Application of Project-Based Learning to Improve Creativity and Knowledge Competence

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***Abstract*—The purpose of this research was to improve the creativity and knowledge competence of students in subjects welding practice II with the application of project based learning strategy in the Engineering Department Metal Fabrication and Welding South Shore Community Academy. Using classroom action research on three cycles Subjects were students of Engineering Department Metal Fabrication and Welding South Shore Community Academy totaling 26 students. Data collection techniques used include inquiry, observation and test. Analysis of the data used in this research was tested the thoroughness of individual.The results showed that the application of project based learning strategy can enhance the creativities and competence skills of students in the course of welding practice II.**

Keywords— project based learning strategy; creativity; knowledge competence.

I. INTRODUCTION

For producing an object by using welding methods, welding skills and creativity are required from the worker. The ability in the weld field will ensure that the resulting connection will be of quality, while the element of creativity provides an alternative way of working to produce a quality product.

Academy Community is a vocational education that aims to learners have the creativity and competence of good skills. This goal can be done in various ways of learning strategy. Observations made at the Southern Coast Community College, Laser learning is done by training students to weld on pieces of metal without knowing what the object will be afterwards. This causes students to feel bored in learning.

This research applies project based learning strategy [1] which is SCL method, so that creativity and competence of knowledge obtained by learners will be achieved. This research aims to know and reveal (1) Application of learning model of Project Based Learning (PjBL) to increase creativity and competence of student knowledge of Fabrication Technique and Metal Welding of South Coast Community Academy in welding practice course II.

Creativity is closely related to imagination, because creativity develops thought power, and intellectual fantasy power [2]. Creativity is a typical meeting point between the three psychological attributes: intelligence, cognitive style, and personality [3], [4].

Creative thinking includes aptitude and non-aptitude features. Aptitude characteristics are characteristics associated with cognition or thought processes, which include: (1) Fluency, (2) Flexibility, (3) Originality, (4) Elaboration. While non-aptitude characteristics are characteristics that are more related to attitudes or feelings, motivation or encouragement than in doing something: (1) curiosity, (2) imaginative, (3) challenged by pluralism, (4) brave taking risks, (5) being respectful [4].

Competence is the ability of each individual work that includes aspects of knowledge, skills and work attitudes in accordance with established standards, Competencies that must be owned by graduates of the Academy Community refers to the Indonesian National Qualification Framework (KKNI) which has been regulated in Presidential Regulation of the Republic of Indonesia No 8 of 2012, that Diploma 2 graduate is equivalent to level 4 [5].

Project Based Learning is an innovative student centered learning method and teacher as motivators and facilitators, students are given the opportunity to work autonomously in constructing their learning [6]. This method is compatible with the concept of educational engineering innovation, especially in the following cases (1) the learner obtains basic sciences which are useful to solve the engineering problem he or she encounters, (2) learners actively and independently with integrated material presentation and relevant to actual reality, often called student-centered, (3) students are able to think critically, and develop initiative.

The learning steps of PjBL can be illustrated in the following diagram Figure 1.

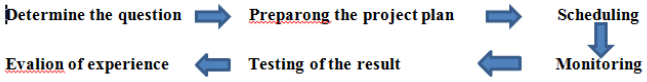


Fig. 1. Diagram of Steps of PjBL Learning Implementation [7]

II. METHOD

This research uses experimental method quasi by design pretest-posttest control group [6]. The experimental design used is 2x2 factorial design, 2x2 Design is two learning models (blended learning, conventional) with two categories of learning motivation (high, low). The experiment was conducted on students in the Physics subjects. The research phase is: (1) conduct a preliminary survey, (2) develop a learning tool blended learning (learning plan semesters, manual lab work, and assessment), (3) to validate learning device, (4) develop research instruments, (5) tested learning devices and instruments, (6) analyze the trial data, (7) provide pre-test, (8) provides motivation questionnaire study, (9) provide treatment to implement blended learning at all-graders experiment, whereas all students a control class performs the conventional learning, (10) provides a post-test, (11) analyzes the data and interprets the results. The instruments used in the research are: observation sheet, test, and motivation questionnaire. The observation sheet was used during the preliminary survey. Questionnaire learning motivation is used to classify students based on learning motivation.

