

The Seven Steps of Project Based Learning Model to Enhance Productive Competences of Vocational Students

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Abstract—this study aims to reveal the effectiveness of the seven steps of Project based learning model (PjBL) in order to enhance the student's productive competences. The implementation of the PjBL model was implemented in two places at different times, there were at *Akademi Komunitas Negeri Tanah Datar* and *Akademi Komunitas Negeri Pesisir Selatan*. Previously, the seven steps of PjBL model was validated by experts judgment and measured by Aiken coefficient significantly (0.796), also this syntax e reliable to be implemented in vocational learning process. The seven steps, consisting of: (1) the formulating the expected learning outcome, (2) understanding the concept of the teaching materials, (3) skills training, (4) designing the project theme, (5) making the project proposal, (6) executing the tasks of projects and (7) presentation of the project report. The study showed that the implementation of seven steps of PjBL, were practice and effective to enhance student's productive competences.

Keyword-Models of Teaching; Project Based Learning Model; Productive Competences

I. INTRODUCTION

The demands of the world of education to produce professional graduates are in line with the development of the industrial worlds; it means that the rapid development of the industrial world are increasingly demanding world of education to produce professional graduates. The demands of education in Indonesia in preparing professional graduates increase with the existence of ASEAN Economic Community (AEC). In the era of AEC, there are fierce competitions between the products of labor and the member of ASEAN countries. Therefore, the quick response and appropriate action must be performed by the world of education to produce professional graduates and to prepare excellent human resources in creating innovative products.

The Indonesian government continues to develop and improve the quality of vocational education and adds colleges which organize vocational educations such as *Akademi Komunitas*. *Akademi Komunitas* is a higher education which runs vocational diploma level one and / or two in one or several branches of science and / or technology-based specific to have local advantages or to meet particular needs [1].

Establishment of *Akademi Komunitas* as vocational education providers can be a breakthrough in preparing graduates who have competence in accordance with the needs of the industry and are able to develop the potential of the region by creating appropriate technologies and innovative products that are economically valuable. The ability of a nation to innovate and to produce a variety of products and services is the key to the success of the nation in improving its competitiveness in the global era as well as a free and open trade [2]. One of the goals of vocational education is to prepare professional labor in accordance with the field of expertise, so that the graduates held at all levels of education are able to face globalization and technological changes that impact on the dynamic needs of industry and society.

Based on the observations conducted in *Akademi Komunitas* in Sumatera Barat, like *Akademi Komunitas Negeri Tanah Datar* and *Akademi Komunitas Negeri Pesisir Selatan*, it was found that several findings and problems, especially in Welding Practice subject, in which the applied learning approach has not led to the making of appropriate technology products to improve and develop the potential areas or innovative products that are economically valuable. Form of the task/job only connecting the two plates, on this condition the student only acquire competence welding techniques, whereas in creating of the product very needed other productive competence. Basically, the process of making a product has complete stage, consisting of identify problem real-world and the challenges development in the people, formulate an idea or ides, design project, make drawing design, make estimates of production, production process, product testing and evaluation of the product.

Responding to the challenges faced by the world of education to produce professional graduates according to the needs of industry and the learning process that is applied during this time on vocational education have not lead the student to make the appropriate technology products that can improve and develop the potential areas or innovative products that are economically valuable, so that it is necessary to develop the learning activities. One of the innovative learning models that can direct students to create project based learning (PjBL). The choice of project based learning teaching is

justified because, as stated previously, it is students centered process that meets students' needs and encourages them to become more involved in their own learning process [3].

Vocational Education

Vocational education is also designed to develop skills, abilities, understanding, attitudes, work habits and appreciation encompassing knowledge and information needed by a worker to enter and make progress in employment on a useful and productive basis [4]. The term vocational education is general and includes every form of education that aims to the acquirement of qualification related to a certain profession, art or employment or that provides the necessary training and appropriate skills as well as technical knowledge, so that students are able to exercise a profession, art or activity, independently of their training level, even if the training program contains also elements of general education [5].

