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IMPLEMENTATION OF GUIDED INQUIRY LEARNING MODEL USING TRACKER VIDEO ANALYZER SOFTWARE TO IMPROVE STUDENTS' SCIENTIFIC PROCESS SKILL IN PARABOLIC MOTION TOPIC

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Abstract

This research is aimed to describe student's scientific process skill after the student experienced a guided inquiry learning using Tracker video analyzer. The pre-experimental research adopted one group pre-test post-test design and applied to 76 number of student at 10th grade in SMA N 3 Surabaya. How the learning process was implemented, together with how the students conduct the experiment and their performance during experiment are all accessed by using evaluation sheets. Proceeding these evaluations, pre-test on the student's scientific skill was completed. The results were subsequently compared with the post-test result that was running after the afore mentioned evaluations. The student's response were also gathered to enrich the data. Subsequently the pre- and post- test data were analyzed using T-test and N- gain normalized test. It was obtained that the examined inquiry learning model in the topic of Parabolic Motion has increased the student's scientific process skill significantly under the accusation coefficient (α) of 5%, while the n-gain was in a medium range.

Keywords: Guided inquiry learning model, tracker video analyzer, student's scientific process skill, Parabolic Motion

INTRODUCTION

In the life of a country, education has a very important role to ensure the survival of citizens, because education is a means to improve and develop the quality of human resources. The curriculum is one way to improve the quality of education, therefore the development of education in Indonesia will be influenced by the curriculum that is applied as a reference of the quality of education. Currently the curriculum in Indonesia is Curriculum 2013. The curriculum emphasizes on three aspects of assessment, so that the knowledge aspect is not the only determinant of students' graduation such as the previous curriculum. One other aspect that becomes the determinant is the skills of students in building knowledge or known as skills aspect. Skills can be trained or enhanced through a variety of approaches. One of them that can be used is the approach of science process skills, where students are conditioned to follow a series of learning that requires students to conduct investigations or investigations by using scientific methods. The skill of science process is very important to be taught because according to Hidayatulloh (2015) by training the science process skill, the student is able to use math ability in analyzing a problem that exist in his life.

Physics as one of the subjects in the Curriculum 2013, is also taught through a scientific approach. Trianto (2017) Physics itself is defined as a branch of Natural Science or science born and developed through observation steps, problem formulation, hypothesis preparation through experiments, conclusions, and the discovery of concepts. As a compulsory subject in the mathematics and natural sciences group, referring to the Curriculum 2013, physics learning should provide learning experiences for learners. It agrees with Ogan, et al (2014) Physics learning is built and tested through a series of activities such as identifying variables, stating hypotheses, making operational definitions, and interpreting data and graphics better than instructions.

However, based on observations made during the internship in SMAN 3 Surabaya, Physics subjects are considered difficult by students, especially Parabolic Motion materials. The results of the pre-research questionnaire analysis which conducted on 6 April 2017 show that 67% of the two classes observed stated that Parabolic Motion material is difficult to understand, 92% of the total students stated Parabolic Motion Material is difficult due to has many materials to be memorized. Obviously, Physics is not only a memorizing learning, but a systematic learning based on the discovery of a concept that is understood by which conducted through lab activities in the laboratory. Regarding the Physics lab equipment in SMAN3 Surabaya is quite complete, but the equipment is not entirely available for all Physics materials, such as Physics material on Parabolic Motion. Based on the results of interviews with physics teachers in SMAN 3 Surabaya, obtained information that Parabolic

Motion material is a matter of physics lessons that are difficult to practice, so that teachers have difficulty in teaching the concept of Physics by experimental method or practicum but only demonstrating each type of

Parabolic Motion in the classroom. As a result of these problems, the students' process skills such as observing, hypothesizing, planning the research, controlling the variables, interpreting the data, predicting and communicating were not trained because of the absence of practicum, considering the process skills will greatly assist the students in understanding the Physics concepts studied. According to Cigrik, et al (2015) students actively studying through complete experiments in the laboratory will then continue to use cognitive skills, psychomotor skills and scientific process skills so that student learning outcomes are meaningful.

One of the learning models that appropriate with 2013 Curriculum criteria is guided inquiry learning model. Such learning is defined as learning that prioritizes the discovery process in its learning activities to gain knowledge. The guided inquiry model is characterized by students working together in groups, acting as a scientist, who constructs the concept through investigation using the method. Inquiry learning is believed to have a positive impact on students because it can facilitate students in understanding and building knowledge during learning, especially in activities that require skills during experiment. It agrees with Kostelnikova et al (2013) inquiry learning makes students not only remember but also perform activities directly. Based on the problem described earlier, virtual laboratories, using computer media, can be used as an alternative activity in case of limitation of real laboratory. This agrees with Anglin (2011) that learning technology has been able to take over things related to what traditional teachers normally do. Consequently, the use of a virtual laboratory is not to completely replace the role of a real laboratory, but as an alternative to a real laboratory complement.

