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Effectiveness of the project based learning model integrated ethno technology to actualize superior teacher candidates

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***Abstract*— The purpose of this study was to determine the effectiveness of ethno technology integrated project-based learning models to improve the competency of superior physics teacher candidates. With the subject of physics education students at PGRI Semarang University who participated in environmental physics courses as many as 30 people. Students were given the task of observing brick making around the city of Semarang, then made a simple research related to the use of physics in brick making. The superior indicators chosen are mastery of concepts, critical thinking skills, problem solving skills, information technology skills, scientific communication skills, team work skills, objective attitudes, and environmental care attitudes. This research method is quantitative by analyzing data using t-test and N-gain. The average score before assignment after the assignment is increased. The results of the t-test showed a sig value <0.05, for the mastery of concepts, critical thinking skills, problem solving skills, information technology skills, team work skills, objective attitudes, and environmental care attitudes. This means that there is a significant difference between the subject variables before and after the assignment of project tasks. From the results of the N-gain test all variables were obtained in the low and medium improvement categories. Low categories for variable mastery of concepts, scientific communication skills, teamwork skills, and objective attitudes. Obtained a medium category for variable critical thinking skills, problem solving skills, information technology mastery skills and environmental care attitudes. Based on the above results it can be concluded that the integrated project-based learning model of ethno-technology is effective in improving the competency of superior teacher candidates.**

Keywords*— *Project based learning, ethno technology, superior competence

I. INTRODUCTION

Superior teacher candidates are prospective teachers who have the skills, skills and attitudes expected by the community in the 21st Century. Teacher candidates should master the subject matter according to their fields. The skills of prospective teachers in accordance with 21st century skills are critical thinking skills and problem solving, communication, collaboration, creativity and innovation and mastering information technology [1]. Current advances in information technology have a negative impact, namely dehumanization [2], where humans are not like their nature in communicating with others. The use of social media is important to communicate with other people, share / request information, and follow / evaluate / interpret events, but has a negative impact on student learning and habits [3]. Therefore, teacher candidates need to be equipped with the attitude and identity of a teacher who is fair, honest, objective, wise, patient, caring, and others.

In accordance with Menristekdikti Regulation No. 44 of 2015 concerning Higher Education Standards, graduates of the Teacher Training Institution (LPTK) must master the theoretical concepts of certain fields of knowledge and skills in general and the theoretical concepts of specific sections in the field of knowledge and skills in depth [4]. These knowledge and skills are reflected in the graduates' competencies or the learning outcomes of each study program must refer to the formulation of the description in the Indonesian National Qualification Framework (KKNI) in accordance with the level / level. S1 graduates must have a level 6 qualification, where equivalent S1 graduates are required to have the ability in the field of work that is able to apply their expertise and utilize science and technology in their fields in solving problems and be able to adapt to the situation at hand [5]. Based on the Minister of Research and Higher Education Regulation number 55 of 2017, LPTKs must meet 8 standards, namely: graduate competency standards, content, process, assessment, educators and education personnel, learning facilities and infrastructure, management and financing. In article 7 paragraph 1 of the Education Standards Teacher stated that the graduate competencies of the Bachelor of Education Program include attitudes, knowledge and skills expressed in the formulation of graduate learning outcomes [6].

But in reality the quality of LPTK graduates is still questionable by the community because it is considered

inadequate. The low quality of LPTK graduates who work as teachers has an impact on the quality of learning in schools. The low quality of teachers is reflected in the low average teacher competency test (UKG). UKG data in 2015 averaged only 56.69. The impact of learning quality is reflected in the 2015 Program for International Student Assessment (PISSA) test which ranked Indonesia 64th out of 75 countries [7].

To adjust the government provisions related to the Bachelor of Education Program, the LPTK has revitalized the curriculum. The LPTK curriculum must be based on the IQF and adapt to Teacher Education Standards. Efforts to adjust this matter not only in determining the course, but must arrive at the content and process of how the course is taught. The learning process of each subject must reflect how the graduates will have learning outcomes in accordance with the achievements of the graduate learning. Learning outcomes must include attitudes, knowledge and skills.

During this time, the learning process of the Environmental Physics course was not directed towards active student-centered learning. The learning patterns commonly used by lecturers are explaining the material, training the questions then discussing and at the end of the learning usually the lecturers give assignments. This results in students being less critical in responding to and solving problems that arise during learning activities [8]. Physics teaching materials are less associated with real problems around students such as energy crisis, greenhouse effect, lightning problems, building fire problems due to short circuit, high voltage power lines (SUTET) and so on [9].

