IMPROVING THE SCIENCE PROCESS SKILLS OF PHYSICS EDUCATION STUDENTS BY USING GUIDED INQUIRY PRACTICUM

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Abstract

This research investigate that science process skills significantly improve after doing some practicum activities. The research population are fifth semester physics education students and the research sample are fifth semester physics education students who was doing electricity and magnetism experiment C class course. We used two questionnaires, the first one is given to the students after doing three experiment activities and the second one is given after doing six experiment activities. This research is quantitative research using paired sample t test analysis that compared the first questionnaires score and the second questionnaires by using *SPSS* software. The result indicates that the number of practicum activities is able to improve the science process skills significantly.

Keywords: Science process skill, guided inquiry, guided inquiry practicum.

Introduction

The development in the education world especially physics education is very rapid because of the development of technology. Nowadays, the students from elementary until high school can access everything from media for example you can find information about atomic structure lecture from *youtube* or *blog*. But, the media in internet can contain wrong informations. In this case, the role of teachers as educator and companions is very needed.

To begin with, the teacher's skills and mastery of teaching materials should be deepened. Moreover, the scientific approach is used and taught in 2013 curriculum (K13). Not only scientific approach, character building also is introduced so that the students have good knowledge and character. Therefore, the most important and easiest way to reach K13 goals is to improve the science process skill of teacher candidate students in university. Particularly physics teacher candidate.

University plays a role to teach and deepen content knowledge and an appropriate method to teach a concept or teaching material. The offered course in the study program is expected can develope the affective and psychomotor aspect besides the cognitivive aspect.

One physics learning method that is able to combine both aspects is practicum. The practicum method is a method that involves students to be active in an experiments of physics materials that have or will be studied. This practicum method is one of the constructivist methods, i.e the students will find something during the practicum at lab so that students do not memorize but find something. It is hoped that the students will become deeper in understanding the concepts of physics so that they are ready to become teacher in the future.

In practicum, the students are also taught to work in groups, both in assembling, analyzing, discussing and concluding what has been obtained by doing practicum. By using practicum method can also train some characters building such as: rational thinking, cooperation, respect for others, honest, conscientious, disciplined, respect for nature and God. The importance of practicum experiences as a key determinant of pre-service science teachers' emerging inquiry-based science views and practices (Fazio dkk, 2017).

Theory

Physics education is a part of scienc1e education which have three elements, that are knowledge, process and attitude (Martin, 1991). The knowledge about nature laws and the underlying theory always be emphasized in physics education. Student study physics material for

example Newton Law, Relativity, Atomic Theory, etc to improve and apply this material to daily life.

Physics education helps students to know how the physicists work when they did some experiments and made a conclusion from those experiments. This is what we call scientific method. By using scientific method, student is hoped can think rationally and making a conclusion from data that they have collected. Physics education also helps students in developing correct learning attitude, for example honest, discipline, thorough, objective, not doing data manipulation, and teamwork.

Sugianto et al. (2009) said that science process approach is teaching and learning approach which emphasize the study process, activity, and creativity of students when obtain the knowledge, skill, achievement and attidue, and also apply the theory in daily life. Hamalik (1995) said there are six aspects which want to be improved by using science process approach, that is (1) question, (2) hypothesis, (3) investigation, (4) observation, (5) classification, (6) prediction, (7) interpretation and (8) communication.

Suparno (2007) said that, in general experiment methods is teaching method which invite student to do experiment or practicum as verification of the theory. This method also invite students to be active and doing in groups so we can identify which student is active or passive. Hamalik (1983) said that there are some benefits by using experiment or practicum in teaching and learning, (1) exercise to apply the theory that have been learnt, (2) To obtain practical experiences that did not obtain in class, (3) to find another theory.

Methodology

This research is quantitative descriptive. The population is the fifth semester of physics education student and the sample is 15 students of electricity and magnetism practicum class C. The instrument used is two questionnaires, the first after doing three practicums and the second after doing six practicums.

This research is a quantitative research with analysis using paired sample t-test. The instrument that used is a Likert-scale questionnaire on aspects of science process skills. The first questionnaire was given to the students after three practicums and the second questionnaire was given after six practicums. The first and second questionnaire scores will be compared using paired sample t-tests with help of the SPSS 22 program to see the significant improvement or not.

Results and Discussion

A. Science Process Skill Improvement

The mean value from pretest and posttest for six aspects of science process skill is shown in table 1. We can see that the mean value is increase from 76,33 to 82,40 after posttest.