One alternative solution to solve this problem is to apply a student-centered learning model which can improve their science process skills. This is supported by some researchers including Santoso (2009) that laboratory combinations can be effectively used to discover the Physics concept of GLBB, Wahyudi (2013) reveals that students' science process skills in Heat materials after applied inquiry are classified as good category. Sheeba (2013) encouraging the skills of the science process, students will be productively contributing towards a better global education. In addition, Wee (2015) the use of the tracker software can consistently provide an opportunity for students to engage in active inquiry-based learning and by using data from video analysis so that students can find the abstract concept of parabolic motion along with the proof.

According to Fathurrohman (2015) The guided inquiry learning model is a discovery-based learning in which the teacher provides sufficient guidance or instruction to the learners. The role of a teacher in this model is active in determining the problems and the steps of the solution that encourage students to think for themselves for the solution of their problems within the group. In the learning model of the discovery suggest that the learning should be flexible and explorative, which means if students appear to be trying to confront a concept, give them time to try to solve the problem themselves before the teacher gives the solution. Based on guided inquiry indicators disclosed by Suparno (2005) which (1) presents questions or problems; (2) create or propose a hypothesis; (3) conduct experiments to obtain information or data; (4) collecting and analyzing data; and (5) make a conclusion. Meanwhile, as an alternative for tool limitation used for the lab is the need for learning through the discovery that combines real and virtual laboratories. The combination is practicum activity and parabolic motion data is still implemented in real terms. However, data processing and analysis can be performed directly with a software analyzer. One of the software analyzer that can be used to combining of real and virtual laboratories is the video tracker analyzer software. This software is created by Open Source Physics (OSP) Java framework that serves for modeling and analyzing video that integrated with computer.

Based on the above description, it is necessary to conduct research on "Application of Guided Inquiry Learning Model using Traker Video Analyzer on Parabolic Motion Material to Improve Student Science Process Skill". This study aims to describe the improvement of students' science process skills on Parabolic Motion materials after a guided inquiry learning model is applied.

METHOD

In this research used pre-experimental, with one group pre-test and post-test design. The design of research is picted at figure 1.

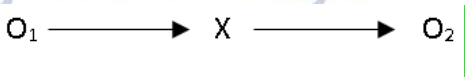

Figure 1. Research Design

Information:

O_1 : Pre-test (before being treated)

O_2 : Post-test (after being treated)

X :Applying guided learning assisted by tracker video software

The design of this study using two classes namely X MIA 5 and X MIA 6 by giving the same treatment of

delivery of Parabolic Motion material with the implementation of guided Inquiry learning model using tracker video analyzer. In general, the design of this study is illustrated as shown in Table 1.

Table 1. Research design

Class	*Pre-test*	Independent Variabel	*Post-test*
X MIA 5	O_1	X	O_2
X MIA 6	O_1	X	O_2

Information:
O_1 : Pre-test (before being treated)
O_2 : Post-test (after being treated)
X : Applying guided learning assisted by tracker video software

The subjects of research were students at SMAN 3 Surabaya X MIA 5 and X MIA 6 class with total number of students are 76 students. The methods of data collection used consist of: observation method (learning activity and performance test observation sheet), performance test method, test of process skill (pre-test and post-test), and questionnaire method (student response questionnaire).

Before taking the research data, first, tested the problem of the students who have obtained the Parabolic Motion material, they are students of eleventh grade. The test questions have done to determine the feasibility of the questions that will be used for pre-test and post-test. This feasibility test covers the level of difficulty, validity, reliability and differentiation. The feasible question will be used as a matter of pre-test and post-test, consists of 19 questions which correspond to eight indicators of skills in the science process skills.

The data which obtained from this study include data on the assessment of the learning activity, the results of students' science process skills, and student responses. Learning activity is the consistency of the way of learning which conducted by teachers in accordance with the syntax or steps of learning models based on the problems that have been planned and listed in the Lesson plan (RPP). Learning is determined to be accomplished when the phases or stages in the guided Inquiry learning model get the grades in good category according to the Lesson Plans (RPP). The data on the activity of learning is obtained by observation at the time of learning in progress. In the learning that acts as a teacher is a researcher. Observations were made by three observers: physics teacher and two physics students. Observations were assessed using the observation sheets of instructional implementation and carried out from the beginning to the end of the activity.

