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Experiment Role in Developing Metacognition Ability of Teachers‘ Prospective

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Abstract

This study aims to shoot the role of experiments in the skill course of study program in case of building metacognition abilities. This study was conducted at the Physical Education Study Program, Teacher Training and Education Faculty of Muhammadiyah University of Metro. The data were collected by using documentation, observations, interviews, written tests and performance tests. The data were analyzed qualitatively and quantitatively. Qualitative analysis includes the following phases: tabulation, description and interpretation in order to connecting the facts that are related to the research focus. Quantitative analysis was using a statistical correlation between activities of doing experiment with metacognition abilities. This study found that in every physics course, experimental activities carried out separately by the course but in the same course package. Based on qualitative data, it was found that the experimental activities have a good role in building the capability of students. Based on quantitative data, it was found that metacognitive abilities were associated with the ability to execute the experiment; the ability to execute the experiment contributed 13.2% to the ability of metacognition. Based on the results, it can be seen that the experiment role should be optimized in order to build students‘ metacognitive abilities and need to integrate other potential so that the students‘ metacognitive abilities could be well developed.

Keywords: Physical Concept, Experiment, Metacognition Abilities

1. INTRODUCTION

Physical Education Study Program is the educational unit that organizes the preparation for Bachelor of Physical Education. The Constitution No. 12 of 2012 on Higher Education paragraph 18 states that the undergraduate program prepares students into the intellectual and / or cultured scientists, to be able to enter and / or create jobs, and be able to evolve into a professional. Therefore, it is necessary to do some efforts in order to develop a variety of students‘ potential in manifesting human resources with high competitiveness, which is expected to create a job and become professional.

To build human resources that capable of creating jobs, it is necessary to equip the ability of creative and innovative thinking even the ability of metacognition. Meanwhile, to make professional human resources according to the field—the teaching profession, it is required to have four competencies; namely pedagogy competence, professional competence, personal competence and social competence.

Competence is a performance that is shown by the individual that includes of knowledge, specific skills and abilities by a certain standards. Competence will appear as the behavior shown in carrying out the work involved in the organization's culture in the work environment, as a combination of knowledge and skills required in carrying out the duties as a teacher of physics. A physics teacher competence should be demonstrated through the knowledge of physics and pedagogy, having skills in implementing learning activities and having ability to develop the duty and the role as a physics teacher in creative and innovative way.

In the learning process, it is frequently occur some situations which is incompatible with the plan, so that it is necessary to have any creative preventive steps in order to handle such problem through changes of plan, monitoring or evaluation. As the example of the problems faced by teachers in the classroom, Buck, et al. (2007) found that the inquiry-based learning have a positive impact and generate a complete understanding, in both content and skills, but many teachers expressed frustration because the students' understanding not appear immediately, and they did not know what to do. Norlander-Case, et al. (1998) revealed that, the challenges in implementing the learning-based inquiry include: (a) lack of time, (b) the difficulty refraining to answer questions students directly, (c) describes the abstract, and (d) an assessment instrument that takes into account the vocabulary local said.

It is not an easy matter to produce a creative and innovative physics teacher who is able to overcome the problems that occur in the classroom. The results showed that creative thinking skill is not enough to produce a creative teacher (Suseno, 2014). Many aspects must be developed in order to create such physics teacher competence. One important aspect for a teacher is the ability to know how to think critically, creatively and intuitively, and be able to control and evaluate it all times. This way of thinking is known as metacognition abilities.

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According Sukmadinata and Ash'ari (irmayani, et al., 2014) Metacognition refers to higher order thinking which involves the activity of control over the cognitive processes involved in learning. The activities such plotting how the approach used in the study, the overall monitoring, and evaluating development are the natural metacognition. According to Woolfolk (Sudia, 2015) metacognition refers to increasing the awareness of thinking and learning process that is conducted. This awareness can be realized if someone started thinking by planning, monitoring, and evaluating the outcomes and cognitive activity. Asrori (2009: 31) argued that metacognition is an individual's ability "to stand outside the head" and trying to reflect on the way he thinks or contemplate the cognitive processes he does.

