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Article

Implementation of Basic Physics Practicum Guide I Based On Science Process Skills by Using Cooperative Model Group Investigation Type

Darmaji DARMAJI[1] **Astalini ASTALINI**[2]

Dwi Agus KURNIAWAN[3] **Ayu LESTARI**[4]

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Author 1
Universitas Jambi, INDONESIA
E-mail: darmaji@unja.ac.id

Author 2
Universitas Jambi, INDONESIA
E-mail: astalinizakir@unja.ac.id

Author 3
Universitas Jambi, INDONESIA
E-mail: dwiagus.k@unja.ac.id

Author 3
Universitas Jambi, INDONESIA
E-mail:
ayu.lestari.al52@gmail.com

Abstract

This study aims to determine the differences in science process skills in each class in the Jambi University Physics Education Study Program in 2018 and to see the differences in the science process skills between the experimental classes using Basic Physics practicum I Skills-based science processes use models of Cooperative Learning type Group Investigation with control classes that use conventional guidebooks. This research is an experimental study with themethod quasy-experiment, with the Static-Group Comparison design. The student samples studied were 1088 students of physics education in 2018. Data collected from the results of observations using the observation observation process science skills and reinforced using temporary reports of lab work. Data obtained were analyzed using inferential statistics. The results showed that there were significant differences between the experimental classes using the Basic Physics I practical guidebook based on science process skills using the Cooperative Learning model in the type of Group Investigation with the control class using conventional guidebooks when conducting measurement activities using Calipers, Micrometers screw, and Spherometer. With the experimental class, they have better science process skills than the control class. Some of the obstacles encountered during practicum certainly hinder the science process skills of Jambi University Physics Education students. This finding has provided information on differences in science process skills possessed by students in the experimental class after using a science process skill-based guide with a control class that still uses conventional practicum guides.

Keywords: Higher Education, Science Process Skills, Basic Physics I, Practical Guides, and Group Investigation

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INTRODUCTION

Skills are important things that must be owned by everyone, especially for a physics teacher candidate. One of those skills is science process skills. The process, it takes some field of science called science process skills (SPS) (Azizah, 2018). (Karamustafaoğlu, 2011). Teachers who have science process skills will be able to teach based on the concepts obtained. In addition to applying understanding of the concepts that have been obtained, process skills can also provide ability to solve problems. Science process skills are needed to generate, use scientific information, conduct scientific research, and solve problems (Aktamis and Ergin, 2008).

There are two categories in science process skills, namely basic process skills and integrated skills. SPS can be divided into two groups as "Basic" and "Integrated" (Necati, 2013). "Basic process skills include observing, inferring, measuring, communicating, classifying, predicting, using time space relations and using numbers" (Gokul and Nirmala, 2014). Basic science process skills are basic skills in conducting scientific investigations. Science process skills are the basis of scientific inquiry, such as the ability to classify and describe objects or events (Karamustafaoğlu, 2011). Students will be helped to build new information by means of scientific inquiry through this skill. If a student has mastered basic science process skills, then students will easily master the integration of science process skills for further scientific inquiry. The basic skills considered as prerequisite to learning the integrated skills (Hafez and Rashed. 2015).

Science process skills are a continuation if someone has mastered basic process skills, namely integrated process skills. This skill is essentially the skills needed to conduct research. The Integrated Science Skills Process (ISPS) is the terminal skills for solving problems or doing science experiments (Karamustafaoğlu, 2011). Without mastering integrated science process skills, students will have difficulty in conducting research to solve a problem. Rillero (1998) states that individuals cannot use the science process skills so that individuals will have difficulty succeeding in their daily life. Students who cannot define variables, the student will be confused in carrying out the research steps and creating a data table. Controlling variables, defining operational, formulating hypotheses, formulating models, interpreting data and experimenting are integrated process skills (Gokul and Nirmala, 2014). Aside from not being able to do research, students who do not have science process skills also cannot teach students with science process skills based learning. In fact, integration KPS starts to be taught to students after students master the basic KPS. The integrated process skills can be acquired in secondary (5th through 8th grade) (Aydogdu, 2015).

