Implementation of Straight Motion Learning Using Software Tracker Towards Junior High School Students 'Cognitive Abilities

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ABSTRACT

This study aims to determine the effect of using tracker software media on students' cognitive abilities in straight motion material in junior high school. This research is an experimental study with a post-test only control design. The population was tested for homogeneity to obtain samples, namely two classes with homogeneous abilities. Furthermore, learning was carried out using the tracker software media in the experimental class. The students' post-test scores were tested for normality using the Kolmogorov Smirnov test. Furthermore, if the data is normally distributed, it is followed by an independent sample t-test. The results of the analysis using SPSS show that the sig. (2-tailed), namely 0.000 so that it is smaller than 0.05. Based on these results it can be concluded that there is a significant difference in the cognitive abilities of students between the control and experimental classes in learning straight motion.

INTRODUCTION

21st century education refers to the independence of students in learning and the ability of students to use technology (Masykur et al., 2017; Wang & Chang, 2012; Wijaya et al., 2016). Therefore, the quality of education must be improved (Pulungan, 2017; Suratno et al., 2019). The teacher's role in learning is only as a facilitator in learning. Students who play an active role in learning accompanied by guidance from the teacher. The level of development of a nation is also determined by the elements of progress and development of an education, where one of the elements of education that determines the progress of a nation is the teacher (Dewi et al., 2013) (Dewi et al., 2013) through classroom learning (Asyhari and Silvia, 2016). In addition, the learning that is carried out is also expected to provide direct experience for students, especially in Natural Science (IPA) learning (Afrizon, 2012; Rahayu et al., 2012). This is because science is a subject that is very close to students, where natural science phenomena occur in students' daily lives. Science learning also trains students to study themselves.
and the environment so that they are able to develop the life they will face (Marjan and Arnyana, 2014).

Science is also commonly referred to as natural science (Rahayuni, 2016) which studies nature and everything in it and the relationship of natural events that occur in everyday life (Rahayu et al., 2012). Science learning is not only related to memorizing and calculating using formulas, but also a process of finding knowledge (Listyawati, 2012). That is, in studying science the method used must be in accordance with the scientific method or approach. In addition, some natural science phenomena can be easily observed, but it is difficult to analyze these phenomena if only by looking at them, so we need a tool or media to help us analyze them. One of the natural science phenomena that is quite easy to find in everyday life is the phenomenon of straight motion.

The essence of the teaching and learning process is the communication process, namely the delivery of information from information sources through certain media to recipients of information (Kusumawati, 2016). The use of media is also highly recommended to reduce the use of the lecture method in learning (Irwan et al., 2017; Nurseto, 2012) so that learning is not student-centered. Learning media can support the effectiveness of achieving learning goals (Darimi, 2017; Rahman et al., 2017). Students can more easily understand a material when using a medium, one of which is the media in the form of images or graphics (Wibowo & Nilawati, 2015).

Straight motion material is kinematics material in Junior High School which is the basis for studying the next kinematics material (Yusro & Sasono, 2016). Therefore, students' understanding of this material is very important. However, based on several studies, it shows that students have difficulty understanding this material (Efrilia, 2016; Erlina et al., 2018; Sa’diyah & Handayani, 2015; Wijayanto & Susilawati, 2015). The choice of instructional media is also important in learning this material, because as previously explained, there are natural phenomena that are easily seen and found in everyday life, but it is quite difficult to analyze them just by looking at them. One alternative learning media that can be used in straight motion learning is tracker software.

Tracker is a video analysis and modeling software developed by Open Source Physics (OSP) with a framework using Java. Tracker is a free application used to analyze videos. Trackers are used to make disturbances against an object, be it the position of the object, the object's velocity or the object's acceleration (Afifah et al., 2015). This software allows learning to be connected to real life (Wee & Lee, 2011). The use of this tracker software media can make it easier for students to create and represent data in graphical form (Bryan, 2004). Therefore, the application of this media is needed in learning straight motion material. The purpose of this study was to determine the effect of using tracker software media on students’ cognitive abilities on straight motion in junior high school.

