



Improving Critical Thinking through Research Based Learning Model for Pre-Service Teacher

Fitri April Yanti^{a*}, Partono^b, Heru Kuswanto^c, Mundilarto^d

^a*Faculty of science and technology, University of Nahdlatul Ulama Lampung, Indonesia*

^b*Physics Education of Study Program, Muhammadiyah University of Metro, Indonesia*

^{c,d}*Physics Education of Study Program, Yogyakarta State University, Indonesia*

^a*Email: april.ynwa@gmail.com, ^bEmail: partono66@gmail.com*

^c*Email: herukus61@uny.ac.id, ^dEmail: mundilarto@uny.ac.id*

Abstract

This study aims to improve the critical thinking skills of physics pre-service teachers at the University of Muhammadiyah Metro, Indonesia. This research is conducted through the application of syntax of research based learning model in learning. To know the effectiveness of learning model, the implementation has been done to 45 of Physics pre-service teacher in Faculty of Teacher Training and Education as the subject of research. Pretest and posttest that has been done is to obtain data 'model effectiveness' in order to improve the critical thinking skills of pre-service teachers. The results of critical thinking skills tests have been showing that the pretest average score of 31.80 increases to 70.32 and the N-gain score is 0.56 and is included in the 'Medium' category. Based on the results of research, it can be concluded that the critical thinking skills of pre-service physics teachers in the subject of basic physics electrical topics can be improved by applying research-based learning model.

Keywords: Research based learning; learning model; critical thinking skill.

* Corresponding author.

1. Introduction

Research-based Learning model that can provide 21st century skills effects for pre-service teachers, including: learning innovative skills, information, media, technology skills, life and carrier skills. In addition to 21st century skills, pre-service teachers need to have a standard of competence in accordance with the role of teachers in the 21st century which includes pedagogic competence, personality competence, professional competence and social competence. As a pre-service teacher, the college environment is the shaper of professional competence. Professional competence is manifested in mastering the material and developing critical thinking skills. Critical thinking skills are one of the 21st century skills and as a professional competence of pre-service teachers who are recommended to have an individual pre-service teacher in every day. Critical thinking skills as an active thinking process, or not just passive in accepting other people's ideas [1–3]. Critical thinking indicates a reason to believe in something. Indicators of critical thinking skills include analytical thinking skills, synthesis thinking skills, problem-solving skills, concluding, and evaluating or judging skills [3]. Critical thinking skills are important in teaching science. This is because, through the skills of critical thinking, pre-service teachers can recognize the problems that occur in the environment, to solve the problem so that it can get the conclusion of the problems encountered. The application of good Physics learning can encourage the development of critical thinking skills. Electrical material is one of the most difficult basic physical materials. So to understand the material is required by learning with direct experience.

The result of previous observation shows that students have difficulty to understand the concept of electricity and critical thinking skill in lecturing process is still low. The results of the observations have also shown that the lecture model used is oriented towards the pre-service teacher's learning outcomes, not to develop critical thinking skills. Based on the facts and literature review, critical thinking skills have been improved by applying research based learning model on the basic physics course of electrical topic.

2. Review of Literature

21st century skills lead educators to design learning into a learning process that can train and enhance the skills of learners. Research based learning has been applied in higher education to improve learning to be more contextual. Research-based learning has been able to effect the 21st century skills that aspiring teachers require; learning and innovative skills, information, media, technology skills and life and carrier skill [4–8]. The syntax of research based learning includes the introductory phase, outlining the material, conducting training and guidance, conducting research, conducting analysis, confirmation and evaluation, and writing articles [9]. Research based learning is able to provide learners with experience to identify problems critically and use their critical thinking skills to write scientific papers. Critical thinking is needed to be able to write a book or a scientific article [10]. In addition to affecting the skills of the 21st century, research-based learning has an effect on the critical thinking skills of pre-service teachers. Critical thinking skills are needed to analyze the problem critically so as to solve it. Indicators of critical thinking skills include; analytical thinking skills, synthesis thinking skills, problem-solving skills, concluding skills and evaluating or judging skills [3].