The teacher is a very important aspect in the success of education. The teacher is a vital and fundamental component in the education process, which emphasizes the process of mental maturation, mindset and formation of student characters to realize the whole person (Wiwin, 2018). Therefore, prospective physics teacher students are required to master skill skills after they graduate especially in science process skills. “SPS teachers must have and understand cognitive ...” (Mutisya, et al. 2013). If a physics teacher who does not have a KPS will have an influence on the learning process which can be said is still relatively simple. When teachers teach in traditional ways, the teacher will find it difficult to develop integrated student skills. “Traditional methods cannot develop the integrated science process skills” (Zeidan, 2015). In addition, it will have an impact on the learning activities of students who are tend to be passively and cannot construct their knowledge independently. The science of teaching approach skills has tendency in constructivism and learner-centeredness (Abdullah, 2013). Thus, a physics teacher must have these science process skills in order to minimize the impacts that will occur later.

Physics teachers who teach without using KPS can have long-term effects on students. If a teacher has a good KPS, it will have an impact on the better science process skills possessed by students. Because a student does not acquire the skills of the science process, the student cannot understand the necessary connections (Harlen, 1999). A science teacher should understand the importance of attitude toward science because it is a predictor of student achievement in science activities (Karsli, 2012). Research shows if teachers who have KPS will be able to develop and teach these skills more actively in the classroom (Downing & Gifford, 1996). So, a teacher who does not have science process skills then when the learning process in the class will tend to be passive and monotonous in using learning methods and models in the classroom, as a result students will tend to be passive and learning objectives not delivered properly. This study aims to determine the differences in science process skills of Physics Education students after using the Basic Physics practicum I guide based on science process skills by using amodel *cooperative learning* type *group investigation* on the measurement material using a caliper, screw micrometer and spherometer.

The findings of this study are expected to contribute to the application of science process skills to students at Jambi University so that they can produce graduates who have strength and have good competence. In addition, the results of this study are also expected to contribute to the learning process in higher education institutions both in Indonesia and other countries.

METHODOLOGY

Research Design

This research is a type of quantitative research, with a Quasi-experimental model. *Quasi-experimental designs involve independent variable manipulation of an but the subject are not randomly assigned to the treatment group* (Ary, 2010). The quasi-experimental model used is *Static-Group Comparison.*

Sample

Research This study took samples from Jambi University Physics Education students in 2018 with a total sample of 108 students. The sample used was students of Jambi University Physics Education who were contracting Basic Physics I. In this study we used a total sampling technique to obtain quantitative data by observation.

Instruments and Procedures

The Science Process Skills Observation Sheet (KPS) is used to measure student science process skills. The*kill domain of Science Process Skills (SPS) can measure by using observation sheet of SPS activity* (Azizah, et al., 2018). On the KPS observation sheet, the rating scale used is using the linkert scale 4. The skills of the process under study are basic process skills and integrated process skills. There are three activities in the measurement that will be examined, namely the measurement using a caliper, micrometer screw and spherometer. The experimental class will be given treatment in the form of practicing activities using the Basic Physics Guidebook I based on science process skills using cooperative learning learning model group investigation type, while the control class is given treatment in the form of practicing using a conventional guidebook.

Data Analysis

Analysis of the data in this study uses inferential statistics. Inferential statistics are used to determine whether or not there are differences in science process skills from the experimental class and the control class studied. The statistical test used is Independent Sample t Test. In analyzing the data, *Statistical Package for the Social Science was used (SPSS).*

RESULTS

The data obtained are then analyzed by the basic assumption test before continuing to inferential statistics. Test the basic assumptions carried out, namely the normality test and homogeneity test. Data on the results of the normality test and homogeneity test are shown in the table below:

Table 1. Results of Analysis of the Test for Normality of Skills in Experimental Classes and Control Classes in Measurement Activities Using Calipers of

	Kolmogorov-Smirnov		
Kelas	Statistic	df	Sig.
Eksperimen	,105	54	,200*
Kontrol	,114	54	,075

Table 1. Shows if the experimental class and control class data on the measurement activities use the calipers term Sig. greater than 0.05. Data requirements can be said to be normal, that is, if the Sig. > 0.05 then the data is normally distributed and if the value of Sig. <0.05, the data is not normally distributed. Because the value of Sig. the experimental class is 0.200 and the control class is 0.075, meaning value Sig. Of the two classes> 0.05, the data has been normally distributed.

