Article

The Effect of Virtual Laboratory Implementation on The Science Literacy Ability of Class VIII Students on Material Force and Movement of Objects at MTs Negeri 1 Jember

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ABSTRACT

Students who do not raise questions that are applicable and the ability to identify a problem according to the concept of science, show that the scientific literacy of students is classified as low science in a real context. In general, this study aims to examine the effect of the application of the virtual laboratory on the scientific literacy ability of students on the subject matter of force and motion. This research method uses quantitative research types Quasi Experimental Design. The population in this study were students of class VIII and the sample was selected by purposive sampling. The instrument of scientific literacy is a description test. Prerequisite test results use Kolmogorov Smirnov for normality and use One-Way ANOVA for homogeneity. Then the hypothesis test was performed using the Z test. The results of the study obtained an average value of scientific literacy at a pretest significance value of 0.403> 0.05 so that H0 was accepted and Ha was rejected. While the posttest value has a significance value of 0.001 <0.005 so that H0 is rejected and Ha is accepted. So that it shows a significant influence between the scientific literacy abilities of students in the two classes.

INTRODUCTION

Education is basically a process to help humans develop their potential so that they are able to deal with any changes that occur. In addition, Law number 20 of 2003 concerning the National Education System states that education is a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, as well as the skills needed by him, society, nation and state. So the process carried out by educators in helping students to develop their potential in terms of their personalities

such as morals, intelligence, spiritual skills and skills needed by students in facing the dynamics of social and state life.

Based on this, education must create an effective and efficient learning process in order to produce quality students. Quality learning will produce quality students, proficient in their fields and succeed in fostering critical, logical, creative thinking skills, ability to solve problems, and adaptive to the changes and developments of the times. So thatthe quality of education is the benchmark for the progress of a nation and country. Improving the quality of education can be pursued from various things, for example increasing the form of teaching educators, the methods applied, and the media used (Relia & Sodikin, 2018). So an educator plays an important role in educating and creating a quality future generation of the nation to improve the quality of a country's education.

Technology is a form of system created by humans for a specific purpose, namely to simplify or lighten its business, increase its results, and save existing manpower and resources. So that current technological advances can help human work, especially in the field of education. Technology plays a role in the learning and teaching process as a learning medium that functions to make it easier for students to receive the subject matter delivered by educators. Along with this, Trianto strengthened his opinion that science learning is expected to prepare students to be literate in science and technology, able to think critically, logically, creatively, and be able to argue correctly. (Trianto, 2007)

Science learning aims to help students to be able to master knowledge of scientific regularities. This knowledge is obtained through a scientific process so that students have a scientific attitude that can be used to solve problems in everyday life (Ismail et al., 2016). For example in learning object motion material, students who live in riverbank areas can do meaningful learning by observing the movement of all liquid objects flowing from a high place to a lower place and the motion of these flowing objects can be used, one of which is for sports activities. rafting. Therefore science learning does not only include concepts, principles, or theories, but also scientific processes that are taught through practicum activities. (Pendahuluan, 2009)

In line with this, the Al-Qur'an calls on people to carry out experiments or practicum in order to confirm the truth that has been conveyed. This is as found in the dialogue of Prophet Ibrahim in QS. Al-Baqarah: 260 which means as follows. (*Qur'an Kemenag*, n.d.)

> And (remember) when Abraham said, "O my Lord, show me how You bring the dead to life." Allah says, "Do you not believe it yet?" He (Ibrahim) replied, "I believe, but so that my heart is calm (steady)." He (Allah) said, "Then take four birds, then chop by you then put one part on each hill, then call them, surely they will come to you immediately." Know that Allah is all-powerful, all-wise.

In this dialogue Prophet Ibrahim wanted to know the secrets of God's creation that exist in nature, not a matter of faith to know divine secrets when carrying out an action. The taste of the results of human trials is not the same as the sense of faith in the unseen. Then the Al-Qur'an hints at the need for empirical trials to find out the secrets of nature to calm hearts and strengthen beliefs(Suyudi, 2005).The intended empirical trial is a practicum activity.