3. Method

This research has been able to improve the critical thinking skills of pre-service teachers in the basic physics course of electrical topics using research based learning. Research based learning model that has been applied in lectures has the following syntax [9]:

- a. Preliminary stage
 - 1. Presenting questions or problems
 - 2. Design research

- b. Stage of material description

Material discussion and discussion

- c. Stage training and guidance

Guiding and providing insight into research

- d. Implementation of research
 - 1. Organize students to learn
 - 2. Guiding and monitoring projects

- e. Analysis, confirmation and evaluation

Analyze, evaluate, and confirm the results of data collection

- f. Article Writing

Perform product assessment

This learning model has been implemented on 45 Physics of preservice teacher as research subject to know its effectiveness. Instruments that have been used to collect data are critical thinking skills tests that include indicators of analytical thinking skills, synthesis thinking skills, problem-solving skills, concluding skills and evaluating or judging skills. Pretest and posttest that have been done to know model effectivity to improve critical thinking skill of pre-service teacher, then obtained Data is analyzed by using normal score analysis. Calculate N-Gain using equations based on [11].

$$\text{N-Gain} = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \quad (1)$$

Note:

S_{post} : Posttest score

S_{pre} : Pretest score

S_{max} : The ideal score maximum

Table 1: Category of N -Gain Score

Score	Category
$g > 0,7$	High
$0,3 < g \leq 0,7$	Medium
$g \leq 0,3$	Low

4. Result and Discussion

The effectiveness of research-based learning model to improve the critical thinking skill of physics pre-service teacher is shown in Table 2 below:

Tabel 2: Critical Thinking Skill

	Pretest	Posttest
Number of students	45	45
Highest score	59	85
Lowest score	23	59
Total average	31.80	70.32
N-Gain	0.56	

Figure 1: Pre-Service Teachers' problem solving skill average score

Implementation of research-based learning model has been able to improve the critical thinking skill of Physics pre-service teacher. The results of critical thinking skills tests in Table 2 have been showing an increase in the average score from pretest to posttest. The average score on pretest-posttest was 31.80 increased to 70.32 with N-Gain 0.56 and was included in 'medium category'. In Figure 1, it has been shown that the average score of measured critical thinking indicator has increased significantly, an increase of more than 50% compared to the previous score.

The average score of analyzing skills increased from 4.12 to 9.72 on the pretest-posttest score. While the mean scores for synthesizing skills increased from 9.04 to 16.64, problem-solving skills from 7.32 to 19.00, concluding skills increased from 6.00 to 12.4, and the skills of evaluating or assessing from 5, 32 to 12.56 on pretest-posttest. Implementation of research-based learning model can be described in the following syntax.

Step 1 of the research-based learning model, researchers have assisted pre-service teachers in finding the problems, designing appropriate research, and division of research groups. Pre-service teachers have identified the problem according to the electrical topic.

Step 2. After the researchers explain the material and discuss with the pre-service teacher about electrical materials.

Step 3. Conduct training and guidance. Training and guidance have been given to explain the research steps to be undertaken. At this stage, pre-service teachers have been mentored and given insight into the research. Research that has been used for each group of pre-service teachers through 'mini research' is conducted in the laboratory.

Step 4. Conduct research. Researchers should have organized pre-service teacher to study and guide and monitor the research. Pre-service teachers examine through the duties of each member. This is done in order to use time efficiently.

Step 5. Analyze, confirm and evaluate. Researcher and pre-service teacher do analysis, confirmation and evaluation of the results of data collection. Data analysis is done in the form of table / graph. The last stage is to write an article. The results of the pre-service teacher's articles are then presented and assessed deficiencies. Revisions are made to the deficiencies in article writing. At the writing stage of the article, pre-service teachers have experienced difficulties. This is because they are not yet accustomed to writing scientific articles. Therefore, the difficulty in article writing can be overcome by providing various examples of similar articles and provide direction for each step of article writing. Basic physics lectures on electrical topic using research based learning model has proven effective in improving critical thinking skill of physics pre-service teacher. Learning with a research approach has been able to encourage critical thinking skills [8,12,13].

5. Conclusion

According to the results of the study, it can be concluded that the critical thinking ability of pre-service physics teacher in the subjects of 'basic electrical physics' has been improved through learning of research-based

learning model.

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