Furthermore [6] revealed that vocational and technical is a program of specialized studies designed to prepare the learner for employment in a particular occupation. Vocational training is generally defined as the part of vocational education that provides the specialized professional knowledge and skills, which attribute professional adequacy to the trainee and are the focus of every vocational training program [7].

Defining of PjBL Model

Opportunity for students to learn constructivist in gaining affective, cognitive and psychomotor competences as a whole through the project task lifted from the real problems. [8] Project-based learning (PjBL) is a constructivist pedagogy that intends to bring about deep learning by allowing learner to use an inquiry based approach to engage with issues and question that are rich, real and relevant to the topic being studied. [9] Project based learning has roots in constructivist learning and discovery-based methods, both of which rely on the inquiry process and students' ability to devise solutions based on their individual perspective and thinking.

In project-based learning, students are the center of learning who are learning actively to improve their competences. [10] Project-based learning is the method that places students at the center of the learning process. [11] Out of these contemporary modern methods, project-based learning or PJBL has been widely recognized as collaborative, progressive, student-centered, interactive, active and deep learning approach, particularly for engineering education.

Learning resources on project based learning models is multidimensional. The project task is lifted from the real problems to provide opportunities for students to improve their ability and to understand the implementation of the competence that is being studied. [12] Project based learning (PJBL) provides opportunities for students to build these qualities, as well as more deeply learn traditional academic contents and understand how it applies to the real world.

The Seven Steps of PjBL Model

Implementation of the PjBL model is make condition the learning process by following of the syntax, thus creating interaction between teacher, students and instructional media according to the characteristic of the PjBL Model. The syntax of PjBL model can be seen in Figure 1.

