

IMPLEMENTATION OF THE PjBL MODEL TO ENHANCE PROBLEM SOLVING SKILL AND SKILL COMPETENCY OF COMMUNITY COLLEGE STUDENT

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Abstract

The research aims at enhance problem solving ability and competency skills of students. The method used was classroom action research in the course of welding practice with a group of 10 students. The research data obtained from the problem solving skills assessment interview techniques, competency skills gained from the project assessment and a written test, and the improvement data were analyzed using average gain (g). PjBL model provides students the opportunity to solve the problems of the real world by creating innovative works through their project work. PjBL model provides opportunities and experiences for students to solve the problem so the next project the students already have experience and ability to make decisions about what effort needs to be done to solve the problem. The power of thinking ability in solving the problem implications for increasing student competency skills, because any problems found can be resolved properly so that the process and the work of students increased for the better. From these results be obtained conclude the implementation of project based learning models can enhance the problem solving ability and competency skills of students.

Keywords: *project based learning model, problem solving, skill competency*

INTRODUCTION

Mechanical Engineering of Diploma Program II Akademi Komunitas Tanah Datar (AKNTD) serves as preparation of manpower qualification level 4 (four) Indonesian National Qualifications Framework in the industrial sector manufacturing services belongings metal. Vocational education with the form of Academy Community is one of the government's new policies to face the free market or the ASEAN level, known as the ASEAN Economic Community (AEC). As a new vocational education institutions, to the need for efforts to improve the learning process to be able to produce graduates who are competent in accordance with the needs of business and industry, and have high competitiveness to face the intense competition in the era of MEA's work.

Based on observations in the learning process of welding practice in Mechanical Engineering AKNTD learning approaches that do still provide task/job in the form of exercises and positions the welding process of welding. In this learning approach students tend to be passive and less motivated in doing the task/job made. Students just do what is instructed and in accordance with the framework set by the lecturer. In conditions like these students the opportunity to discover and build knowledge itself does not exist.

Likewise, when students have problems related to the field of welding being studied, always professors who perform problem-solving efforts. It is of course the student has not had the opportunity to develop the ability of thinking in solving problems. Sudjana (2010, p. 115) suggest that "The learning activities should focus on solving problems due to face the problem of learners will be encouraged to use creative thinking and working intensively to solve the problems faced in life".

Basically, the process of making a product has the stage a complete, includes identifying a growing problem in society or market demand, formulate an idea or ideas, designing a product, create working drawings, make estimates of production, the production process, carry out product testing and evaluating products. In each phase of work of course there are some problems or issues to be addressed. Thus the problem-solving abilities should be owned by students. Regulation of

education and culture minister of government Indonesia No. 49 2014 explained that the diploma II shall have general skills, namely "Being able to solve the problem with the nature of work and the usual context, and to implement and independently responsible for the results" (Menteri Pendidikan dan Kebudayaan Republik Indonesia, 2014) .

Judging also from the value of competency skills of students in the last three years in the course of welding practice there are still many who received grades of C + to E, with the amount of approximately 66.67% for the class of 2012, 60% for class of 2013, and 60% for the class of 2014. According to Sudjana (2002, p. 39) "learning outcomes are achieved is influenced by two factors. Factors within the student which is a change of its capabilities and external factors, namely the student environment of the most dominant form of quality of learning".

Attempts to solve the problems related to applied learning approach has yet to develop problem-solving abilities of students and still the number of students whose grades C + to E is to apply the model of project-based learning (PjBL). As revealed by Rais (2010, p. 251) states "The PjBL model of student demands creativity which is above the average, such as a high learning motivation, attitude that learn some vital collaborative lessons, good problem solving ability, and self-learning (self regulated) ". So is the case with the opinions Jalinus & Ramli (2016, p. 5) that "The PjBL model provides opportunities for learning systems that are learner-centered, more collaborative, learners are actively in-volved complete projects independently and work together in teams and integrates real problems and practical.

One thing that is interesting is why it is important to apply the PjBL model as an effort to improve the quality of the learning process is itself in the results of Shinde (2014, p. 211), which found that "the students found that the PjBL environment was useful for developing skills such as communication, teamwork, and project and time management ". Further Uziak (2016, p. 122) states that "The PjBL emphasizes the development of engineering skills by providing real life engineering problems. Therefore, engineering students who Participate in project work should have a better picture of the engineer's

job. It can be concluded that the project-based learning is the best way to fulfil industry needs".