The result of questionnaire of learning motivation is analyzed by percentage technique to classify the students into two groups of learning motivation that is high and low. Data were analyzed quantitatively to determine the effects of blended learning models to students competence in learning physics. Data analysis using two way Anova (analysis of variants) and effec This research using class room action research method in three cycles [8]. Before the research was conducted at the Southern Coastal Community College at Jalan Sudirman, Sago Pesisir Selatan. The research time is done on the even semester of academic year 2015/2016 March to June 2016. The research timing refers to the academic calendar of the South Coast Community College.

Subjects in this study are students of South Coastal Community Academy Prodi Fabrication Technique and etal Welding Year Entry 2015, with the number of students 26 people.

This research applies the strategy of Project Based Learning in Fabrication and Metal Welding Course. The Project-based implementation steps use syntax as the following matrix:

TABLE I. MATRIX STUDENT AND TEACHER ACTIVITIES

No	Fase	Student activities	Teacher activities
1	Formulation of learning outcomes	Pay attention, ask questions and discuss tasks	Briefing the purpose of the project work task
2	Understanding the material concept of the welding process	a. Studying independently of teaching materials and modules in accordance with the courses. b. Discuss with peer and teacher	a. Giving the task of reading the modules and materials concerned with subject. b. Conduct tests
3	Training of welding technique	Practice using a welding machine with a simple object	Demonstration and traning of welding machine operation
4	Project assignment (Project development tailored to the needs of equipment in fabrication and welding workshops)	a. Identify the required equipment in the workshop b. Analyze some discourses related to the project to be created c. Discuss with groups, tutorials with educators.	a. Stimulate the learners to find and identify the required equipment in the workshop b. Provision of project design tasks c. Carry out mentoring tasks, discussions and serve consultation learners
5	Project design	Choose project assignments to be drafted and suggest drafts to educators	Consider the project proposals of learners, provide input and approval
6	Making project design	Create project specification tasks, make working drawings, materials and machinery needed, production costs, work procedures, and safety, design time of production	Provide guidance, direction, consultation and tutorial
7	Finishing design	do and revise project tasks	Approval project task
8	Done the project tasks	a. Preparing materials, machinery and equipment needed b. work preparation c. Carry out work in accordance with SOP	a. Keep an eye on and help learners b. Provide guidance and time for consultation
9	Finishing project and feedback	a. Finishing of project tasks b. Discussion and summarize c. Work report	the final consultation
10	Evaluate processes and products	Following assessment and making a report	a. Give exams and provide feedback to learners b. Provide assessment of test results

Source [9]

Instruments was used for data collection in this study are questionnaire creativity, and assessment sheet. Prior to being used for data collection, instruments were first validated.

Aspects was used to measure creativity are (1) fluency, (2) flexibility, (3) authenticity, (4) decomposition [7]. Number of item of 36. The test sheet has the following lattice:

TABLE II. MATRIX OF TEST INDICATORS

Cycle	Subject	Test Indicator	Number of item
1	Gas Oxy Acytelene	Knowledge of oxy acetylene gas welding material	10
2	Arc Welding	Knowledge of arc welding	10
3	Gas oxy acetylene and Arc welding	Knowledge of oxy acetylene and arc welding	10

[k.] Source [10]

Before using, the instrument was tested Validity and reliability using SPSS version 15.0. The instrument test was given to 22 respondents with 36 items of items, the value of r table 0,423 from the value obtained 33 valid items and 3 invalid items.

III. RESULTS AND DISCUSSION

Effect of blended learning model on students competency obtained from the analysis of two way Anova and effect size. The result of two way Anova analysis is aimed to find out the differences of students competency of experimental class and control class in terms of learning model and learning motivation. Large impact of the application of blended learning on student competence is known from the effect size test results.