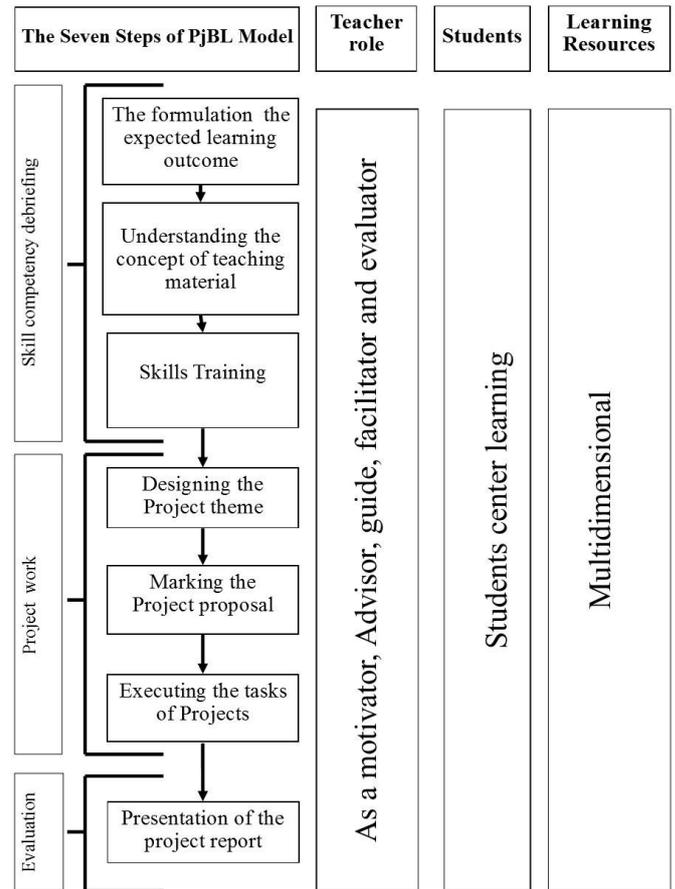


Fig.1. The Seven Steps of PjBl model

The seven steps of PjBL model was designed and developed by Nizwardi. This model was validated by expert judgment with Aiken coefficient 0,796 and this model reliable to be implemented in vocational learning process [13]. The seven steps of PjBL model consists of three main stages (primary) then they are broken down into seven stages (secondary). The primary stages consist of 1) skill competences debriefing, which aims to make students have an understanding about the expected outcome capabilities, have a high motivation because their project task to be solved in the real-world, have an understanding the concept of teaching material, and have the skills of essential learning content conducted, 2) Project work, the student assignment as a project work in PjBL model lifted from real-world issues and processing of work stages realistic to a real workplace and relevant to learning outcome, and 3) evaluation, aims to reveal the achievement of the learning process and students competences, so that it becomes a matter for assessment and evaluation. More details of the seven steps of project-based

learning model about the role of faculty, student interaction and learning resources are listed below.

A. The formulation of expected learning outcomes

This stage provides information and exploration by teacher and student's interaction about the learning outcomes obtained and exploration of the relevance of study materials are being studied relate to the real world (the needs of industry and project tasks from the real problem). In this part it can be by with the contextual teaching and learning approach. Contextual teaching and learning is a conception of teaching and learning that helps teachers relate subject matter content to real world situation; and motivates student to make connections between knowledge and its applications to their lives as family members, citizens, and workers; and engage in the hard work that learning requires [14]. Project-based learning puts a motivating and meaningful real-world task in the center of the student's attention [15]. Students need to be directed to discuss the problems emerged in their environment (real-world), so that their science of concern growing sense and have high motivation to solve the problem.

B. Understanding the concept of teaching material

Understanding the concept of teaching material is to debrief knowledge to students. The role of the teacher is to instruct students to study modules and guide them in a class discussion. Students must be involved actively in discussions about materials being study. The cooperative was applied at this steps. The cooperation based learning-teaching environment of the study provided cooperative learning environment, supported permanent learning, provided opportunities to be successful, contributed to the development of social and personal skills, but caused students to worry as it requires students to be successful at all stages [16]. Cooperative learning stimulated cognitive activities, promoted higher levels of achievement and knowledge retention [17]. In this study we developed learning model as an instructional media.

C. Skills training

Vocational training technique or operation of the machine intended to make students master the essential content of the technical or operational machinery of the subjects taught and debriefing practice skills before students carry out project tasks. The learning method on providing technical and operational skills training machines can be done through demonstration and practices.

D. Designing the project theme

The early stage of designing theme is the teacher and students discuss and identify real-world problems or challenges that arise in areas where the school or college is located. The primary reason for project-based learning (PjBL) is a need to adapt to a changing world [18]. The argument is that students should strive in an environment centered on learning instead of on teaching. Identifying potential areas can be done through surveys, interviews with certain society and

student about problems or challenges that developed in each area. Students identify real problems to pursue and they investigate them through real-world sources of information (e.g., interview, internet sites, magazine articles, primary sources) [19]. From some of the problems or challenges that arise in areas that have been identified, a teacher with students select and define what the real-world issues that will be serves as the theme of the project tasks.

Furthermore, students are divided into groups. In each group, students discuss what products to be offered in order to solve a problem in the area (real-world) or to produce an innovative product that can be worth economically, and take decision about the products that will be their project. After deciding the products, the students submit a draft proposal to the teacher who then gives suggestions, feedback, consideration and approval toward the proposal.

E. Making the project proposal

In this stage, the proposal of project tasks is created, it consists of:

1. Problems and solutions
2. Framework
3. Estimated Production
 - a. List of materials, consumables, and costs
 - b. List of machines and machine costs/hour
 - c. Estimated production activities and costs

In designing the project, the considerations are the availability of student consumables and machine facilities owned by the school. The following factors should be considered while selecting the material: 1) Availability of the material, 2) Suitability of the materials for the working conditions in service, and 3) the cost of the material [20].

