The impact of the media tracker on student critical thinking skills

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Abstract. This research aims to determine the impact of media tracker on students’ critical thinking skills in the concept of free fall motion and responses of students to the media tracker. The method used in this research is the pre-experimental design method through one group pretest-posttest design, the research design that gives treatment to the experimental group without being compared with the control group. The type of approach used is a quantitative approach. The population of this research was all students of grade ten of Senior High School 3 Banda Aceh, while the sample was 30 students which were randomly selected. The treatment in the sample class is learning using a media tracker. Data collection uses essay tests and student response questionnaires developed by researchers. The results of data analysis with descriptive statistics indicate that there is an influence of tracker learning media on improving critical thinking skills with an N-gain value of 0.68 in the medium category. Besides that, learning using media tracker gets a positive response from students. Inference from the results of this study, teachers are expected to be able and willing to apply the media tracker on temperature and heat learning or other concepts in physics.

1. Introduction
Efforts to increase critical thinking have been carried out in various ways or learning models, including the Numbered Heads Together learning model [1], Inquiry-Discovery [2], Problem Based Instruction [3,4], Problem Based Learning [5], Guided Experiment Method [6 ], and Based Learning [7].Integration of learning models with various forms of media has been carried out, among others, integration with mobile pocket media [8], Edmodo on Android platform [9] and the use of simulation with PhET [10], but the drawback is that we review one of the media uses that is know the real form of the practicum component they are doing, because the characteristics of the PhET, media only present the form of data simulation. This is not fully able to train students’ critical thinking skills. The ability of thinking is always evolving and can be studied, because of the higher order thinking skill is one of the stages of thinking that cannot be separated from everyday life [11].

One form of computer interactive multimedia is video and media tracker. The implementation of media tracker involves students mainly related to the use of mobile phones to record physical events, transfer recordings to computers, and analyze recordings with tracker software. Overall the incorporation of video with computers is an innovative method in science learning [12]. Several
Studies show that the use of interactive multimedia can improve mastery of concepts [13], learning achievement [14], and critical thinking skills [15]. Some previous studies show that the video tracker media has several advantages, including being able to record openly every object movement in everyday life [16], run on a java framework [17,18,19], and easy to run [20,21], students can get more complete data than using experimental methods [22,19], students get data in the form of numbers and graphs [23], the calculation results are in accordance with the theory [24]. The concept of physics has been taught with the help of video tracker media, including the concept of free fall motion [25,26], Coriolis force motion [27], momentum and impulse [24], moment of inertia [28], circular motion [23], and also used for kinematics experiments on two-dimensional airstrips [29], as well as other object motion parameters [30]. Some research results also show the impact of the use of media tracker, including being able to improve students' thinking skills [24], process skills of students in terms of observing, measuring, designing experiments, interpreting data, and communicating [26].

Based on the results of the above research, it is reasonable through research to choose a media video tracker to improve students' critical thinking skills in the concept of free fall motion. Although the media tracker has been applied to the previous free fall concept [25,26], but in research not yet seen the level of critical thinking skills students only used video recorders as experimental media and looked at students' process skills. Therefore, through this time it will be tried to improve by applying a media tracker to see students' critical thinking skills. Besides that, the purpose of the study also wants to know the response or response of students to the media tracker used.

2. Research Aim and Question

2.1. Method and research design
The method used in this study was a pre-experimental design method through one group pretest-posttest design, the research design that gave treatment to the experimental group without being compared with the control group. The type of pre-experimental design was chosen because this design is not yet a serious experiment, because there are still external variables that influence the shape of the dependent variable [31].

2.2. Population and sample
Total population sampling technique was employed in this study. Samples of this study were 257 teachers who participants in the first cohort of 2019 professional development. Samples of this study were mathematics, science and social science teachers. It took three months for the participants to complete the online professional development.

2.3. Technique of data collection
Data collection is carried out in accordance with the design of the research technique. There are two types of instruments used in this study including tests of critical thinking skills in the form of essay questions and response questionnaires in the form of statements developed by researchers. Before the instrument is used, it is first validated by an expert. The results of the validation will then be tested on the class that has learned about free fall motion concept. The results of the trial analysis were obtained with difficulty index of 0.602, index of difference 0.33, index of validity of 0.690, and index of reliability of 0.625 with a category of moderate, sufficient, high and high, respectively.

2.4. Technique of data analysis
The data used in this study is a prerequisite test consisting of a normality test. While for testing hypotheses using the t test and for testing the improvement of critical thinking skills using N-gain.
3. Results and Discussion

3.1. Critical thinking skills

Improvement of critical thinking skills were reviewed in terms of the results of the pretest and posttest after attending the study. Students are given essay questions. Comparison of achievement of critical thinking skills was analyzed using N-gain statistics. Comparison value of critical thinking skills can be seen in Table 1.

| Data of critical thinking skill | Average | N-gain |
|-------------------------------|---------|--------|
| Pretest                       | 44.57   | 0.68   |
| Posttest                      | 82.27   |        |

Table 1 showed the results of the pretest with an average value of 44.57 and the average posttest score has a value of 82.27. The results of data analysis illustrate an increase in students' critical thinking skills in the free fall motion concept seen from the percentage of N-gain of 0.68 with a high category. These findings are in line with the research conducted by [24] on moment and impulse concept that using media tracker in learning can improve student critical thinking skills.