A. Difference of experimental class student competence and classroom control

Before analyzing data to know the difference of the students competence of the experimental class and the control class, using two way Anova, firstly tested the normality of data distribution and homogeneity of data. The result of normality of data distribution shows that the competence of the students of the experimental class and the control class before the learning is normally distributed at significance level p = 0,05. Same result for students competence after learning. The results of homogeneity of data shows that the competence of students experimental class and control class before learning is homogeneous (p = 0.05), as well as the students competence after learning.

After tested the average different of the data students competency before learning the result that the average competence the students of the experimental class and the control class did not differ significantly (p = 0.05). Thus it can be stated that student competence before learning is the same in both classes. Difference of students competence after learning obtained from the results of two way Anova, can be presented in Table 1.

TABLE III. RESULT OF TWO WAY ANOVA

Source of Variation	SS	df	MS	p-value
Learning model	7307.846	15	487.19 0	0.0323
Learning motivation	3778.993	1	3778.993	0.0002
Interaction	7121.58	15	474.772	0.0378
Within	15859.32	64	247.802	

Based on the results of two way Anova it can be concluded first null hypothesis is reject, it means that there are differences in learning outcomes of students who conducted learning blended with an student implement conventional learning. Learning outcomes of students who conducted blended learning is better than learning outcomes of students who conducted conventional learning. The result of the second null hypothesis is reject, it means that there are differences in learning outcomes of students have high learning motivation with learning outcomes of students who have low learning motivation. Learning outcomes of the students who have a high learning motivation are better than the students who have low learning motivation. The third null hypothesis is reject, it means there is interaction between learning model and student's learning motivation in influencing the student learning outcomes. This suggests that the model of learning and learning motivation mighty influence on student learning outcomes. The interaction between learning model and learning motivation of students can be presented in Figure 1.

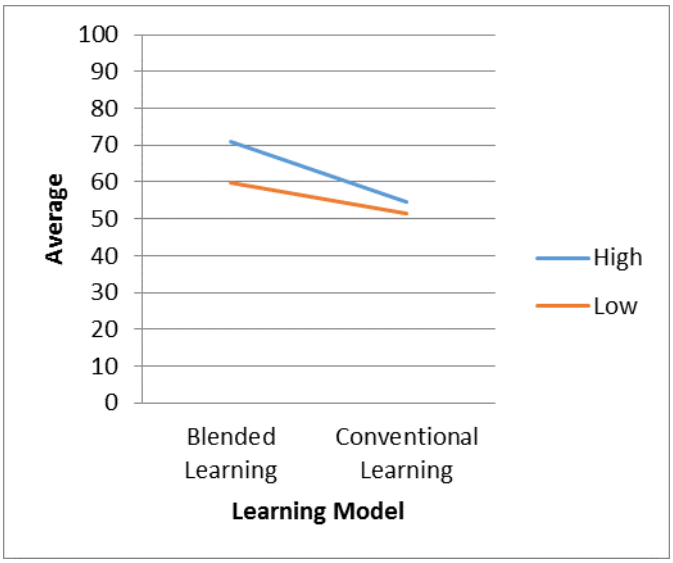


Fig. 2. Interact between modes l learning and student motivation

B. Effect of learning model on student learning outcomes

A large effect on the implementation of blended learning to the student outcomes are calculated using the formula Cohen's effect size, the effect size obtained by 0.99. These results indicate that the effect of blended learning on student learning outcomes is large.

C. Discussion

The implementation of the blended learning model in the learning of engineering physics does not mean reducing the number of face-to-face in the classroom, but to overcome the time limit to discuss the classroom subject matter with face-to-

face. Students can learn and online interact with lecturer or friends. The results showed that the effect blended learning to the competence of students including large categories. This means that blending learning is more effective than face-to-face or e-learning. Blended learning has an impact on students' learning mastery. The students achieve learning mastery 100% and 80% of students give a positive perception to implementation of blended learning [7]. The e-learning can improve reflective thinking skills and mastery of student concepts on chemical bond teaching materials [8].

The blended learning model contributes positively to the implementation of learning [9]. The blended learning model can improve students' motivation and learning outcomes [10]. One form of implementation of blended learning model is the utilization of online materials by teachers in the learning process without involving students [11]. There are no standard rules about blended learning and this can be as the need [12].