Practicum which is none other than the experimental method (experiment) is a way of presenting lessons, where students conduct experiments by understanding and proving something they have learned themselves. In this learning, students are given the opportunity to experience themselves or do it themselves, follow a process, observe an object, analyze, prove and draw their own conclusions about an object, state, or process (Djamarah, 2006). Thus, students are required to experience themselves, seek the truth, or try to find a law or theory, and draw conclusions on the process they are experiencing.

Based on the results of observations and interviews at MTs Negeri 1 Jember, there are several facts that emerge, namely: during the learning process students tend to only read,

write, follow educators, without understanding the material being studied. During learning, educators have tried to link material or concepts with phenomena or issues that exist in everyday life by giving students the task of bringing plants to transportation material in plants, but when learning takes place students do not explore the plants they carry. so that it becomes a learning tool and material. This is like being one of the causes for the lack of students' scientific literacy skills when viewed based on several indicators, namely the lack of students in raising applicative questions because students tend to ask questions according to content, besides that the ability of students to identify a problem according to the concept of science is also still low, and the last indicator is the lack of students' ability to demonstrate understanding of science concepts in different situations so that it can be interpreted that the scientific literacy skills of students at MTs Negeri 1 Jember are still low.

This practicum activity is rarely carried out by educators for several reasons that there is a lack of availabilitytime to do practicum, inadequate tools and materials used, and some educators do not really understand how the laboratory works. Even though this practicum activity is important in science learning in order to make the learning process of students more meaningful in the long term. Obstacles to these practicum activities can be overcome by teaching methods that utilize media. The use of appropriate learning media can help students understand the subject matter. In the science learning process it is easier to convey when using motion audiovisual media. Audiovisual motion is a media that can display moving sound and image elements such as a virtual laboratory or virtual laboratory.

The learning process using a virtual laboratory is one of the effective methods in applying the 2013 curriculum to the science learning process for SMP / MTs and its equivalent. This is due to the tendency of students to like things related to computers, for example games that make students lazy to read text books (Wisudawati, 2014). Steps that educators can take in overcoming this problem are to carry out a multimedia-based learning process using a virtual laboratory.

Virtual laboratories have advantages, namely economical materials and practicum tools, which are practically used by students both in the learning process in class and in independent learning. In addition, virtual laboratories make it possible to improve students' interpretation skills. This interpretation ability can make it easier for students to understand a concept (Sulistia, 2014). This power of interpretation will be the capital for students to implement concepts that have been understood when facing a problem that exists contextually. In this case, scientific literacy is more directed at how science and understanding of science become a solution in making decisions for any existing problems (Abidin, 2017).

In line with this statement, virtual laboratories can support students to explore and visualize abstract concepts that describe the application of knowledge and increase students' scientific literacy (Başer & Durmuş, 2010). Like the results of research conducted by Ismail, et al., Virtual laboratories are effective in improve students' scientific literacy skills (Ismail et al., 2016). Science literacy is a person's ability to understand science, communicate science (oral and written), and apply scientific knowledge to solve problems so that they have high attitudes and sensitivity to themselves and their environment to make decisions based on scientific considerations (Toharudin, 2011).

The understanding of science learning that leads to the ordering of students' scientific literacy has not been well realized by science educators in Indonesia. As a result, the learning process is conventional and rests on the conceptual mastery of students. This can be seen from some of the results of measurements of students' science learning which are carried out internationally. The results show that the record for Indonesian students is still far below the abilities of students in other countries in the world.