F. Executing the tasks of project

The execution of project the tasks are practical activities to students with good teamwork to show performance quality and to solve problems related to the project to realize the project design into a real object. The role of the teacher at this stage is to become a mentor, tutor, supervisor and evaluator to allow students to carry out the learning process through inquiry process and constructing work on project tasks they are doing. In executing project tasks, students work in accordance with the estimated production activities, safety priority, solid teamwork and consultation to teachers if any problems are found. successful in a job these days often implies being capable of operating in ill-defined and ever-changing environments, dealing with non-routine and abstract work processes [21].

G. Presentation of the project report

Student presented the process of the worked and results of the project tasks at a seminar in the classroom at the end of the lesson, discussions between teachers and students about the deficiencies in the process and the results of projects that have been implemented, and teachers interpret students' mastery of the project tasks have been carried out. Last seminar focused on the discussion between teacher and

students [22]. Student presented own perception, the evaluated each other. They suggested improving of own presentation, said about mistakes. Teacher summarized own view and evaluation of evaluators.

Teacher Role in The PjBL Model

The teacher's role is not as dominant as it approaches the model of project based learning is student-centered. Teachers act more as a guide, adviser, motivator, facilitator (if in the lab or workshop teacher collaboration with laboratory assistant) and evaluator. Project based learning focuses on a real-world problem, learner must assume responsibility for their own learning, the teacher's role becomes that of a guide or facilitator, and the deliverable must relate the learner's life and/or career [23]. The main point of the PjBL model is how teacher or instructor facilitated student to work individual or in group to find out our solved the real problem of the project being studied.

Assessment carried out by the teacher during the learning activities and evaluated each end of step model of project-based learning, with the aim to measure the progress of student competence and as a reflection for the next step. [24] Assessment as part classroom activities is a fundamental process required to promote learning and ultimately achievement. Project are an ideal vehicle for inviting students to demonstration their understanding through a broad-based assessment approach Assessment *for* (process of learning), *as* (learner-critical reflection) and *of* (summative) learning are integral to project-based learning [25]. Therefore teacher of evaluation has to figure out the student progress, step by step of learning process and draw the portfolio the student competence being achieved

II. PRODUCTIVE COMPETENCES

Reveal that productive competence can be defined as an ability that can be used to produce parts or component machine in a production machine work [26]. Productive competence required in the project described in Table I.

TABLE 1. PRODUCTIVE COMPETENCES

Indicator	Sub indicator
1. Identify the real world problems or challenges that develop their people and its solution.	1.1 The ability to identify a real world problem that is relevant to your area of expertise that is being studied.
	1.2 The ability to formulate solutions solving real-world problem.
	1.3 The ability to design the concept and specification of component, tools or machines that will be the task of the project so that it can solve real-world problems.
2. Making of proposal project	2.1 The ability to make the introduction of proposal project.
	2.2 The level of functionality and benefits of a tool or machine that has made.
	2.3 Literature review and working principles of the device or machine designed.
	2.4 The ability to make shop drawing.
	2.5 Ability to draw up estimates of

Indicator	Sub indicator
	materials in accordance with shop drawings and project assignments that removed. 2.6 The ability to make estimates of machine required for the project. 2.7 The ability to make estimates stages of processing of project tasks.
3. Executing the tasks of project	3.1 The ability to prepare the materials, tools, and machines that needed. 3.2 The ability to use the tools and machines that accordance with SOP. 3.3 The ability to manage the work step in accordance with the systematics of work. 3.4 The ability to manage the time of project to accordance with the agreed time. 3.5 The ability to cooperate in the team work. 3.6 The work attitude that show as long as project.
4. Making of project reports	4.1 The ability to draw up the project report systematically. 4.2 The ability to select the communicative language. 4.3 The completeness and authenticity of the contents of the report.