The blended activity learning includes the construction of online knowledge in groups, publishing electronic components, components such as collecting virtual ideas, discussion, some form of reciprocity, evaluation and assessment and some other blended techniques [13]. Teachers post messages to the blended learning group as a whole and each individual can provide help as a supporter. Guides for posted students are equipped with assignments, encouraging them to communicate, doing individual exercises, and using the media chosen in the blended learning, they have a facility sharing for their work. Then the tutor controls and assesses online tasks, fills out reports and writes feedback on the activities of the students. Teachers review activities on online learning and students who are at a discretion will be assisted by face-to-face meetings. Then evaluate the achievement of learning outcomes.

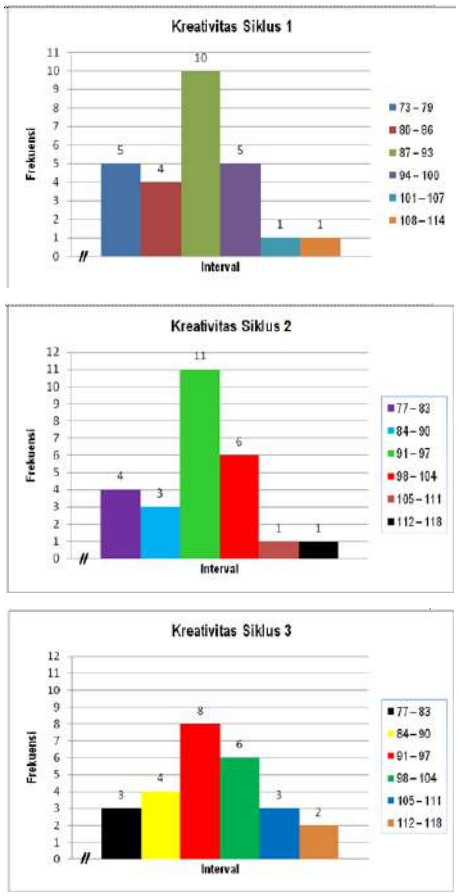
The implementation of blended learning model has an effect on: (1) improvement of student learning quality, (2) improvement of lecturer ability in learning process, (3) learning climate become more conducive, (4) improvement of learning material quality and relevant with stake holder [7]. Blended learning models used is a combination of online learning serves as a complement to face-to-face learning. The results showed that the blended learning model is effective to achieve the learning objectives. Further research found that there are differences in student learning motivation using blended learning model and students using face-to-face learning model, there are differences in student learning outcomes using blended learning model and students using face-to-face model learning, there is increased motivation and student achievement due to the application of blended learning model [14]. The research found that there is an increase in motivation and student learning outcomes after using the blended learning model [15]. The blended learning model is effective from the aspects of student learning outcomes and motivation. From some of this research, it can be concluded that learning using blended model learning can provide a meaningful influence in improving student competence.

The learning motivation can result in maximal improvement of learning outcomes if students are able to combine the motivation that is formed (intrinsic or extrinsic) due to the learning model with the ability to demonstrate its performance [16]. Therefore the application of learning models that have a significant effect on the increase of motivation to learn actually become the basic capital for the next response in the form of improved student learning outcomes. Motivation is a complex psychical factor. The strongest motivation is intrinsic motivation rather than extrinsic motivation [17, 18]. The learning process should be able to create student intrinsic motivation by connecting students' interest and supporting the development of their competence [19]. In addition to applying the learning model to generate motivation externally then lecturers should strive for intrinsic motivation continues to be developed because the motivation is able to give the biggest impetus for the development of student potency become competence.

The research found that learning blended learning can improve students' critical thinking skills [20]. The research found [14]: (1) Student's learning motivation on reaction rate learning with blended learning application is higher than learning motivation by applying conventional learning model. (2) The result of student learning on reaction rate learning with the application of blended learning model is higher than the learning result with the application of conventional learning model. The research on impact analysis of blended learning implementation revealed that through blended learning students and lecturers have 24 hours a day for 7 days to give lectures to students either synchronously or asynchronously [7]. Students can interact with other students and lecturers through the features that exist in e-learning and can be discussed in the classroom. This excellence encourages increased student motivation which directly affects the improvement of student learning outcomes.