To improve students' skills and attitudes, learning needs to be linked to everyday problems, for example by relating ethnics. Ethno science is knowledge possessed by a particular nation or community [10]. Through a contextual approach, teaching is not a transformation of knowledge from lecturers to students by memorizing a number of concepts that seem to be separated from real life, but more emphasis is placed on facilitating students to find life skills from what they learned [11]. Integrated contextual learning can improve learning outcomes [12], mastery of concepts [13], and creativity thinking [14]. Ethnography is a part of ethnics that is specifically about the equipment that is owned by a society along with the ways to use it, which is used to achieve certain goals [10]. Therefore, integrating ethno technology in physics learning is especially appropriate for studying applied physics such as Environmental Physics courses.

Project-based learning is a learning model that can be used to apply the knowledge already possessed, to train various thinking skills, concrete skill attitudes [15]. Project-based learning provides benefits to lower-performing students at a greater level and reduces achievement gaps [16]. The results of studies on the application of project-based learning indicate that this model influences learning outcomes [17], student attitudes and motivation [18], and critical thinking skills of students [19]. By integrating project-based learning with ethno-technology, it is expected to improve the superior competencies of prospective teacher students, namely mastery of concepts, critical thinking skills, problem solving skills, information technology skills, communication skills, teamwork skills and being objective and caring.

The purpose of this study was to determine whether there were differences in superior competencies between students before being given the task with after being given the project assignment and how much the difference was.

II. METHOD

This research method is quantitative with the subject of physics education students at PGRI Semarang University taking 30 environmental physics courses. Students were given the task of observing brick making around Semarang City. The task of students to make a simple research project related to the use of physics in brick making. Project results are presented in front of the class. The superior indicators chosen are mastery of concepts, critical thinking skills, problem solving skills, skills in mastering information technology, scientific communication skills, teamwork skills, objective attitudes, and environmental care attitudes. Indicators of mastery of concepts, critical thinking skills and problem solving skills are measured by tests. While indicators of mastery of information technology skills, scientific communication skills, teamwork skills, objective attitude and environmental care are measured by self-assessment. T-test data analysis is used to determine differences in superior competencies before and after working on the project [20]. To find out the magnitude of the difference, N-gain is used [21].

III. RESULTS AND DISCUSSION

The results of the concept mastery test, critical thinking skills and problem solving skills are like table 1. The average value of each indicator is increased between before and after being given a project assignment. The average increase in value is calculated from the average posttest minus the average pretest value. There was a significant increase in indicators of critical thinking skills of 6.9. While the mastery concept indicator is only 1, and problem solving skills are 2.3.

TABLE I. RESULTS OF CONCEPT MASTERY TESTS, CRITICAL THINKING AND PROBLEM SOLVING

No	Indicator		ms	ma	mi	Av	SD
1	mastery concept	Pre	10	7	1	4.0	1.5
		Pos	10	7	1	5.0	1.4
2	critical thinking	Pre	30	24	6	16.4	4.0
		Pos	30	27	18	23.3	2.4
3	problem solving	Pre	16	10	8	8.5	0.6
		Pos	16	15	8	10.8	2.4

Note : pre = pretests, pos = posttest, ms = maximum score, ma = maximum, mi = minimum, Av = average, SD = standard deviation.

The results of self-assessment of information technology mastery skills, scientific communication skills, teamwork skills, objective attitudes and environmental care attitudes are listed in Table 2 below. The average value of each indicator has increased between before and after being given a project assignment. There is an increase in the average value which is quite large on the indicator of skills in information technology mastering by 3.4. While indicators work in teams there is an

increase in the average value of 2.4, scientific communication an increase in the average value of 2.1, objective attitudes occur an increase in the average value of 1.6 and environmental care attitudes an increase in the average value of 0.6.

The results of the t test between pretest and posttest mastery of concepts, critical thinking skills and problem solving skills are listed in table 3 below. The significance of paired sample t-test for the concept mastery variable, critical thinking skills and problem solving skills shows the number <0.05, this means that there is a significant difference between the subject variables before being given the assignment after being given the assignment. The magnitude of the difference can be seen from the value of each N-gain. The magnitude of the difference for the mastery concept variables is low, while critical thinking skills and problem solving skills are in the medium category.