Table 2. Results of Analysis of the Normality Test of Process Skills in Experimental Classes and Control Classes in Measuring Activities Using a Micrometer Screw

	Kolmogorov-Smirnov		
Kelas	Statistic	df	Sig.
Eksperimen	,106	54	,198
Kontrol	,093	54	,200*

In Table 2. Shows experimental class and control class data on measurement activities using a screw micrometer. Data requirements can be said to be normal, that is, if the Sig. > 0.05 then the data is normally distributed and if the value of Sig. <0.05, the data is not normally distributed. Because the value of Sig. the experimental class is 0.198 and the control class is 0.200, meaning the Sig. Of the two classes> 0.05, the data has been normally distributed.

Table 3. Results of Analysis of the Normality Test of Process Skills in Experimental Classes and Control Classes in Measuring Activities Using a Micrometer Screw

Kolmogorov-Smirnov			
Kelas	Statistic	df	Sig.
Eksperimen	,063	54	,200*
Kontrol	,081	54	,200*

In Table 3. Shows experimental class and control class data on measurement activities using a screw micrometer. Data requirements can be said to be normal, that is, if the Sig. > 0.05 then the data is normally distributed and if the value of Sig. <0.05, the data is not normally distributed. Because the value of Sig. the experimental class is 0.200 and the control class is 0.200, meaning the Sig. Of the two classes> 0.05, the data has been normally distributed. After the data are tested for normality, the data can then be analyzed using inferential statistics using the Independent Sample t Test. The homogeneity test can be seen from the output on the Independent Sample t Test. The following is the data analysis to see the differences in science rposes skills of students in the experimental class and control class, as shown in Table 4. Up to Table 10.

Table 4. Results of Independent Sample t Test (Group Statistic) Science Process Skills Experimental Class and Control Class on Activities Measurements Using the Sorong Term

Group Statistic					
Kelas	Mean	Std. Deviation	Q1	Q2	Q3
Eksperimen	3,2983	,29395	3,0725	3,3300	3,5650
Kontrol	2,5578	,20382	2,4350	2,5750	2,6800

Table 5. Independent Sample Analysis Results t Test of Science Process Skills Experiment and Class Classes Controls in Measurement Activities Using

Independent Sample Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	10,698	,001	15,214	106	,000	,74056	,04868	,64405	,83706
Equal variances not assumed			15,214	94,394	,000	,74056	,04868	,64391	,83720

The results of the data obtained on measurement activities use the sorong term if seen from the comparison value between t_{count} and t_{table}. First, see Table 5. in the Sig. the value obtained is equal to 0.001, because 0.001 <0.05, it can be concluded that the two variances are not the same. Because the two variances are not the same, the t test that will be seen as the output is on the *Equal variance not assumed line* (assumed that the two variances are not the same). In Table 5. The amount of t_{count} is 15,214. For the two-tailed test, the Sig. (2-tailed) in the column *Equal variance not assumed* obtained that is equal to 0,000 at a significance level of 95%. Because the value is 0,000 < 0,05. then Ho is rejected. That is, through the Independent Sample t Test difference test, it is evident if there are differences in science process skills in each class in the Jambi University Physics Education Study Program after using science process skill-based guidebooks using *Cooperative Learning* type *Group Investigation* with those that still use conventional guidebooks on measurement activities using calipers, Table 4. shows the experimental class (*mean* = 3.2893; Std. Deviation = 0.29395; Q1 = 3.0725; Q2 = 3.3300; and Q3 = 3.5650) has process skills higher science than the control class (mean = 2.5578; Std. Deviation = 0.20382; Q1 = 2.4350; Q2 = 2, 5750; and Q3 = 2.6800). In Table 4.6 the differences in science process skills in the experimental class and control class ranged from 0.64931 to 0.83720, with differences in the average of 0.74056.

Table 6. Results of the Analysis of Independent Sample t Test (Group Statistics) Science Process Skills Experimental Class and Control Class in Measuring Activities Using the Micrometer Screw

Group Statistic					
Kelas	Mean	Std. Deviation	Q1	Q2	Q3
Eksperimen	3,2552	,26735	3,0275	3,3050	3,4500
Kontrol	2,5622	,28174	2,3300	2,5600	2,7800

Table 7. Independent Sample Analysis Results t Test of Science Process Skills Experiment and Class Classes Controls on Measurement Activities UsingScrew Micrometers

Independent Sample Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	,132	,717	13,111	106	,000	,69296	,05286	,58817	,79775
Equal variances not assumed			13,111	105,710	,000	,69296	,05286	,58817	,79776

The measurements using a micrometer screw hypothesis conclusion can be seen from the comparison value between t_{count} and t_{table}. Seen in Table 7. section Sig. the value obtained is equal to 0.717, because 0.717> 0.05, it can be concluded that the two variances are the same, with this result the output of the t test is seen, namely on theline *Equal variance assumed* (assumed both variances are the same). To find a distribution table t, it can be searched at α = 5%: 2 = 2.5% (0.025) because the two-sided t test is done with the degree of freedom (df) is 106. The results obtained for t_{table} are 1.98260 and t_{counts} as 13.111 at the 5% significance level. Because the value of $t_{count} > t_{table}$ then Ho is rejected.

