could provide information about student knowledge and attitudes in this Physics subject. Most of students tended to show positive interest and motivation to engage force and movement learning. They also showed willingness to perform achievement behaviour. Student’s comprehension test score increased 15.55% after Rorodaan was used as a learning tool.
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