TABLE II. RESULTS OF SELF-ASSESSMENT OF INFORMATION TECHNOLOGY MASTERY SKILLS, SCIENTIFIC COMMUNICATION, WORKING IN TEAMS, OBJECTIVE ATTITUDES AND ENVIRONMENTAL CARE

No	Indicator		ms	ma	mi	Av	SD
1	Information Technology Mastery Skills	Pre	64	53	35	43.3	5.0
		Pos	64	59	37	46.7	5.9
2	Scientific Communication Skills	Pre	40	40	20	30.2	4.3
		Pos	40	40	21	32.3	4.3
3	Working in Teams Skills	Pre	44	44	25	35.6	5.1
		Pos	44	44	26	38.0	4.6
4	Objective Attitudes	Pre	20	20	5	15.8	3.0
		Pos	20	20	7	17.4	2.7
5	Environmental Care Attitudes	Pre	20	20	7	15.2	2.6
		Pos	20	20	9	15.8	2.6

TABLE III. RESULTS OF CONCEPT MASTERY TEST ANALYSIS, CRITICAL THINKING AND PROBLEM SOLVING

No	Indicator	t	df	p	<g>	Category
1	Concept Mastery	-3.764	29	.001	0.2	Low
2	Critical Thinking	-11.70	29	.000	0.5	Medium
3	Problem Solving	-5.647	29	.000	0.3	Medium

The results of the t-test between initial self-assessment and final self-assessment on indicators of mastery of technology, scientific communication, working in teams, objective attitudes and environmental care attitudes are listed in Table 4 below. The significance of the t-test paired samples for the variable mastery of information technology, working in teams, objective attitudes and environmental care attitudes showed a number <0.05, meaning that there were significant differences between subject variables before being given assignments after being given assignments. Especially for the scientific communication variable shows the number 0.086> 0.05, this means there is no significant difference between scientific communication before and after being given the task.

TABLE IV. RESULTS OF SELF-ASSESSMENT ANALYSIS

No	Indicator	t	df	p	<g>	Category
1	Information Technology Mastery Skills	-4.78	29	.000	0.4	Medium
2	Scientific Communication Skills	-1.77	29	.086	0.1	Low
3	Working in Teams Skills	-3.79	29	.001	0.2	Low
4	Objective Attitudes	-5.44	29	.000	0.2	Low
5	Environmental Care Attitudes	-6.40	29	.000	0.3	Medium

Ethno technology, especially brick making, can be integrated in the learning of environmental physics courses [22]. Integration into environmental physics learning can one of them use a project-based learning model. With this assignment students will interact with the community, especially traditional brick makers. To be able to interact well, students need to be equipped with knowledge, skills and attitudes in society. The use of project-based learning models is very appropriate, because this model can improve students' knowledge, skills and attitudes [16].

From the results of the study it is known that the mastery of the concept is very low and the increase is also low. This is because students are at an early level not yet understand much applied physics. Students at the beginning of the year are in transition and adjusting to the new academic environment. Students at the beginning of the year in lectures are required to be independent and have the ability to face changes in the structure of social life, as well as academically. Every early level student, especially those who are far from parents, must have more independence than students who live with parents [23].

Critical thinking skills and problem solving occur significantly because it is influenced by the use of learning models and approaches. The application of project-based learning models can improve critical thinking skills [24] and problem solving skills [25]. Social skills (mastery of information technology, communication, working in teams) increased due to the task of dealing with the community, as well as the task of uploading status, photos and videos to the internet.

IV. CONCLUSION

Based on the results and discussion above it can be concluded that the integrated project-based learning model of ethno-technology effectively improves the competency of superior teacher candidates. This can be seen from the results of the average value before assignment with after giving assignments that have an increase. The results of the t-test showed a sig value <0.05, for the mastery of concepts, critical thinking skills, problem solving skills, information technology skills, team work skills, objective attitudes, and environmental care attitudes. This means that there is a significant difference between the subject variables before and after the assignment of project tasks. From the results of the N-gain test all variables were obtained in the low and medium improvement categories. Low categories for variable mastery of concepts, scientific communication skills, teamwork skills, and objective attitudes. Obtained a medium category for variable critical thinking skills, problem solving skills, information technology mastery skills and environmental care attitudes.

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