Meaningful Learning of Work and Energy Materials Through Implementation of Basic Locomotor Movements in Basketball Games for High School Students

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Abstract. It is necessary to bring up meaningful learning, especially on work and energy material. Meaningful learning can be achieved through direct experience. Physics learning can be integrated through sports and health physical education learning, so it is possible to bring up meaningful learning. So this study aims to determine the effect of meaningful learning on the material of work and energy through direct experience in basic locomotor movement activities in basketball games on Physical Education, Sports and Health subjects. This research method is a quasi-experimental design with a Post-test only Control Group Design. The average post-test scores for the experimental and control classes were 84.34 and 77.33, which means there is a difference between classes that learn through direct experience and conventional ones. The independent sample t-test results give the value of Sig. of 0.017 that inform there is a significant difference in students' understanding of the concept of work and energy between classes that learn through direct experience with conventional ones. The interviews showed an average score of 89.06% of students indicated that they had experienced a meaningful learning process. So it can be concluded that meaningful learning in the learning process becomes the main focus that teachers should implement. Meaningful learning of the material of work and energy through direct experience in basic locomotor movement activities in basketball games in Physical Education, Sports and Health is proven to be better for student learning outcomes. In addition, through meaningful learning that has been done, it also informs that students become easier to understand the concept of the material through authentic experiences in everyday life.

1. Introduction
Basic locomotor movement is one of the basic materials in Physical Education, Sports and Health at the elementary level. The locomotor motion itself is a basic motion \([1]\) that moves a body to change position \([2]\). Learning basic locomotor movements at the elementary level aims to improve the quality of the student movement to move optimally, such as walking, running, jumping, and so on \([3]\). This movement is also helpful in improving body functions to achieve proficiency in performing basic movements that ultimately improve body health \([4]\). At the high school level, basic locomotor movements such as walking, running, and jumping are directly integrated into some sports games. One of the sports games that integrate basic locomotor movements is basketball.
Physics is one of the basic sciences that discusses all phenomena that exist in life. Physics is a science to find answers to "why" and "how" to phenomena that occur in life [5]. Physics is a science that can be integrated with various other sciences, one of which is in sports. This means that Physics learning can be carried out with students' direct experience in learning sports at school.

In the high school curriculum, one of the materials studied in physics is work and energy. Work and energy material is one of the essential materials in high school physics learning. This material is abstract, so often, the learning process that is carried out does not lead to meaningful learning. In this material, many students have not been able to connect, work and energy [6].

Meaningful learning is an essential factor in the learning process [7] and becomes the ideals of the desired learning process. Meaningful learning can be achieved through direct experience. Meaningful learning occurs when the learning process is active, constructive, intentional, authentic, and cooperative [8,9]. Meaningful learning is realized when students can connect the knowledge they have learned with everyday life [10], thereby increasing the benefits of learning [11].

Based on these reasons, it is necessary to bring up meaningful learning, especially work and energy. Physics learning can be integrated through sports and health physical education learning, so it is possible to bring up meaningful learning. So based on these things, this study aims to determine the effect of meaningful learning on the material of work and energy through basic locomotor movement activities in basketball games on Physical Education, Sports and Health subjects.

2. Method

This research is quantitative. This research method is a quasi-experimental design with a Post-test only Control Group Design. The quasi-experimental research method was chosen because the class groups used were not random [12,13].

This study used two classes, namely the experimental and control classes. The two classes used will be tested for normality and homogeneity first. After the two classes were declared normal and homogeneous, the Physics learning process in the experimental class was carried out by integration through basic locomotor movement activities in the basketball game. At the same time, the control class of the Physics learning process is carried out conventionally in the classroom without direct experience. After the learning process is complete, both classes will take a post-test.

The post-test instrument used was questions from the question bank. The results of the post-test will then be analyzed to determine the difference between learning outcomes in the Business and Energy material between the learning process through actual experience and the conventional learning process with the following hypothesis:

- H0 = There is no difference in the ability to understand the concept of work and energy material between the experimental class and the control class
- Ha = There is a difference in the ability to understand the concept of work and energy material between the experimental class and the control class

Testing is conducted with an independent sample t-test with the following criteria:

- If the value of Sig. (2 tailed) > 0.05, then H0 is accepted, and Ha is rejected
- If the value of Sig. (2 tailed) < 0.05, then H0 is rejected, and Ha is accepted

In addition, interviews were also conducted with students from the experimental class to determine whether students received meaningful learning in the learning process carried out.

3. Results and Discussion

3.1. Normality Test

The normality test was carried out to find out the distribution of students in each class was normal. The normality test is based on the Shapiro-Wilk test due to the limited number of students. The normality test results give the value of Sig. of 0.61 for the experimental class and 0.74 for the control class. Both show a value greater than 0.05, which means that the distribution of students in each class is normal.
3.2. Homogeneity Test

A homogeneity test was carried out to find out that students in each class were homogeneous. The results of the homogeneity test give the value of Sig. of 0.110. A value was greater than 0.05 means that the students in the experimental and control classes are homogeneous.