The Program for International Student Assessment (PISA) is one of the international studies designed and programmed by the Organization for Economic Cooperation and Development (OECD) in the form of an international assessment that provides information about how far schools are to equip students to face real-life situations. The results of PISA research on the literacy skills of Indonesian students are still apprehensive compared to the literacy abilities of students in other countries. Indonesia's ranking as quoted by the OECD on PISA in 2009 was 57th out of 65 countries with a score of 383 points. In 2012, Indonesia was ranked 64th out of a total of 65 countries with the current acquisition of 382 points. Furthermore, in 2015 Indonesia was ranked 64th out of 72 participating countries, with a score of 403 points (Yuliati, 2017). Based on these results, the scores of Indonesian students on scientific literacy skills were still far below the international standard scores determined by the institution OECD.

The low scientific literacy skills of Indonesian students are influenced by many things, including the curriculum and education system, the choice of teaching methods and models by educators, learning facilities and facilities, learning resources, teaching materials, and so on (Kurnia et al., 2014). One of the factors that directly intersect with the learning activities of students and influence the low scientific literacy skills of Indonesian students is the existence of learning resources and the choice of strategies by educators. Science learning that has been carried out so far tends to be a conventional activity that has an impact on the low learning outcomes of students. This condition requires improvements in science learning to create more effective learning so that the process emphasizes product achievement, processes, and scientific attitudes. This is very important, because the assessment of scientific literacy according to PISA is not only on content but includes context, knowledge, and attitudes.Science literacy skills also include the ability to understand Nature of Science such as designing experiments, collecting and analyzing data, and formulating conclusions drawn based on scientific evidence (Wulandari & Wulandari, 2016). So the scientific literacy skills of students can be optimized through the application of learning based on practicum simulation activities.

Based on this educational phenomenon, researchers feel it is important to conduct research on the use of virtual laboratories which aims to provide other alternatives in conducting practicum. The material chosen is the force and motion of objects which are easy topics to relate to phenomena that occur in everyday life. Because not all science material can be applied in learning using a virtual laboratory so that the material on the force and motion of this object is one that meets the implementation criteria.

METHODS

This study uses a quantitative approach with Quasi Experimental Design research. This type of research design used is Nonequivalent Control Group Design (Arikunto, 2009).

The research design used can be seen in Table 1 as follows.

Table 1. Research Design

Subject	Pre-test	Treatment	Post-test
Experimental Class	O_1	X_1	O_2
Control Class	O_3	-	O_4

Source: Arikunto, 2009.

Explanation:
O_1 = Pre-test score of the Experiment Class
O_2 = Post-test score of the Experiment class
O_3 = Pre-test score of the Control Class
O_4 = Post-test score of the Control Class
X_1 = Virtual Laboratory-based Science Learning

This research was conducted from July 2019 to August 2019. The population used was odd semester students of class VIII MTs Negeri 1 Jember consisting of 6 classes with 239 students. The samples taken were students of class VIII B and VIII C, with a total of 32 people each. Class VIII B as the control class and class VIII C as the experimental class. Sampling in this study was carried out by purposive sampling. The considerations made in this sampling were based on the grade VII grade even semester report cards which in this value indicated that class VIII B and class VIII C were considered to represent the ability of the population.

Some of the data collection techniques used were test and non-test. The use of tests is carried out by giving a pretest and posttest in the form of a description in accordance with the indicators of scientific literacy on the material of force and motion of objects. It aims to obtain data on students' scientific literacy abilities before and after the learning process. While non-test techniques are carried out by observation, interview, and documentation techniques in the learning process in the control class and in the experimental class using applied science learning instruments based on virtual laboratory.

The instrument used in this study has been analyzed and is suitable for measuring the domain indicators of scientific literacy competence in straight motion material in junior high schools, however the researcher feels the need to provide some improvements that are tailored to the character of the students in this study. So that the instrument was re-validated by a validator consisting of expert lecturers and teachers of science.