Milentijevic, Ciric, & Vojinovic (2008, p. 1331) explains that "The PjBL is a constructivist pedagogy that intends to bring about deep learning by allowing learners to use an inquiry-based approach to engage with issues and questions that are rich, real and relevant to the topic being studied". Wena (2012, p. 144) explains that the project work on the PjBL model that "project work contains complex tasks based on questions and problems (problem) is challenging, and requires learners to design, solve problems, make decisions, investigations, and provides the opportunity for learners to work independently". In more details, it can be concluded that the PjBL model is an innovative learning that can be applied to practical learning with a focus on the learner in which learners are given the opportunity independently develop cognitive abilities, affective and psychomotor being integrated in a project tasks derived from real-world problems in accordance with the curriculum and the learning is done as directed by placing the lecturer as a motivator, consultant and facilitator.

To achieve the goal of learning to produce graduates with high competitiveness, hence the need for an improvement in the learning process. Effective learning method in accordance with the characteristics of the subjects is key in achieving the objectives of the intended learning.

Noting the unique characteristics and comprehensive, the PjBL model potential enough to meet the demands of the learning. As the opinion of Sani & Joko (2015, p. 260) "To help develop soft skill learners, including learners need to be given a problem-solving skills, technical skills, and cognitive skills, the learning method centered on the learner as a PjBL model is right". More Ergül & Kargin (2014, p. 541) states that "the most important characteristics of the PjBL method to increase of Reviews their students Achieving success are making available a method of teaching a student Including acquisitions and implementation a teaching method where students will be responsible for Reviews their own learning".

Based on expert opinion it can be concluded that the PjBL model potential enough

to prepare soft skills and hard skills students in the face of fierce competition world of work. The knowledge and skills students develop because in the PjBL model students learn to work to make a product is lifted from the real world and the stages of his work was adopted from the real work of the industrial world in accordance with the competency skills being learned by the student. So for that it should apply the PjBL model lecturer in learning activities, in order to produce graduates who are ready to face the world of work.

Jalinus & Ramli (2016, p. 150) developed syntax PjBL model for vocational education with a seven-steps learning process, namely: (1) the formulation of expected learning outcomes (2) understanding the concept of teaching material, (3) skills training, (4) the design project theme, (5) Making the project proposal, (6) executing the tasks of project, and (7) presentation of the project report. The role of lecturers in each step PjBL models are translated as follows:

- 1) the formulation of expected learning outcomes, the role of the lecturer is as follow: (a) explain and discuss with students about the learning outcomes of the course, (b) to explain and discuss with the students about the relevance of competence under study industrial world, and (c) explain and discuss with students about problem-solving or emerging challenges and relevant to the scientific community that is being studied as well as the role of education in solving the problem.
- 2) Understanding the concept of teaching material, the role of the lecturer is as follow: (a) forming a study group of students, (b) distributing material/sub material of study materials for the task discussions and student presentations, and (c) instruct the students to present the assigned material and guiding students to carry out discussion.
- 3) Skills Training, the role of the lecturer is to provide training to students with the following steps: (a) demonstrate technical or professional workers like a machine operating without explaining tips work, (b) demonstrate a technique or operation of machinery like professional workers to explain tips work, (c) instruct a student to practice engineering or operation of the

machine, guiding students, giving the question rationally to these students about engineering accomplishments and evaluate the work done by the student, and (d) instruct students to practice engineering or operational machinery, guiding, and evaluating process overseen the work done by the students.

- 4) Designing the project theme, the role of the lecturer is as follows: (a) guide students to discuss problems or challenges that developed in the community, (b) discuss and establish the theme of the project task as an attempt to solve real world problems, (c) dividing the task group student projects, and (d) instruct students to discuss and define what a machine, tool or machine component that will be the task of the project in accordance with the theme of the agreed project tasks.
- 5) Making the project proposal, the role of the lecturer at this stage is (a) instruct the students to propose duties of their project, providing input and approved the proposed project tasks students, (b) instruct the student to make a proposal project task, the framework of the proposal shall be composed of, background rear, objectives, working drawings and estimates of production, and (c) guide students to make proposals and give approval to the proposal of students who had met the criteria to be able to continue to work on the assignment of the project.
- 6) Execution the tasks project, the role of the lecturer at this stage is to guide, motivate, overseen, and evaluate each work process at stages of processing tasks performed by the student project.
- 7) Presentation of the project report, at this stage the lecturer instructs students to present the report and the product of the project tasks that have been implemented.