METHODOLOGY

The research was conducted at SMP Negeri 1 Yosowilangun, odd semester of the 2019/2020 academic year. In research conducted using a quantitative approach. This type of research is included in the type of experimental research, in which the selection of respondents or samples in the study is carried out randomly (random sampling). The research design used was a posttest only control group design. The population in this study were all students of class VIII. The population will be tested for homogeneity in...
order to obtain a homogeneous class for further use as research samples. The sample chosen is two classes with homogeneous abilities and will be divided into the control class and the experimental class. The number of students in one class consists of 32 students. The design drawing of the posttest online control group design, namely as follows:

![Figure 1. Research Design](Source: Sugiyono, 2017: 75)

Information:
R : respondents or students
X : Learning with media tracker software
O₂ : Post-test scores of the experimental class
O₄ : Post-test scores of the control class

Before proceeding to the post-test result test, first the Normality test is carried out as a parametric test requirement. The normality test used was the Kolmogorov-Smirnov test with the help of SPSS 20 software. The results of the students’ post-test were analyzed using the independent sample t-test to assess the difference in the average post-test between two different classes after participating in learning with different treatments, has been given. The analysis of the post-test results was carried out with the help of SPSS 20 software with a significance of 5% or 0.05. There are also hypotheses formulated in this study, namely:

H₀ : there is no significant difference in students' cognitive abilities
Hₐ : there is a significant difference in students' cognitive abilities

Hypothesis testing can be done by comparing the significance value with the results of the independent sample t-test (SPSS 20). If the significance value is less than or equal to 0.05, then there is a significant difference in student learning outcomes from the two classes or H₀ is rejected and Hₐ accepted. Meanwhile, if the significance value is more than 0.05, then there is no significant difference in student learning outcomes from the two classes or H₀ is accepted and Hₐ is rejected. In addition, hypothesis testing can also be done by comparing the value of t and t table. If \( t_{\text{count}} > t_{\text{table}} \), then H₀ is rejected and Hₐ is accepted, whereas if \( t_{\text{count}} < t_{\text{table}} \), then H₀ is accepted and Hₐ is rejected.

The flow of research conducted can be seen through the following chart.
Figure 2. Research Procedure

Tasks

The data collection technique is using the post-test method. The post-test questions used are in the form of 15 questions that have been adjusted to the learning objectives and the expected level of competence. The questions used consisted of 10 multiple choice questions and 5 description questions. The questions are taken from the class VIII material in odd semesters, precisely on the subject of Straight Motion.

An object can be said to be moving if every time its position changes with a certain reference. Some of the quantities related to straight motion include distance and space, speed and velocity, and acceleration. Based on the speed, straight motion can be divided into two, namely regular straight motion and straight motion that changes regularly. Displacement is a vector quantity that states the change in the position of the object at the reference point. Whereas distance is a scalar quantity which states the length of the path that an object passes. Speed is the result of a comparison between the distance traveled and the time an event occurs. If velocity is defined as the distance traveled per unit time, velocity is defined as displacement per unit time.
Regular straight motion is the motion of an object in a straight line at a fixed speed. Fixed speed means that the acceleration experienced by an object that is moving in a regular straight is zero. Therefore, the formula that applies to this motion is the formula for speed and speed.

\[ v = \frac{s}{t} \quad (1) \]

Meanwhile, velocity can be formulated as follows:

\[ v = \frac{\Delta s}{t} \quad (2) \]

Where:
- \( v \): speed or velocity (m/s)
- \( s \): distance (m)
- \( \Delta s \): space (m)
- \( t \): time (s)

Acceleration is the change in speed per unit of time. If an object is moving at an increasing speed it is called positive acceleration, whereas if an object is moving at a decreasing speed it is called negative acceleration.

\[ a = \frac{\Delta v}{t} \quad (3) \]

Where:
- \( a \): acceleration (m/s²)
- \( v \): velocity (m/s)
- \( t \): time (s)

Straight motion with regular changes is the motion of an object in a straight line at a constant acceleration. In addition, objects can also experience negative acceleration or it can be called deceleration. Straight motion changes regularly has an almost constant acceleration or deceleration so that the graph showing the acceleration against time is a horizontal line, while the speed changes so that the graph of velocity against time is a straight line with a slope that intersects the vertical axis.