The Metacognition ability is the thinking skill includes the ability to plan, monitor and evaluate. The ability of metacognition looked systematically, but in practice it is not always ordered linearly, even recursively. It could happen; an evaluation is done towards planning or monitoring, or planning during the monitoring and evaluation. This way of thinking is very important to be owned by the professional teachers, both for the benefit of their duties or to be imparted to the students.

Many ways and strategies that can be done to build such metacognitive abilities, one of them is to optimize the experimental activity. According to Shulman, et al. (2015), the experimental method can be used to individually find a complex electrical circuit equation. Subsequently according to Carl (2015), learning in the classroom tasks more about cognitive, while learning by experiment is very different, where experience gained much more complete.

In the experimental activities students are trained to make an experimental plan, then implement and monitor the experiment and evaluate the measures or action taken. In physics experiment activities are also occur common problems, such as inappropriate measuring devices‘ scale, bad circuit, the influence of environmental factors and so forth. At that point, the students are required to take an appropriate and quick step or actions, for instance by replacing the devices, procedures change or add to the devices or materials or even add another step and other measures. The learning activities like these are activities that hone students' metacognition.

Based on description above, experiments activity is rationally can be used to build a student metacognition abilities. To that end, it is necessary to conduct a research to assess the extent of the influence and relations of experimental activities in lectures towards the metacognition ability of Physics Education students.

2. RESEARCH METHOD

The study begins by surveys and observations on the implementation of lectures in several Teacher Training Institutions that provide courses of physics education that focused on the implementation of experimental on subjects‘ expertise physics courses. The data were collected through documentation, observation, and complemented by interviews, and used written test and performance test.

The documents used in this study include: learning device, experiment guidelines, experiment reports, schedules and other supporting documents. Observation was done on the activity of students in lectures and experiment activities, and interview was conducted to complete the data as well as a step of triangulation to obtain accurate data. Written and performance tests were also conducted to obtain experiment ability and the ability of metacognition.

Descriptive-qualitative was used in processing data in order to obtain an overview of the activities in the experiment of electric-magnet lecture. Data analysis procedures conducted through several stages. First, checking and selecting the data relating to the issues. Second, data or important information are grouped according to the aspects and problems. The third stage, performing tabulation of data based on the classification, to appear faction, characteristic, type and frequency, to make them easy to be read and categorized. The fourth stage, reading all data and perform preliminary analysis by encode the data, then decipher and connect various types of data and information to create a description, and then conducted further analysis to formulate an appropriate theme in focus of the study by linking several associated descriptions and eliminates data that are not related to the focus of the study. The fifth stage, making interpretation of the data analysis related to the cases that were examined and make the conclusion. Further, the quantitative data analysis using regression-correlation to determine the relationship between the ability of experiment and metacognition ability.

3. RESULT AND DISCUSSION

Data documents covering the plan of semester program (RPS), class schedules and experiment schedule, showing that electric-magnet lectures always combine the two methods of discussion to the other methods, using the media, as well as the experiment activities were separate to the lectures. The results of interviews with lecturer of the electric-magnet course, it was revealed several problems in the lecture electric-magnetic, those are: 1) the concept of electric-magnet is abstract and theoretical, so it is difficult to encourage students to find the concept by themselves, 2) the experiment activities were separated from lectures and frequently not aligned to the course material, so that the learning process of electric-magnet in the classroom is not fully supported by the activities of the experiment, 3) experiment activity can only indicate the presence of symptoms, while to

understand the real phenomenon need such higher order thinking that are difficult to observe in the course of electricity-magnet.

Based on the results of students' interview, it discovered that students find difficulity in understanding the abstract concept of electric-magnetic, while the experiment activities are also less-support the course, because its implementation is separated and not aligned. The analysis finds that the main problem of the difficulties in electricity-magnet course is because the concept of electric-magnet is classified as abstract, the experimental device only shows its symptoms and it requires the higher order thinking, so this would stimulate the emergence of students' idea, whether in making plans, monitoring or evaluating the job. Thus, these experiment activities indirectly establish the students' metacognition ability.