To solve the problems that occur in learning, the opinion of some experts and the results of previous research on the application of the PjBL, the implementation PjBL model in research conducted in the course of welding practice. The purpose of this study was to reveal whether the application of the PjBL can enhance the problem solving skills and

competencies of students in practice welding of Mechanical Engineering of Diploma Program II AKNTD.

METHODS

Type of research is a class action research. Subjects in this study were college students of practice welding Mechanical Engineering AKNTD with a group 10 student who are all male and actively enrolled in the second semester of 2015-2016. Factors to be examined in this study are: the learning process is carried out by implementation the PjBL model as an effort to enhance the problem solving skills and competencies of students.

For optimal research implementation PjBL model in the practice welding researchers used tools of learning consists of Handbook Lecturer (lesson plans semester/RPS and the unit of reference learning/SAP) as a guide lecturer in creating and managing classroom-based on PjBL model, and Learning Modules welding Practice voted handle student learning and as a source of student learning which has been validated by three experts. The results of the validation by three experts on learning tools that have been developed with Aiken's V coefficient of 0.78, it can be concluded that the learning device Practice Las subjects with PjBL-based models belong to the category valid.

To reveal the problem solving ability of students researcher using valuation techniques guided interviews. According Sudijono (2009, p. 82) "In guided interviews, evaluators conduct debriefing with the students by adhering to the interview guide beads item consists of things that are deemed necessary". Guided interviews conducted by researchers using an interview guide that aims to reveal what problems are found students in project work and how the problem-solving efforts undertaken by the student and the subsequent problem-solving efforts undertaken by students to do the assessment.

Competence is the ability of one's expertise observed include knowledge, skills, work attitude and products as a results of students in accordance with the working standards of expertise. To reveal the student researcher competency skills using project assessment rubrics and techniques written test

about the shape of the description. Data assessment of the project and the written test were analyzed using 2:1 ratio. Rationalization weighting have been selected for the practice of welding is a subject with a credit load of 2 credits of practice and 1 Credit theory.

Indicators of success of the action in this action research is the increasing problem-solving ability and competence skills of students from one cycle to the next cycle. For expressing increased problem-solving ability and competence skills of students from one cycle to the next cycle used average gain $\langle G \rangle$ as follows (Hake, 1999, p. 1):

$$\langle g \rangle = (\% \langle S_f \rangle - \% \langle S_i \rangle) / (100 - \% \langle S_i \rangle)$$

Criteria for the increase in use:

High gain $\langle g \rangle > 0.7$

Middle gain $0.7 > \langle g \rangle > 0.3$

Low gain $\langle g \rangle < 0.3$

RESULTS AND DISCUSSION

Improvement of student's Problem Solving Ability

Assessment results of student's problem solving skills are presented in Table 1.

Table 1. Problem solving abilities of student

| No. | Students | First Cycles | Second Cycles | Third Cycles |
|----------------|----------|--------------|---------------|--------------|
| 1 | DA | 56,66 | 76,66 | 86,33 |
| 2 | ENS | 53,33 | 73,33 | 83,33 |
| 3 | FR | 73,33 | 76,66 | 90 |
| 4 | FA | 66,66 | 73,33 | 83,33 |
| 5 | GRR | 66,66 | 73,33 | 83,33 |
| 6 | GR | 56,66 | 76,66 | 83,33 |
| 7 | MAH | 66,66 | 73,33 | 86,33 |
| 8 | R | 53,33 | 73,33 | 86,33 |
| 9 | A | 56,66 | 73,33 | 83,33 |
| 10 | YS | 56,66 | 76,66 | 86,33 |
| Rata-rata | | 60,66 | 74,66 | 85,33 |
| Gain Score (g) | | | 0,35 | 0,42 |

In the first cycles students problem solving skills have not reached either category, based on data from interviews first cycles is found students who do not make the effort troubleshooting upon finding problems in making the working drawings, production

estimates and reports on their project tasks, so that the assessment students problem solving skills 60.66.

In the second cycles of problem-solving ability of students increased to 74.66. It can be concluded that the application of the results of the reflection of first cycles in second cycles effectively improve problem-solving abilities of students, the student should be able to carry out the project tasks systematically according to the syntax of project tasks. Implementation of the project tasks in the PjBL model is carried out systematically by phase of work on the real work of the business or industry in accordance with the competencies of learning, when in one stage have problems or problem then the issue must be solved beforehand in order to proceed to the next stage and is not a new problem arises. In this course by itself encourage students to solve any problems that are found so that the project tasks can be resolved properly.