Before the test is given to students, it must be analyzed the items in the form of validity, reliability, difficulty level and differentiation power. Validity includes content validity, construct, and empirical validity. Content validity was pursued through consultation with expert lecturers and science subject teachers at MTs Negeri 1 Jember accompanied by revisions. The instrument for measuring the validity of this construct is in the form of items that can be used to measure the scientific literacy of students. In addition, treatment instruments in the form of RPP and LKPD were also validated. This validation was carried out by expert lecturers and science subject teachers. Meanwhile, the empirical validity of the items was analyzed using Bivariate Correlation in SPSS Version 25 using the Pearson correlation coefficient with the Two-tailed Test of Significance. The correlation between the respondent's answer variable on each item and the total score obtained by each respondent produces r-count values. This value will be compared with the value on the table. In this study the r-table was 0.464 because the sample size was 24 people. If the value of r count is greater than r table then the items are declared valid, whereas if r count is less than r table then the items are declared invalid and unfit for use.

The calculation of the reliability of scientific literacy questions was carried out using the Reliability Analysis in SPSS Version 25 with the Alpha model. The resulting Alpha value is then compared with the r table as in the previous validity test. If the Alpha value is greater than the r-table value, the item is declared reliable and if the Alpha value is smaller than the r-table value, the item is declared unreliable.

The level of difficulty in the description of the items taken by calculating the average score for an item can be calculated using the formula (1):

$$Average = \frac{Total\ score - scores\ of\ students\ on\ the\ items}{Total\ students\ who\ took\ the\ test}$$

(1)

Then calculate the level of difficulty with the formula (2):

$$Level\ of\ Difficulty = \frac{Average}{The\ maximum\ score\ of\ the\ item}$$

(2)

The criteria for the difficulty level of the items obtained from the above calculations are presented in Table 2 as follows.

Table 2. Criteria for the Level of Problem Item Difficulty

Degree of Difficulty Range	Criteria
0,00 – 0,30	Difficult
0,31 – 0,70	Medium
0,71 – 1,00	Easy

Source: Arikunto, 2016

The formula for determining the discrimination index or difference in strength is in equation (3) below.

$$D = \frac{B_A}{J_A} - \frac{B_B}{J_B} = P_A - P_B$$

(3)

Explanation :

J : total test takers
J_A : total participants in the upper group
J_B : total participants in the lower group
B_A : total in the upper group who answered the question correctly
B_B : total in the lower group who answered the question correctly
P_A : the proportion of participants in the upper group who answered correctly
P_B : the proportion of participants in the lower group who answered correctly

To determine the level of difficulty using SPSS Version 25 is to compare the r-count value at the SPSS output with the distinguishing power criteria shown in Table 3 as follows.

Table 3. Distinguishing Power Criteria

Discrimination Index	Criteria
0,00 – 0,20	Bad
0,21 – 0,40	Enough
0,41 – 0,70	Good
0,71 – 1,00	Very well

Source: Arikunto, 2016

Data analysis of science literacy students of the experimental class and control class was carried out after the data was collected through the instruments given to the sample. The pretest and posttest values were then analyzed using a statistical test in the form of the Z test with the help of SPSS Version 25, which previously carried out prerequisite tests in the form of normality tests and homogeneity tests. The test uses SPSS Version 25.

The data normality test in this study was carried out by Kolmogorov Smirnov, who then made the decision, namely if the significance value was greater than 0.05, the data was normally distributed. The opposite applies, if the significance value is smaller than 0.05, the data is not normally distributed.

The decision making in the homogeneity test is if the significance is greater than 0.05, the data being tested has the same or homogeneous variants, whereas if the significance value is less than 0.05, the data tested does not come from the same variant or is not homogeneous.

The Z test is an inferential statistical technique that has a mission to make general conclusions (generalizations) with statistical hypotheses which include:

Ha: There is a difference in the average posttest results of students' scientific literacy skills in class VIII between the experimental class that applies virtual laboratory-based learning and the control class that applies conventional learning to the material of force and motion of objects at MTs Negeri 1 Jember.