**RESULTS AND DISCUSSION**

The students’ post-test scores in the research that was carried out by applying this tracker software media there were significant differences between the control class and the experimental class. The following is the data on the differences in post-test students from the two classes.
The results of the post-test of the two classes were first tested with the Normality test (Kolmogorov Smirnov). The test results can be seen in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Experiment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Normal Parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>69,7500</td>
<td>56,3750</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>8,81348</td>
<td>13,88606</td>
</tr>
<tr>
<td>Absolute Most Extreme Differences</td>
<td>.151</td>
<td>.140</td>
</tr>
<tr>
<td>Positive</td>
<td>.151</td>
<td>.140</td>
</tr>
<tr>
<td>Negative</td>
<td>-.136</td>
<td>-.139</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov Z</td>
<td>.852</td>
<td>.791</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.462</td>
<td>.559</td>
</tr>
</tbody>
</table>

a. Test distribution is Normal
b. Calculated from data

Based on the table above, it shows that the post-test results of students from the two classes are normally distributed with a significance value of more than 0.05. Thus, it can be continued with the parameteric test, namely the independent sample t-test to determine the difference in the average post-test of students from the two classes. As for the results of the independent t-test that has been carried out, the significance value (sig. (2-tailed)) is obtained, which is 0.000 or less than 0.05. These results mean that there is a significant difference in the cognitive abilities of students from the two classes or $H_0$ is rejected and $H_a$ is accepted. However, to further ensure the correctness of the hypothesis test by comparing the significance value, it can also be compared to $t_{\text{count}}$ with $t_{\text{table}}$. In t table, it can be seen by paying attention to the df which is 62. Meanwhile, the significance is $\alpha / 2$ or 0.025. The $t_{\text{table}}$ shows the value 1.99897. This value is compared with the $t_{\text{count}}$ of 9.367. From these results it can be seen that $t_{\text{count}} > t_{\text{table}}$ so that $H_0$ is rejected and $H_a$ is accepted, which means that there is a significant difference
in the cognitive abilities of students from the two classes. The descriptions of the results of the independent sample t-test above show that learning straight motion in junior high schools using tracker software has a significant effect on students' cognitive abilities.

Based on the interview after the post-test was carried out in the control class, students said that they had difficulty working on graph-related questions. Meanwhile, in the experimental class after learning with tracker software, students said that graphical questions were not easy enough, but if they were done carefully, they could still be done. This is because students in the control class are more accustomed to solving problems using mathematical formulas compared to representations using graphs. The cause of students' post-test scores on solving problems with mathematical representations is higher than those with graphical and image representations, namely because students are more familiar with mathematical symbols and formulas (Hasbullah, et al. 2018). One form of student difficulty in movement problems is the presentation of material that contains graphics (Hasbullah and Nazriana, 2017). Therefore, students from the experimental class do not experience significant difficulties when working with graphs because tracker software has the ability to provide a way for users to represent data (Asrizal, et al. 2018), namely by using graphs. The use of tracker software media in learning it can improve students' understanding in interpreting the graph of the relationship between physics quantities in kinematics (Oktriyeni and Putra 2019). Student activities in the preparation of tables and graphs are implications of understanding students' concepts while analyzing with the tracker software.

CONCLUSION

Based on the description of the discussion, it can be seen that the students' post-test is normally distributed, so it is followed by an independent sample t-test. From the results of the independent sample t-test shows the results are $t_{\text{count}} > t_{\text{table}}$ so that $H_0$ is rejected and $H_a$ is accepted, which means that there is a significant difference in the cognitive abilities of students from the two classes. Based on this study, it can be concluded that the application of tracker software media in straight motion learning has a significant effect on the cognitive abilities of junior high school students.

REFERENCE