### Test of Homogeneity of Variances

| Levene Statistic | df1 | df2 | Sig |
|------------------|-----|-----|-----|
| 1.139            | 1   | 62  | .110|

3.3. Post-test

The post-test was carried out to determine students' understanding of the concept of work and energy. The average post-test score for the experimental class was 84.34, and the control class was 77.33. This significant difference in numbers descriptively shows a difference between classes that learn through direct experience and conventional ones.

### Group Statistics

| Class          | N  | Mean  | Std. Deviation | Std. Error Mean |
|----------------|----|-------|----------------|-----------------|
| Posttest       |    |       |                |                 |
| Experimental   | 32 | 84.3438 | 5.45722       | .95471          |
| Control        | 33 | 77.3333 | 8.26766       | 1.43921         |

3.4. Independent Sample T-Test

An Independent sample t-test was conducted to determine the significant differences in students' understanding of concepts on the work and energy materials. The test results give the value of Sig. of 0.017. This value smaller than 0.05 informs that the first hypothesis (H0) is rejected and the second hypothesis (Ha) are accepted. This explains the significant difference in students' understanding of concepts in work and energy between classes that learn through direct experience and conventional ones.
3.5. Meaningful Learning

Students in the experimental group carried out the learning process of work and energy physics through real experience by performing basic locomotor movements in basketball games. After the learning process, students were interviewed to find out whether students received meaningful learning or not. The interviews showed an average score of 89.06% of students indicated that they had experienced a meaningful learning process. The questions in the interview are as follows.

**Table 1. Meaningful Learning Questions.**

| No | Question                                                                 | Score   |
|----|--------------------------------------------------------------------------|---------|
| 1  | Is the learning process with real experience through basic locomotor movements in basketball games very closely related to the concepts of work and energy? | 90.62%  |
| 2  | Can the learning process with real experience through basic locomotor movements in basketball games facilitate understanding the concept of work and energy? | 93.75%  |
| 3  | Can the learning process with real experience through basic locomotor movements in basketball games connect the basic concepts of work and energy that they already have? | 84.38%  |
| 4  | Can the learning process with real experience through basic locomotor movements in basketball games connect new concepts about work and energy? | 87.50%  |

From the interviews, it was found that 90.62% of students stated that the learning process with real experience through basic locomotor movements in basketball games was closely related to the concept of work and energy. Then, 93.75% of students agreed that the learning process with real experience through basic locomotor movements in basketball games could facilitate understanding the concept of work and energy. In addition, 84.38% of students stated that the learning process with real experience through basic locomotor movements in basketball games was able to connect the basic concepts of business and energy they already had, and 87.50% were able to connect new concepts about work and energy.

3.6. Discussion

This study aims to determine the effect of meaningful learning on the material of work and energy through direct experience on basic locomotor movement activities in basketball games in Physical Education, Sports and Health. This study used two classes, namely the experimental and control classes. Both classes were initially in normal and homogeneous conditions.

The normality test was carried out to find out the distribution of students in each class was normal. The normality test is based on the Shapiro-Wilk test due to the limited number of students. The normality test results give the value of Sig. of 0.61 for the experimental class and 0.74 for the control class. Both show a value greater than 0.05, which means that the distribution of students in each class is normal. Normality was a vital part of the research. The normal class can show actual analysis.

A homogeneity test was carried out to find out that students in each class were homogeneous. The results of the homogeneity test give the value of Sig. of 0.110. The value was greater than 0.05 means that the students in the experimental and control classes are homogeneous. Like the normality test, the homogeneity test is also crucial in this study.

The post-test was carried out to determine students' understanding of the concept of work and energy. The average post-test scores for the experimental and control classes were 84.34 and 77.33, respectively. This significant difference in numbers descriptively shows a difference between classes that learn through direct experience and conventional ones. Descriptively, it is clear that there are differences in learning outcomes between the two classes.
An Independent sample t-test was carried out to find out the significant differences in students' understanding of concepts in work and energy. The test results give the value of Sig. of 0.017. This value smaller than 0.05 informs that the first hypothesis (H0) is rejected and the second hypothesis (Ha) are accepted. This explains the significant difference in students' understanding of work and energy between classes that learn through direct experience with conventional ones.

Students in the experimental group carried out the learning process of work and energy physics through real experience by performing basic locomotor movements in basketball games. After the learning process, students were interviewed to find out whether students received meaningful learning or not. The interviews showed an average score of 89.06% of students indicated that they had experienced a meaningful learning process.

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Physics learning that is integrated with sports turns out to be interesting for students [14,15]. This is in line with the statement that learning effectively increases student interest and learning outcomes [16]. Both statements are following other statements that support that learning Physics should focus on meaningful learning [17].

This is in line with several studies related to meaningful learning. The learning process with meaningful learning and less dialogue gives better results [18]. Meaningful learning gives the importance of new knowledge gained with its very close application in everyday life [19,20]. So that meaningful learning in the learning process becomes the main focus that teachers should implement.

4. Conclusion
Meaningful learning is the main focus of the actual learning process. Meaningful learning of the material of work and energy through direct experience in basic locomotor movement activities in basketball games in Physical Education, Sports and Health is proven to be better for student learning outcomes. In addition, meaningful learning that has been conducted also informs that students become easier to understand the concept of the material through authentic experiences in everyday life.

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