H_0: There is no difference in the average posttest results of students' science literacy abilities in class VIII between the experimental class that applies virtual laboratory-based learning and the control class that applies conventional learning to the material of force and motion of objects at MTs Negeri 1 Jember.

The decision making from the output of SPSS Version 25 is that if the significance value is smaller than 0.05 then H_0 is rejected and Ha is accepted, which means that there is an effect of the application of virtual laboratories on the scientific literacy abilities of class VIII students on material force and motion of objects at MTs Negeri 1 Jember vice versa, if the significance value is greater than 0.05, then H_0 is accepted and Ha is rejected, which means that there is no effect of the application of virtual laboratory on the scientific literacy abilities of class VIII students on the material force and motion of objects at MTs Negeri 1 Jember.

RESULTS AND DISCUSSION

The following are the results of the validity test recapitulation presented in table 4.

Table 4. Recapitulation of Validity Test Results

Category	Question Number	Total Question
Valid	1, 2, 4, 5, 6, 9, 10	7
Invalid	3, 7, 8	3
Total		10

Based on the results of the validity test recapitulation, there are 7 questions that meet the criteria and can be said to be valid, and there are 3 questions that do not meet the criteria and are said to be invalid. The results of the validity test carried out with the help of SPSS Version 25 can be obtained directly from the correlation coefficient for each item. After knowing the correlation coefficient (r_{xy}), the next step is to consult with the r value of the Product Moment table at the significance level $\alpha = 0.05$ with n-2 degrees of freedom.

Based on the results of the analysis using the SPSS Version 25 program, it can be presented in table 5 below.

Table 5. Results of Question Item Validity Test

Question Number	Validity Test Results	Explanation
1	0,606	Valid
2	0,482	Valid
3	0,225	Invalid
4	0,682	Valid
5	0,544	Valid
6	0,589	Valid
7	0,308	Invalid
8	0,043	Invalid
9	0,745	Valid
10	0,782	Valid

Based on the results of SPSS Version 25 in the table 5 it can be said that although it does not make sense (r_{xy}) is different, it is still bigger when compared to rtabel. The problem of most of the items on the scientific literacy ability test of students is valid. So the researcher

used the valid test results to be tested in the control class and the experimental class with 5 questions for the pretest and 5 questions for the posttest from 7 questions. Of the 10 items that were tested for reliability using SPSS Version 25, the calculation result of the reliability test was 0.691. This means that the questions are made reliable and feasible to use.

The recapitulation results of the difficulty level test and the results of the successive level test can be seen in table 6 and table 7 below.

Table 6. Recapitulation of Level of Difficulty Test

Criteria	Question Number	Total Test
Very difficult	-	-
Difficult	7	1
Medium	2, 3, 4, 8, 9, 10	6
Easy	1, 5, 6	3
Very easy	-	-
Total		10

Table 7. The results of the successive level test

Question Number	Result	Criteria
1	0,71	Easy
2	0,53	Medium
3	0,45	Medium
4	0,53	Medium
5	0,74	Easy
6	0,87	Easy
7	0,28	Difficult
8	0,36	Medium
9	0,70	Medium
10	0,69	Medium

The recapitulation of the distinguishing power of the items used in this study is presented in table 8 below.

Table 8. Recapitulation of Distinguishing Power Test

Criteria	Question Number	Total Test
Bad	-	-
Enough	3, 7, 8	3
Good	1, 2, 4, 5, 6	5
Very well	9, 10	2
Total		10

Based on the results of the analysis of the above items, 7 questions were found that were suitable for use as instruments to measure students' scientific literacy skills from the 10 questions that had been provided and tested.

Descriptive analysis of the students' scientific literacy ability data that has been obtained includes the minimum value, maximum value, average value, median and standard deviation of the data can be seen in table 9 below.