In addition to referring to the value of t_{count} and t_{table}, it can also be seen from the value of Sig. (2-tailed) on the line *Equal variance assumed*. Sig value. (2-tailed) in the column *Equal variance assumed* which is equal to 0,000. Significance value 0,000 <0,05, then Ho is rejected. That is, through the Independent Sample t Test difference test, it is evident if there are differences in science process skills in each class in the Jambi University Physics Education Study Program after using science process skill-based guidebooks using *Cooperative Learning* type *Group Investigation* with those that still use conventional guidebooks on measurement activities using a micrometer screw, Table 6. experimental class (*mean* = 3.26735; Std. Deviation = 0.26735; Q1 = 3.0275; Q2 = 3.3050; and Q3 = 3.4500) having science process skills that higher than the control class (mean = 2.5622; Std. Deviation = 0.26735; Q1 = 2.3300; Q2 = 2.5600; and Q3 = 2.7800). In Table 7. the differences in science process skills in the experimental class and control class ranged from 0.5887 to 0.79775, with differences in the average of 0.69295.

Table 8. Results of the Analysis of Independent Sample t Test (Group Statistics) Science Process Skills Experimental Class and Control Class in Measuring Activities Using the Spherometer

Group Statistic					
Kelas	Mean	Std. Deviation	Q1	Q2	Q3
Eksperimen	3,4209	,34467	3,1700	3,4450	3,6850
Kontrol	2,3728	,34453	2,0950	2,4250	2,6275

Table 9. Independent Sample Analysis Results t Test of Science Process Skills Experiment and Class Classes Controls in Measuring Activities Using the Spherometer

Independent Sample Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	,146	,703	15,805	106	,000	1,04815	,06632	,91667	1,17963
Equal variances not assumed			15,805	106,000	,000	1,04815	,06632	,91667	1,17963

The third activity is the measurement using a spherometer, the conclusion of the hypothesis is the same as the previous activity by looking at the value of the comparison between t_{count} and t_{table}. First, see in Table 9. Section Sig. the value obtained is equal to 0.703, because 0.703> 0.05, it can be concluded that the two variances are the same. if the two variances are the same, then the results of the t test output are the reference for decision making, namely on the line *Equal variance assumed* (assumed the two variances are the same). To find the distribution table t sought at α = 5%: 2 = 2.5% (0.025) because the test carried out is a two-sided test with degrees of freedom (df) is 106. Obtained results for t_{table} that is 1.98260 and t_{count} of 15.805 at the 5% significance level. Because the value of $t_{count} > t_{table}$ then Ho is rejected. In addition to referring to the value of t_{count} and t_{table}, it can also be seen from the value of Sig. (2-tailed) on the line *Equal variance assumed*.

Sig value. (2-tailed) on the line *Equal variance assumed* which is equal to 0,000. Because the significance value is 0,000 <0,05, then Ho is rejected. That is, through the difference *Independent Sample t Test*, it is evident if there are differences in science process skills in each class in the Jambi University Physics Education Study Program after using science process skill-based guidebooks using *Cooperative Learning* type *Group Investigation* with those that still use conventional guidebooks on measurement activities using a spherometer, in Table 8. the experimental class (*mean* = 3,4209; Std. Deviation = 0,34467; Q1 = 3,1700; Q2 = 3,4450; and Q3 = 3,6850) have science process skills that higher than the control class (mean = 2.33728; Std. Deviation = 0.34453; Q1 = 2.095; Q2 = 2.4250; and Q3 = 2.6275). Table 9. Differences in science process skills in the experimental class and control class ranged from 0.91667 to 1.17963, with differences in the average of 1.04815.