The data of students' science process skill is obtained by giving pre-test and post-test questions to students and performing experimental test. The question of pre-test and post-test used is equal as the number of 16 questions that match the science process skill indicators. The pre-test questions are given to the students before learning with guided inquiry learning model conducted, to know the students' early science process skills. After learning, students are given the post-test questions to measure students' science process skills. The students' pre-test and post-test values were analyzed using paired t-test and n-gain. While performance tests of conducting experiments by testing the skills of students to perform the experiment completely independently through the step-by-step skills of the science process during the experiment.

Student response data is obtained by filling the student response questionnaire. The questionnaire filled by all students after the learning complete. In the questionnaire there is a statement of teaching and learning activities, students are asked to express their opinions on learning with guided Inquiry learning model.

RESULTS AND DISCUSSION

The data of learning activity are assessed by activity observation sheet which filled by observer. The result of activity learning is showed in figure 2.

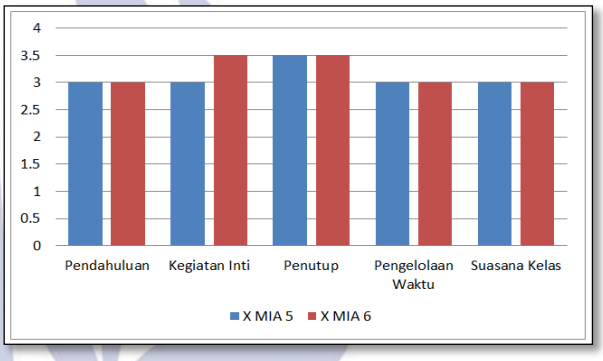

Figure 2. Learning Activity Accomplishment

In Figure 2, it is known that learning in guided inquiry model in the preparation stage in both classes has been done well, teachers and students have prepared everything needed for learning well.

In the preliminary step teachers get good categories in both classes. This is because in this phase the teacher displays the video of learning motivation and able to guide the students to ask questions related to the displayed video. Do not forget also the teacher also convey the purpose of learning to be achieved. In this introductory phase, with students motivated in learning will be able to cause students to feel involved and involved in the learning process.

In the core activities aspect, learning progresses smoothly in accordance with the plan that has been made in the implementation plan of learning activity. The core activities correspond to the guided inquiry learning phases,

including observing, predicting, hypothesize, variable identification, operational definitions, experimenting, data interpreting, and communication phases. Get better value than before. This means students' science process skills have been well trained.

In the closing phase the teacher provides an opportunity for students to ask questions about learning materials that have not been understood and summarize the material that has been taught. At the end of the learning the teachers and students pray together. Based on Figure 2 the closing aspects get better value than other aspects, this is because students are very enthusiastic to infer the material they have gained during learning.

In the aspect of the allocation of time teachers are able to organize learning in accordance with well-defined time. While the observation aspect of the classroom teachers gets a good predicate of this because the teacher is able to regulate the learning condition of the classroom, so students become active but still conducive. Consequently, teachers have been able to provide learning to students as well as that learning takes place.

Skills of students' science process can be known from test scores about science process skills in the form of pre-test and post-test of students analyzed by paired t-test and n-gain. The result of t-test analysis is shown in Table 2.

Table 2. Result of t-test two side

Class	t_{cal}	t_{table}	conclusion
X MIA 5	20,06	1,64	H_0 rejected
X MIA 6	36,57	1,64	H_0 rejected

Two side t-test is conducted to find the different of result. Based on Table 4.12 t_{table} for both class are equal to 1,64. $t_{calculation}$ kelasX MIA 5 is 20,06 for X MIA 6 equal to 36,57. Regarding the result of $t_{hitung} \geq t_{tabel}$ of the both side with a real level of 0.05 so it can be concluded that H0 is rejected and Hi accepted. Based on this, there is a significant difference between pre-test and post-test after applied guided inquiry model, where the post-test value is better than pre-test value. This result is consistent with research conducted by Becerra (2012) and Abdullah (2010) which states that students' science process skills improved significantly after a guided inquiry learning model was implemented.

Based on that aspect to know the improvement of science process skill of students obtained the value of pre-test and post-test through gain-test of each student. In Table 3 the result of the recapitulation of the gain index of each student.

Table 3. Result N-*Gain*

Class	*Number of student*	category n-gain
X MIA 5	2	Low
	33	Moderate
	5	High
X MIA 6	0	Low
	19	Moderate
	19	High

Based on Table 3 it is known that the students' science process skill of both classes has increased, where in the varied increase in each student. This is because each student has different initial process skills, so that the n-gain obtained by the students is different. While the improvement of the science process skills of each class is obtained through the average score of the pre-test and post-test value of each class. In Table 4 is the recapitulation result of the gain index of each class.