Table 9. Descriptive Analysis of Science Literacy Ability

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest Experiment Class	32	0	31	19,63	9,189
Posttest Experiment Class	32	37	77	59,19	12,825
Control Class Pretest	32	4	50	17,28	12,804
Posttest Control Class	32	23	62	48,66	11,746
Valid N (listwise)	32				

The results of the experimental class pretest calculations using IBM SPSS version 25 have a total sample of 32; lowest value 0; highest score 31; average value 19.63; and the

standard deviation value is 9,189. While the results of posttest calculations using IBM SPSS version 25 in the experimental class have a total sample of 32; lowest score of 37; highest score of 77; the average value is 59.19; and the standard deviation value is 12,825.

Control Class Science Literacy Ability Data

The results of the control class pretest calculation using IBM SPSS version 25 have a total sample of 32; lowest value 4; highest score of 50; average value 17.28; and the standard deviation value is 12.804. While the results of posttest calculations using IBM SPSS version 25 in the experimental class have a total sample of 32; the lowest score is 23; the highest score is 62; the average value is 48.66; and the standard deviation value is 11,746.

The first step before processing data, first carried out the analysis requirements test in the form of normality and homogeneity tests.The normality test was carried out using the Kolmogorov-Smirnov test using IBM SPSS version 25. The test criterion is that if the significance value is greater than 0.05, the data is normally distributed. The opposite is true, if the significance value is smaller than 0.05, the data is not normally distributed. The following are the results of the pretest and posttest data normality test for the control class and experimental class in table 10.

Table 10. Results of the Pretest and Posttest Data Normality Test for the Control Class and the Experiment Class

	Class	Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
Science Literacy Skills	Pretest Experiment Class	,143	32	,093
	Posttest Experiment Class	,129	32	,191
	Control Class Pretest	,150	32	,066
	Posttest Control Class	,144	32	,089

a. Lilliefors Significance Correction

Table 10 on the pretest results for the experimental class has a significance value of 0.093; the posttest result of the experimental class was 0.191; the pretest result for the control class was 0.066; and the posttest value of the control class is 0.089. The results of the pretest and posttest of the experimental class and control class showed a significance value of more than 0.05, so it can be said that the data on the scientific literacy abilities of students in both classes were normally distributed.

The homogeneity test was carried out to determine the difference in the scores of students in the control class and the experimental class. Homogeneity test was tested with IBM SPSS version 25. Where the basis for the decision is if the significance value <0.05; it is said that the variance of two or more data population groups is not the same (not homogeneous) and if the significance value is> 0.05; it is said that the variance of two or more data population groups is the same (homogeneous). The following is the result of the calculation of the pretest and posttest homogeneity test in table 11.

Table 11. Data on Homogeneity Test Results for Pretest and Posttest

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Pretest	Based on Mean	1,918	1	62	,171
	Based on Median	1,630	1	62	,206
	Based on Median and with adjusted df	1,630	1	49,959	,208
	Based on trimmed mean	1,752	1	62	,190
Posttest	Based on Mean	,507	1	62	,479
	Based on Median	,414	1	62	,522
	Based on Median and with adjusted df	,414	1	61,996	,522
	Based on trimmed mean	,545	1	62	,463

The table of the results of the calculation of the homogeneity test based on the pretest data mean is 0.171 and the posttest is 0.479, which means that the value is greater than 0.05, so it can be concluded that the data in this study are homogeneous.

Hypothesis Testing (Z Test)

After the analysis requirements were carried out, it was known that the data obtained met the requirements, namely the control class and experimental class data were normally distributed, then the two classes were categorized as homogeneous. The next step is testing the hypothesis using the independent sample t test on SPSS Version 25. Where the basis for the decision is H_0 is accepted if the significance value is greater than 0.05 and H_0 is rejected if the significance value is less than 0.05. The results of the calculation of the hypothesis test can be seen in table 12 below.