				Std.	
				Devia Std	l. Error
		Mean	Ν	tion Mear	1
Pair I	pretrampil	76.33	15	8.7 2.2	.65
				72	
	postrampil	82.40	15	9.9 2.5	65
				34	

Table 1. The science process skill pretest and posttest mean value

	Paired Differences							
		Std. Deviation	Std. Error Mean	Interval Differenc	Confidence of the e Upper		Df	Sig. (2-tailed)
Pair pretrampil I – postrampil		10.194	2.632	-11.712	421	-2.305	Ι4	.037

Table 2. The value of paired sample t-test of science process skill

Furthermore, with the help of SPSS program will be analyzed whether by doing practicum will be a significant improvement in science process skills. The results of the analysis are presented in Table 2. From Table 2 the analysis using SPSS program, related to the process of science skills experienced a significant improvement. This is indicated by the value of p = 0,037 < a = 0,05. So it can be concluded that by doing more experiments will improve students' science process skills.

B. Science Process Skill Aspects

There are eight aspects of the science process skills that will be seen in this study: (1) asking, (2) hypothesis, (3) investigation / planning experiment, (4) observation, (5) classification, (6) prediction, (7) interpretation and (8) communication. The mean pretest and posttest values for the eight aspects of the science process skills are presented in Table 3. It can be seen that there is an improvement in mean values for the eight aspects of the science process skills.

For further research, it will be analyzed using paired sample t-test with the help of SPSS 22 to know which aspects of process skill are significantly improved. The results are shown

in Table 4. From Table 4 it can be seen that significant increase occurs in two aspects, namely observation aspect (p = 0,009 < a = 0,05) and communication aspect (p = 0,023 < a = 0,05). While for the six other aspects (ask, hypothesis, investigation, classification, prediction and interpretation) improved but not significant.

		Mean	N	Std. Deviation	Std. Error Mean
Pair I	Prebertanya	6.27	15	I.486	.384
	Posbertanya	6.87	15	1.552	.401
Pair 2	Prehipotesis	7.27	15	1.534	.396
	Poshipotesis	7.60	15	1.352	.349
Pair 3	Preinvest	13.73	15	2.251	.581
	Posinvest	15.00	15	2.360	.609
Pair 4	Preobserv	15.20	15	1.656	.428
	Posobserv	16.40	15	I.724	.445
Pair 5	Preklasif	8.73	15	.799	.206
	Posklasif	9.07	15	1.033	.267
Pair 6	Prepredik	6.80	15	1.082	.279
	Pospredik	7.00	15	1.000	.258
Pair 7	Preinter	11.00	15	1.604	.414
	Posinter	12.00	15	2.204	.569
Pair 8	Prekomun	7.33	15	1.397	.361
	Poskomun	8.47	15	1.187	.307

Table 3. Pretest and posttest science process skill aspects mean value

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower Upper		t	Df	Sig. (2-tailed)
Pair I prebertanya	Ivicali	Deviation	Ivicali	Lower	Opper	L	DI	Sig. (2-tailed)
posbertanya	600	1.882	.486	-1.642	.442	-1.235	14	.237
Pair 2 prehipotesis poshipotesis	333	1.799	.465	-1.330	.663	717	Ι4	.485
Pair 3 preinvest posinvest	-1.267	2.492	.643	-2.647	.113	-1.969	I4	.069
Pair 4 preobserv posobserv	-1.200	1.521	.393	-2.042	358	-3.055	Ι4	.009
Pair 5 preklasif posklasif	333	1.113	.287	950	.283	-1.160	14	.265
Pair 6 prepredik pospredik	200	.676	.175	574	.174	-1.146	14	.271
Pair 7 preinterpre posinter	-1.000	2.360	.609	-2.307	.307	-1.641	Ι4	.123
Pair 8 prekomun poskomun	-1.133	1.727	.446	-2.089	177	-2.542	I4	.023

Table 4. Paired Sample t-test of science process skills aspect

Observation and communication aspects have a significant improve when students do practicum. The more numbers of practicum that students do make them become more proficient in reading tools, especially multimeters because the electric and magnetism practicum almost every practicum using a multimeter. After doing a lot of practicum students become not easily satisfied with the data obtained. They will continue to repeat the data retrieval process. As for the communication aspect, the practicum report written by the student becomes more coherent and clear in making the discussion. As the oral exam of the students is increasingly adept at assembling tools and explaining what was done in the experiment.

Conclusion

Based on the results of research that has been done the researchers obtained some

conclusions as follows.

1. Practicum improves students' science process skills significantly.

2. There are two aspects that experienced a significant increase in aspects of observation and communication.

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