Blended learning can train students' ability to adapt to the internet-based learning. The blended learning has advantages compared to the face-to-face learning and e-learning. Blended learning can diversify learning and meet the learning characteristics of students [1, 11]. For example, students who are reluctant to discuss in class may be more active discussion in writing. Blended learning can enhance students' understanding in learning languages [21]. In a number of studies similar findings were obtained [15, 22, 23]. It can also be stated that blended learning has positive effect on the students’ attitudes towards the internet; especially use of the internet for education, research and information This research was conducted in three cycles with the result of measurement about creativity and knowledge competence as follows (Figure 2):

Creativity measurement results



Creativity score on cycle 1, 2, and 3

Fig. 3. Creativity score on cycle 1, 2, and 3

Measurement of Knowledge Competency

TABLE IV. MATRIX OF CRITERIA FOR SUCCESSFUL EACH CYCLE

Cycle	Past			
	< 55 (failed)		*≥ 55 (success)*	
	N	***%***	***N***	***%***
1	5	19,2	21	80,8
2	3	11,5	23	88,5
3	0	0	26	100

In learning cycle 1 creativity of student was obtained in the enough category, then in the 2nd and 3rd cycle of creativity of students into good category. These results prove an increase in creativity from the first cycle until the third cycle. Then the use of application of project-based learning can improve the creativity of students. The studets look more active in implementing learning when implementing project-based learning strategy. If students experience difficulties in completing the project making then they themselves conduct group discussions and if they experience stalemate they directly ask the faculty member of welding practice subjects II.

Implementation of project-based learning strategy can improve students creativities, because this strategy is one of the innovative learning model that involves students actively in building their knowledge, developing the potential of students through a series of processes that help students understand what they learn through acts and facilitates students in realizing ideas and ideas through products with a series of creative and meaningful processes, since basically as Bergius gives meaning to 'productive learning as learning with maximum transfer.

Based on the description that has been submitted it can be shown that the learning model Project Based Learning can lead someone to practice and understand complex thinking and know how to integrate in the form of skills that are often associated with real life, able to utilize the search for various sources, critical thinking, problems with which they will be able to complete their projects. Assignments on the PjBL strategy in the form of project tasks will stimulate all the senses of learners to do the tasks or problems provided by educators, so that learners will be used actively and creatively in solving the existing problems. Thus the PjBL model can result in better creative thinking skills.

Implementation of Project Based Learning model of learning can improve the competence of the students' skills. From the data that has been obtained that there is an increasing number of students who reach the graduation in cycle 1 there are 21 people (80.8%) and 5 people (19.2%) who have not reached the graduation. For cycle 2 the number of students who graduation increased to 23 people (88.5%) and students who have not reached the graduation decreased to 3 people (11.5%). While for cycle 3 the number of students who reached the graduation increased again to 26 people (100%).

Learning outcomes of students can be influenced by various factors such as increased learning activities that have implications for increased learning outcomes. As revealed (Bahri, 1994) that "the factors of learning outcomes can be grouped into two main factors namely factors from within self and factors from outside the student self." These factors can be the level of intelligence, how to learn, talent, time to learn, the burden or task to learn, the level of self-discipline, the application of teaching materials available, learning strategies used and so forth.

Implementation of learning-based project learning model can improve the competence of the students' skills. This is because the method of learning project based learning has been proven to increase the motivation of learners while learning, because in the learning method of project based learning learners are required to be active in learning and trying to complete the project given. Learners will be more passionate about learning because learners are required to work collaboratively in solving a given problem. That's what causes the model of learning-based learning can improve the competence of the students' skills.

IV. CONCLUSION

Based on the research that has been done about the application of learning model of project based learning, it can

be concluded that implementation of project based learning model of learning can improve the creativity of learners in the course of practice las ii and the competence of the students.

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