3.2. Critical thinking skill per indicator

The achievement of critical thinking skills is evidenced by the increase of each critical thinking indicator contained in each question number. Students' critical thinking skills are analyzed using the N-gain equation to see how much improvement for each indicator. Analysis of each N-gain on each indicator of critical thinking skills was conducted to see how much improvement occurred through the application of the media tracker. The results of the average analysis of each indicator of full critical thinking skills can be seen in Figure 1.

![Figure 1. The average improvement of critical thinking skill per indicator](image)

Indicators of critical thinking skills explain that evaluation of critical thinking is generally carried out through a scientific work process. In this study, critical thinking indicators are limited according to the stages of the learning model including, 1) analyzing and evaluating arguments, 2) asking questions and answering questions, 3) observing and considering observations, 4) educating and considering the results of induction, 5) deciding an action.

Figure 1 explained the difference in increasing critical thinking skills with different categories of five indicators. This is consistent with research [32] that tracker has a very good predicate for analyzing motion kinematics video, thus helping students improve mastery of concepts and critical thinking. Learning by using IT can help students to actively learn and stimulate the ability of critical thinking skills learners in learning [33].
3.2.1. Analyzing and evaluating the argumentation
Indicators of critical thinking skills analyze and evaluate arguments show an average N-gain value of 38 in the medium category. This indicator appears in the learning process takes place and at the end of learning, indicated by the presence of students who are able to use their abilities to solve problems or analyze video data using tracker or questions given in learning, giving reasons or by identifying conceptual problems. This is supported by [34] learning activities that require students to be able to formulate, understand, analyze and evaluate to answer a problem that will develop students’ critical thinking skills.

3.2.2. Asking and answering the questions
Indicators that have an average N-gain value with a medium category of 41, namely indicators asking and answering questions (KBK 2). The results obtained describe an increase in students in analyzing what is the reason for a problem, explain observations and apply the concepts obtained in solving systematic problems. Indicators asking and answering questions occur when students can relate old knowledge concepts to newly acquired ones, guiding in making observations so that they will get accurate results [35].

3.2.3. Observing and considering the observation results
According to Figure 1, Indicators of critical thinking skills observe and consider the results of observations have an average N-gain value of 45 with a moderate category. The learning process that occurs by utilizing the media tracker makes students more active and interactive, so that the experience can be obtained in real term, this makes the cognitive development of students more permanent or not quickly forgotten. In this indicator students are able to develop critical thinking skills by carrying out activities to record the things needed at the time of practicum and to be involved in concluding the results obtained. This is supported [36] that developing critical thinking skills is very necessary for students to be able to conduct a series of investigations such as observing, formulating, evaluating and deducing observations.

3.2.4. Inducting and considering the induction results
Indicators of critical thinking skills educate and consider the results of induction have an N-gain value with a low category with a value of 28 because in the learning process some students have not raised the skills to condition logic and express interpretations of the learning. Reasoning is a logical and systematic process of thinking on observable facts to obtain conclusions in the form of knowledge [37]. When learning using tracker media students are required to try more in understanding the lesson.

3.2.5. Deciding an action
This indicator appears when conducting observation activities, students are asked to decide what things will be done when practicum. Whether this can be done or not so that it can provide the right answer or reason in explaining the results of the observation and concluding the results of the observation. Increasing the indicator decides an action can be seen from the average value of N-gain of 38 in the medium category. This is supported [38] Critical thinking is reasoned and reflective thinking by emphasizing making decisions about what to believe and do.

3.3. Analysis results on student responses
To find out the responses of students to the media tracker on free fall motion concept, a questionnaire sheet was filled out by students at the end of the meeting. This questionnaire was given at the end of the study, the questionnaire distributed in the form of a closed questionnaire that had a response rate ranging from strongly agree (SS), agree (S), disagree (TS), and strongly disagree (STS). Then each percentage of responses is calculated. The response data obtained from the questionnaire given to students contains 15 items of statements. The results of the questionnaire processing showed that the use of media tracker received positive responses from students, as evidenced by the large number of
students who select agree (S) category which reached (93%) very interested. This is supported [32] the response of students with close to 100% percentage can be said that students have a very good response after learning using tracker software.

4. Conclusions
Video-based learning using Tracker analysis is a very good idea to develop in learning of physics. By using media tracker, it can improve student critical thinking skills in the concept of free fall and learning using media tracker to get a positive response from students.

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