Here are presented the observations results of scientific activity that appears in the classroom activities and experiment activities in the laboratory that were observed during five meetings, and presented in Table 1.

Table 1. Observation Result

Students' scientific activity in the lecture/experiment	**Observation Result**			
	Lecture		**Experiment**	
1) Observing the phenomenon	4	80%	5	100%
2) Formulating the problem	0	0 %	5	100%
3) Formulating the hypotheses	1	20%	5	100%
4) Observing and measuring	0	0 %	5	100%
5) Hypotheses testing and data collecting	0	0 %	5	100%
6) Interpreting and answering questions	1	20%	5	100%
7) Reporting results and the implications	1	20%	4	80 %
Average of students' activity	**1**	**20 %**	**4,86**	**97 %**

Table 1 show that the scientific activity of the students in experiment activities is much higher than scientific activities in lectures. This could also indicate that the experimental method will provide better learning outcomes. With the scientific activities undertaken by the students, the students' metacognition ability will also be formed.

Quantitative data—obtained from the written test and test performance—obtain the data of the capabilities in implementing experiment and the ability of metacognition. Those can be seen in the following table:

Table 2. Description of Capabilities in Implementing Experiment and the Metacognition Ability

	Mean	Std. Deviation	N
Experiment Capability	76.8631	4.94843	26
Metacognition Capability	55.1923	9.43194	26

The correlation between experiment capabilities and metacognition abilities can be determined using statistics and the results are as follow:

Table 3. The Correlation Between Experiment Capabilities and Metacognitive Abilities

		Metacognition Abilities	Experiment Capabilities
Metacognition Abilities	Pearson Correlation	1	.363
	Sig. (1-tailed)		.034
	N	26	26

Based on Table 3, it is obtained that ry correlation coefficient = 0.363 with a significance 0.034 (<0.05), it means that correlation coefficient is significant. Test results of significance obtained t value = 2.0488 and t table = 1.711, so t count> t table which means the correlation coefficient ry is significant. For the regression correlation between experiment capabilities and metacognition abilities, the regression coefficients can be disclosed in the following table:

Table 4. The Regression Correlation

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	2.058	27.925		.074	.942			
experiment capabilities	.691	.363	.363	1.907	.069	.363	.363	.363

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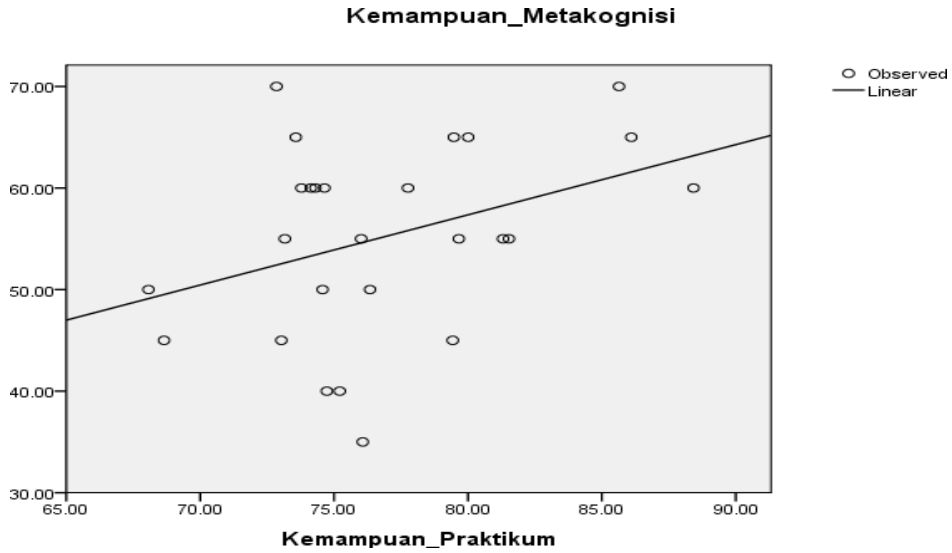
experiment capabilities	.691	.363	.363	1.907	.069	.363	.363	.363

a. Dependent Variable: metacognition abilities

Based on Table 4, the model of the regression equation can be written as follows: Y = 2.058 + 0,691X, with Y is the ability of metacognition and X is ability to conduct experiments. According to the table above, it is also obtained a significance of 0.069 (> 0.05), which means regression equation y on x is less significant. However, it can be described linearity correlation between the ability of experiments on metacognition abilities as follows:



Picture 1. The Correlation Between Experiment Capabilities and Metacognitive Abilities

Based on the chart above, it can be argued that the ability to experiment positive effect on the ability of metacognition. This can be explained by a positive gradient chart, or it can be interpreted that the metacognitive ability is directly proportional to the ability of experiment, where the greater the ability of student experiment, the greater the ability of the student metacognition. To see how big contribution to the ability of metacognition experiment ability, it can be seen from the following table:

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.363[a]	.132	.095	4.70660	.132	3.635	1	24	.069

a. Predictors: (Constant), Metacognition Ability

Based on Table 5, it can be argued that the contribution coefficient R of 0,363 and contributes the ability of experiments on metacognition capability by 13.2%.

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5. CONCLUSION AND SUGGESTION

Conclusion

Based on the data analysis and discussion, it can be concluded that:

a. The ability of metacognition physical education students need to be developed to realize the human resources that capable of creating a job and professional.
b. The experiment can be used to develop the ability of metacognition.
c. The ability to experiment directly proportional to the ability of metacognition, where the higher ability to experiment, the higher theability of metacognition.
d. The ability of students to carry out experiment affects the ability of metacognition with a contribution by 13.2%.

Suggestion

Based on the results, the suggestions can be the following:

a. In order to produce bachelors of education that are professional and be able to create employment, it is necessary to develop the ability of the students' metacognition.
b. To develop the ability of metacognition, the role of experiment in the course of expertise need to be | optimized.
c. It is necessary to assess other potential that can be optimized to build metacognition abilities of the students.
d. It needs to conduct a combinned strategy between experiment activities with any possible potential, to float metacognition abilities of students.

REFERENCE

[1] Asrori, Muhammad. 2009. Psikologi Pembelajaran. Bandung: Wacana Prima.
[2] Buck, G. A. *et al.* (2007). ―Learning How to Make Inquiry into Electricity and Magnetism Discernible to Middle Level Teachers‖. *Journal of Science Teacher Education*. 18, 377 - 397.
[3] Carl, W. 2015. Comparative Cognitive Task Analysis of Experimental Science and Instructional Laboratory Courses. The Physics Teacher. Vol. 53. No. 6. 349 – 351
[4] Daniel. Muhammad. 2010. Pengaruh Strategi PBL terhadap Keterampilan Metakognisi dan Respon Mahasiswa. Jurnal Chemica. Vol.11.
[5] Irmayani, Silvia.(2014) Pengaruh Keterampilan metakognisi terhadap Minat dan Hasil Belajar Melalui Metode pembelajaran discovery. Jurnal Pembelajaran Fisika. Vol. 2.
[6] Norlander-Case, K. e*t al.* (1998). ―The role of collaborative inquiry and reflective practice in teacher preparation‖. *The Professional Educator*. 21, (1), 1–14.
[7] Shulman, J. at al. 2015. Experimental Determination of Circuit equations. American Journal of Physics. 83 (1), 64 – 71.
[8] Sudia, Muhammad. (2015). Penerapan Metakognisi dalam Pembelajaran Pemecahan Masalah Matematika. Jurnal Math Educator Nusantara. Vol. 01. FKIP. UHO. Nopember 2015.
[9] Suseno, N. & Harjati, P. 2014. Pemetaan Analogi Konsep Abstrak Fisika untuk Mengembangkan ketermpilan Berpikir Kreatif Mahasiswa Calon Guru Fisika. Metro: Lembaga Penelitian dan Pengabdian kepada Masyarakat UM Metro.
[10] Undang-undang Republik Indonesia Nomor 12 Tahun 2012 tentang Pendidikan Tinggi.