Table 4. Result of N-*Gain every class*

Class	N-*gain Average*	category
XMIA 5	0,55	Moderate
X MIA 6	0,68	Moderate

Based on Table 4 it is known that both classes have moderate improvement. The results show that in the X MIA and X MIA 6 have an average N-gain of 0.55 and 0.68, respectively, where the two classes have no significant difference. this is due to differences in the science process skills students have in each class, can affect the results of pre-test and post-test. So, it can be concluded that the implementation of guided inquiry learning model can improve students' science process skill in both classes significantly with medium improvement category. This result is consistent with a study by Nnorom (2017) which suggests that guided inquiry learning models can improve the skills of the science process.

The N-gain analysis result of each science skill indicator in both classes is shown in Figure 3

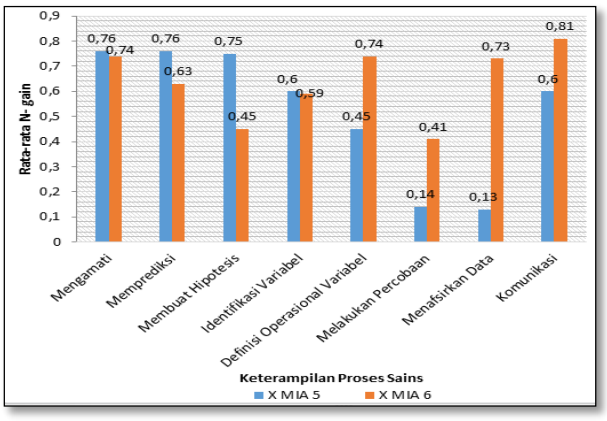

Figure 3. *N-gain* analyze each indicator

Based on Figure 3 shows that students in both classes experienced significant improvements in psychosocial science skills for eight aspects assessed related to observing, predicting, hypothesizing, identifying variables, operating definitions, experimenting, interpreting data, and communications.

For the aspects of observing the two classes are in the high category of other aspects. This is possible because in that aspect the students are able to observe the phenomenon of Parabolic Motion easily because of the result of the software that gives and facilitate student easier in observing so that most students can answer the given problem as well.

In the aspect of predicting the two classes also increased the value of pre-test and post-test. Class XI MIA 5 has an increase percentage with high category. This is because the teacher gives students the opportunity to learn and to predict related events about parabolic motion directly. It also occurs in class X MIA 6, but the increase is smaller with the N-gain got moderate category.

In the aspect of identification of these variables related to the ability to classifying variables in the experiment. In this case the learning that is given related to a series of parabolic motion experiments that make students practice making variables from the experiment, so students get a moderate category improvement in both classes.

In the aspect of the defining of operational variables, experimenting, interpreting data, and communication for this aspect occurs in a significant difference, although the n-gain of both classes increases but the n-gain of the two classes is different. X MIA 5 class obtains n-gain smaller than X MIA 6, it is due to an unexpected constraint during the class X-class MIA 5 learning which is power outages during learning which causes some students did not finish experiment completely, while the class X MIA 6 finish the learning completely, so the value of the n-gain class is increased significantly

The Data regarding to student response was obtained from student response questionnaire which was given to all students after the learning process was completed in class X MIA 5 and X MIA 6. The result of student response shown by Figure 4.

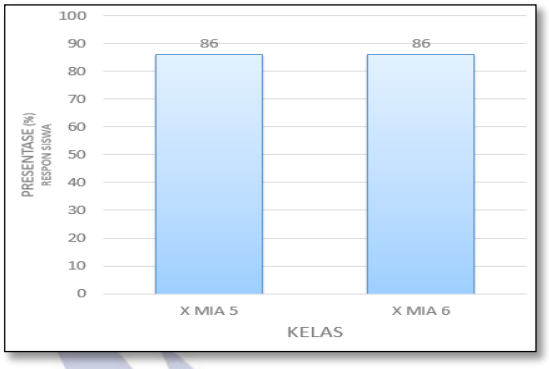

Figure 4. Percentage of student Response

Based on Figure 4, the percentage of student responses has a high category in both classes. According to Ridwan (2010) the higher the percentage of students' responses obtained indicate a positive student response to the learning. Although both classes have different values but are still in the same category that is very good. The high response of these students supports that the learning model is based on effective problems to be applied in physics learning.

In principle the whole series of this learning process is to help students to see the meaning of matter, in this case is parabolic motion by way of linking the concept of subject matter with real life every day. Linking issues with everyday life, can make it easier for students to master concepts and problem-solving skills.

CONCLUSSION

The results of the implementation of learning management using guided inquiry learning model using tracker video analyzer on Parabolic Motion material in X MIA 5 and X MIA 6 performed well. The guided inquiry learning model applied to Parabolic Motion material improved students' science process skills significantly at α = 5% and the improvement was consistent for each class with moderate category improvement in both classes. The learning using the guided inquiry model in Parabolic Motion material get good response in both experiment class.

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