The indicators of science process skills studied included 16 indicators of science process skills. Indicators are most dominated by the students in the experimental class in all three of these activities are described in the following table:

Table 10. Process Skills Mastery Science Experiment Class

Activity	Indicators	Category	Percentage (%)
Calipers	Analyzing Investigations	Very Not Good	0.00
		Not Good	11.11
		good	14.81
		Very good	74.07
Micrometer Screw	Analyzing Investigations	Very Not Good	0.00
		Not Good	3.70
		good	42.59
		Very good	53.70
Spherometer	Designing Investigations	Very Not Good	0,00
		Not Good	0,00
		good	18 52
		Very good	81.48

DISCUSSION

The purpose of this study was to determine the differences in science process skills between experimental classes using practical process skills-based practicum guides using cooperative learning models of control groups using conventional guidebooks on Basic Physics practice I measurement material. Science process skills are skills that shape basic science knowledge. *Science process skills form the basis of science* (Aydogdu et al, 2012). Physics as part of science requires students from physics teachers to possess and master science process skills. When students have science process skills, students will be able to build knowledge and solve an experimental problem. *Participatory experimental skills in students' skills make students in science laboratories* (Karamustafaoğlu, 2011). KPS can also help students to be more literate in science and improve their scientific literacy.

Indicators of science process skills that are most inclined to be mastered by students in the experimental class in measuring activities using calipers and screw micrometers are indicators of analyzing investigations as shown in Table 10. For measurement activities using a sliding period the mastery of science process skills possessed by the experimental class is equal to 74.07% in the very good category. In the measurement activities using a screw micrometer percentage of mastery of science process skills which is equal to 53.70% in the excellent category. This is supported by observation sheet data and strengthened by documentation during practical activities. In the indicator analyzing the investigation, students are required to be able to determine what will be done on the variables in the experiment, and can know the effects of the influence given to the experimental variable. According to Rezba (1995) states that, before being able to conduct an investigation, students should be able to find out the variables in the experiment, and what the hypothesis is in the experiment. By mastering investigative analyzing indicators, students are expected to carry out experiments during the experiment in accordance with the objectives of the practical activities.

Practical activities carried out are measurements using a spherometer. In this activity, indicators that are more inclined to be mastered by students in the experimental class are indicators of designing investigations with a percentage of 81.48% in very good categories. This is supported by the observation sheet data and strengthened by documentation during practical activities. Indicators of designing investigations, according to Rezba (1995) state that, on this indicator it helps in proving experimental hypotheses. The design of the investigation does not need to be too complicated, the simpler the design, the more likely it is that students will be able to collect the required data. In this indicator, students are required to determine the tools and materials to be used in the lab, determine the steps to be taken, and take tools and the material needed for measuring activities using a spherometer.

The difference in treatment given between class experiments using basic physics lab guides I based science process skills using a model of *cooperative learning* type *group investigation* with classroom control using conventional guides, it makes a difference science process skills of students advance of the experimental class and control class. In accordance with this, the results of research conducted by (Abungu, 2014), stated that *"After five weeks of science process skills based instruction, the researchers found that students in the Experimental Groups were attained to be significantly higher in chemistry than did the students the Control Groups "*. That is, in the learning process based on science process skills in the experimental class the value obtained is higher than the control class. So, learning that uses science process skills can help students improve science process skills. For this reason, it is hoped that this guide, after being revised, is expected to be applied to become the guide of Basic Physics practicum I in supporting practical work.

Problems and solutions

In general, the results of the study show if there are differences in science process skills of students between the experimental classes who use the Basic Physics practicum guide I based on science process skills by using a model *cooperative learning* type *group investigation* with a control class that uses conventional practicum guides. From these differences it can be seen if the experimental class has higher science process skills than the control class. This means that the Basic Physics practicum I guide based on science process skills by using models *cooperative learning* of types *group investigation* can help in developing science process skills of Jambi University Physics Education students.

The application of Basic Physics practicum guide I based on science process skills by using a model *cooperative learner* type of *investigation group* in the laboratory practice experienced several obstacles, namely the language used in the guide was less communicative so that sometimes students still had difficulty understanding the practical guide especially in the experimental procedure section. To be able to maximize the use of the Basic Physics practicum I guide based on science process skills by using a model of the *cooperative learner* type of *investigation group,* language revisions should be made so that they are more communicative and easier for the reader to understand.

CONCLUSION

Based on Data analysis and discussion can be concluded if the experimental class using Basic Physics practicum guide I based on science process skills by using a model *cooperative learning* type *investigation group* has science process skills that are better than the control class that do practicum using a conventional guide. So, the Basic Physics practicum I guide based on science process skills by using a model *cooperative learner* of type *group investigation* can help in developing science process skills of Jambi University Physics Education students.

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