III. EFFECTIVENESS

This study is an effort to reveal the effectiveness of seven steps of PjBL model to enhance students productive competences, conducted in two places at different times, were: 1) Akademi Komunitas Negeri Tanah Datar (AKNTD) with a group of 10 students, and 2) Akademi Komunitas Negeri Pesisir Selatan (AKNPS) with a group of 26 students. The method used is action research of the course of welding practice. The productive competences of student disclosed by using project assessment with indicators and aspects that described in table I. The average result of the assessment productive competences of AKNTD students show in figure 2 and the average result of the assessment productive competences of AKNPS student show in figure 3.

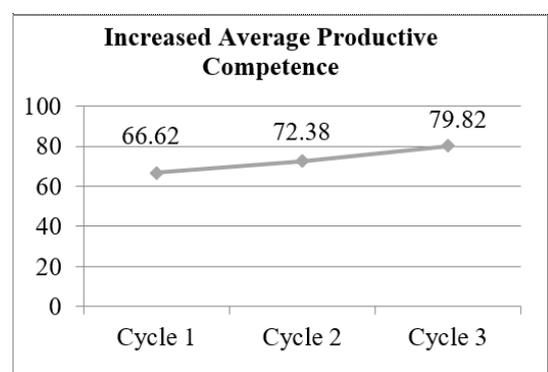


Fig. 2. Productive competences students AKNTD

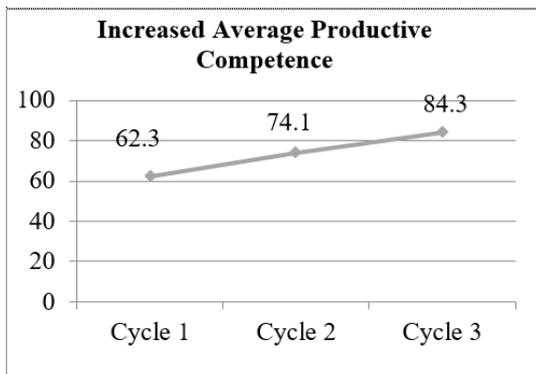


Fig. 3. Productive competences students AKNPS

Generally, the conclusion of two studies conducted showed that in the first cycle, the productive competence of students are in the low category, it caused that the step of project task, like create proposal project, the executing of project task, and create the project report, was a new thing and most of them was difficult to implement.

In the second cycle, the productive competences of student's improved, it was caused in which students already experience in previous cycle. Students showed finished every steps of project tasks. Tasks implementations, project in PjBL Model carried out systematically by adopting the form of factual work in industry, in accordance to the competence of learning outcome.

In the third cycle, the productive competence of student still increase. Task project activity which has been done by students in seven steps of PjBL Model be a useful experience for them. The most valuable aspect as the project variant is the real work application of the theory, students have opportunity to explore and practice design skill and peer learning were guarded by student. So that based on seven steps of project create on design project work make a proposal, calculated the cost doing the project and presented report. The real-world application of theory, the opportunity the explore and practice design skills, and peer learning were regarded by the student as the most valuable aspects of the project experience [27].

The significant improvement that occurred in ability doing project work, skilled student in preparing the materials, the equipment and machine in accordance with procedure, managing of work, managing of time, cooperation with team work more solid and show better work attitude. So that, assumed that implementation PjBL model with these seven steps so effective is used to improved productive competence on vocational education. project-based learning has become an ideal method to anticipate future professional practice for training engineers [28].

IV. CONCLUSION

Based on results of research and refer to aim of this research. So, this research can be concluded:

1. Project based learning model (PjBL) with seven steps have been defined can help to improve learning activity that have meaningful for students. In the framework of PjBL that applied, more focus to activity that done by

them. So that, students have the real learning experience in accordance with the existing problems and needs.

2. Implementation of project based learning model (PjBL) with the seven steps that applied is so effective to improve productive competence of students. This is illustrated by to ability to identify and formulate the problems, and designing the project to solve the real world problems, the ability making project proposal, skillfully in doing the project and can prepare the project report.

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