Table 12. Results of Pretest and Posttest Hypothesis Test

Variabel	Average	F_{count}	T_{count}	Sig (2-tailed)	Explanation
Pretest Experiment	19,63		0,84		There is no difference in average
Pretest Control	17,28	1,918	1	0,403	
Posttest Experiment	59,19		3,42		There is a difference in average
Posttest Control	48,66	0,507	6	0,001	

Based on the table, it is known that the pretest (2-tailed) significance value is 0.403> 0.05 so that H_0 is accepted and Ha is rejected, meaning that there is no average difference between the scientific literacy abilities of students in the experimental class and the control class. Whereas the posttest value has a significance value of 0.001 <0.05 so that H_0 is rejected and Ha is accepted, meaning that there is an average difference between the scientific literacy abilities of experimental class students who are given the application of virtual laboratory and the control class that applies conventional learning.

The results of the content and construct validation show that the learning tools used have been validated, as evidenced by the average validation results from expert lecturers, namely 0.88 for the lesson plan instrument; 0.87 for LKPD instruments; and 0.81 for instrument items. The three results were categorized as valid without revision. While the validation of science subject educators has a value of 0.79 for the RPP instrument; 0.77 for LKPD instruments; and 0.76 for instrument items. The three results are categorized as valid without revision.

In addition to the content / construct validation results for the learning tools, this study also conducted empirical validation on a number of class IX respondents who had received material motion objects. The respondents were 24 students of class IX A, all of whom were asked to work on 10 essay questions in 40 minutes. After the respondent's answer is given an assessment, it can be categorized as valid and invalid questions. There are 7 valid questions and 3 invalid questions.

The next step is to measure the reliability of the 10 items, and test the reliability using SPSS Version 25. The next item analysis is the difficulty level of the items that are calculated manually with the help of Microsoft Excel 2007. Of the 10 questions tested, there are 1 difficult questions, 6 medium questions, and 3 easy questions. A good question is a question that has a moderate level of difficulty. Meanwhile, the distinguishing power of this item categorizes 3 questions as sufficient, 5 questions as good, and 2 questions as good enough. Distinguishing power is analyzed to distinguish the abilities of smart students and those with less abilities. This level of difficulty and distinguishing power has a correlation or relationship, where the item with the maximum difficulty level will have low distinguishing power, likewise if the item is too easy it will also not have distinguishing power. So that from the various stages of the item analysis, there were 7 items that were feasible to use including

numbers 1, 2, 4, 5, 6, 9, 10 where these questions would be used as a pretest with 5 random questions and 5 questions for the posttest.

Based on the results of research conducted in the experimental class and control class, it shows that there is no difference in the pretest mean score. It is known that the independent sample t-test results in the Sig. 2 tailed 0.403 is greater than 0.05 so that H0 is accepted and Ha is rejected, meaning that each class has the same initial scientific literacy ability.

The results of the posttest data show that there is a difference in the average between the control class and the experimental class after being given learning treatment using a virtual laboratory in the experimental class. Based on posttest data, the experimental class using virtual laboratory has a higher average value than the control class that uses conventional learning. Based on the results of the independent sample t-test with the Sig. 2 tailed 0.001 is smaller than 0.05 so that H0 is rejected and Ha is accepted. Thus there are differences in students 'scientific literacy abilities after learning is applied using a virtual laboratory with students' scientific literacy abilities who do not use virtual laboratories (conventional).

Based on the results of hypothesis testing, the application of a virtual laboratory in the experimental class can have an effect on students' scientific literacy skills as seen from the increase in the pretest to posttest scores. The virtual laboratory facilitates the achievement of students' scientific literacy indicators, including in the second simulation about straight motion changing regularly shown in Figure 1 shows a scientific phenomenon which is the first competency indicator of scientific literacy. From Figure 1, students explain scientific phenomena that can be contextual examples that when someone walks or something is moving, it cannot be separated from the topic of the speed and acceleration of the person or object's motion. By looking at the phenomena in the simulation, students can easily understand and apply the concept of motion of objects which can then become students who are scientific literate / scientific literate.
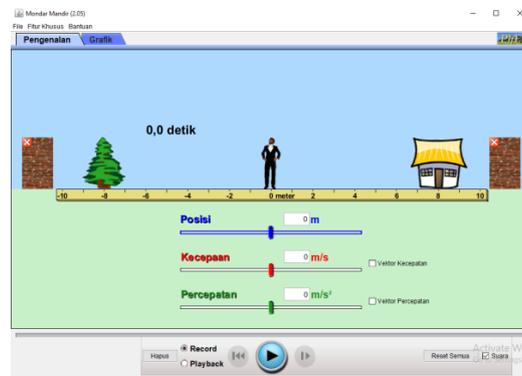
Figure 1. Simulated Regular Changed Motion

A virtual laboratory that simulates the resultant force can facilitate the achievement of the second scientific literacy competency indicator, namely evaluating and designing scientific research. This simulation is shown in Figure 2 which shows a cart connected by ropes on both sides. Students can assess and propose several ways that can be solutions to scientific questions, in other words this simulation can support the ability of students to evaluate and design a study.

Figure 2. Simulated Regular Changed Motion

The next competency indicator is supported by the application of a virtual laboratory, namely interpreting data and scientific evidence, shown by a simulation of Newton's Second Law in Figure 3.The simulation displays objects / boxes that can be manipulated by their mass, then a robot pushes the box and students can analyze and interpret the acceleration data that occurs from the robot's push.
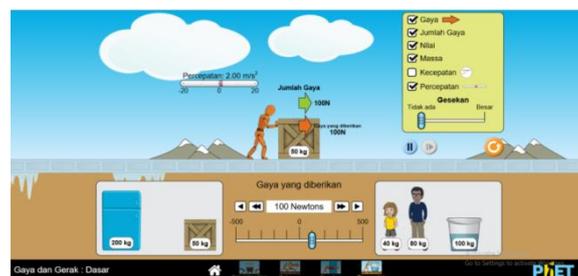
Figure 3. Simulation of Newton's Second Law

The success of virtual laboratories in improving students' scientific literacy skills can also be explained from the perspective of educational psychology that the construction of a theory takes place in two ways, namely deductive and inductive. Deductive is the construction of theory by making a theory that looks logical on an a priori basis, then the truth is tested by experimenting. Meanwhile, inductive is a theory construction by generalizing the results of experiments or small existing theories into a broader / larger theory. When examined in a virtual laboratory-based science learning, the two constructions of knowledge are in harmony. At the beginning of learning students are faced with the phenomena of everyday life, then required to make logical statements, then students design and conduct experiments to prove the hypotheses they have made. The experiment is simulated in a virtual laboratory. After conducting experiments students can justify and or corroborate their knowledge. Therefore science education develops the ability of students to use scientific knowledge and understanding, such as the ability to seek, interpret, and treat evidence. So that the cognitive realm of students is also related to this aspect of literacy because cognitive abilities emphasize students in understanding subject matter in the form of facts, concepts, principles, and procedures. So, it can be said that science learning based on virtual laboratory trains students to construct their knowledge in two ways of construction in one lesson, so it is natural that there is an increase in students' scientific literacy skills.

Regarding the results obtained, virtual laboratory-based learning can improve scientific literacy skills. Mechanical engineering students on basic physics concepts of material measurement (Jannati et al., 2018). Then there was an influence in the application of a virtual laboratory on the biology learning outcomes of students (Sulistia, 2014). Both studies are in line with the results of this study.

CONCLUSION

The conclusion obtained from hypothesis testing shows that the posttest average score in the experimental class that applies virtual laboratory-based learning is different (higher) from the posttest average score in conventional classes. These results indicate that there is an influence in the application of the virtual laboratory on the scientific literacy abilities of class VIII students on the material of force and motion of objects.

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