In the third cycles student's problem-solving skill increased to 85.33, an increase problem-solving ability of students in third cycles of the interview can be concluded that the students already have experience in solving the problem, so that students are able to solve problems better than before. Activity solving the problem that has been done by the students in the PjBL model into the experience and the experience documented in the report of their project, so the document troubleshooting on the report can be used as a database in order to prevent or mitigate the problem and as a material consideration in the decision to solve the problem on the next project.

Based on the calculation of average gain $\langle G \rangle$, increase problem-solving ability of students between first cycles and second cycles is obtained an increase or gain (g) of 0.35 with the criteria of a modest increase and improved troubleshooting capabilities in second cycles and third cycles of 0.42 with criteria modest increase. Of the phenomenon of an increase in problem-solving ability of students from first cycles to second cycles and third cycles it can be concluded that the PjBL model effectively improve problem-solving skills of students by providing opportunities for students to be able to solve problems that they find themselves in the execution of projects and stimulate students to solve each problems found that the project tasks can be

resolved properly. This is in accordance with the opinion Jalinus & Ramli (2016, p. 8) "The PjBL provides students the opportunity to solve the problems encountered when working on a project to take bold decisions". Likewise, research results (Kaya, Şenyuva, Işık, & Bodur (2014, p. 384) states that "*The PjBL model Might Be regarded as an individual improving approach and team work, creative and critical thinking, problem solving and decision making skills of nursing students*".

Improvement of Students Competency Skills

Student competency skills Data obtained from data on project assessment and a written test, shown in Table 2.

Table 2. Competency Skills Student

| No. | Students | First Cycles | Second Cycles | Third Cycles |
|----------------|----------|--------------|---------------|--------------|
| 1 | DA | 62,13 | 69,27 | 80,4 |
| 2 | ENS | 58,53 | 69,61 | 78,31 |
| 3 | FR | 65,33 | 74,56 | 80 |
| 4 | FA | 71,93 | 71,67 | 78,97 |
| 5 | GRR | 68,8 | 75,03 | 79,64 |
| 6 | GR | 64,93 | 68,46 | 78,31 |
| 7 | MAH | 73,67 | 76,02 | 82,82 |
| 8 | R | 68,57 | 71,15 | 79,33 |
| 9 | A | 63,8 | 70,64 | 79,33 |
| 10 | YS | 68,53 | 77,43 | 81,17 |
| Rata-rata | | 66,62 | 72,38 | 79,82 |
| Gain score (g) | | | 0,17 | 0,27 |

In the first cycle of the average student competency skills at 66,62, increase in the second cycles to 72.38 and the increase in cycle 3 to 79.82. Based on the calculation of average gain $\langle G \rangle$, increase student competency skills between first cycles and second cycles is obtained an increase or gain (g) of 0.17 with low criteria, and increase student competency skills in second cycles and third cycles by 0.27 by criteria lower increase.

Increased student competency skills are influenced by various factors, such as increased problem-solving ability of students has implications for increasing student competency skills in project work. It is known from project assessment, and interviews that have

been conducted, can be conclude when students find problems in the realm of knowledge and skills required to complete the project, students can solve these problems because they already have experience of how to do a problem-solving efforts, so the task project can be resolved properly. From the results of the written test of knowledge of students also increased, activities of project tasks easier for students to understand the concepts and scientific theories being studied. As revealed by Jalinus & Ramli (2016, p. 7) "As a constructivist learning, learning in a situation PjBL presents a real problem for the students so that they can give birth to knowledge that is permanent".

From observations and interviews that have been conducted, researchers also found that the PjBL model not only gives students an opportunity to master the essential content of the lessons they learned, but also stimulate students to master competencies that are required to re-learn other subjects or learning to lecturers another accordance with the competencies needed to complete the project tasks. The task of the project has a complete phases of activities, so it also requires a complete competence in order to completion of the project tasks well.

Results peak of project tasks on the PjBL model is a product made by students who are economically valuable. The results of student work product is shown in Figure 1 and Figure 2.



Figure 1. Motorcycle Exhaust as a Result of Student's Project



Figure 2. Game Media for Kindergarten Kids as a Result of Student's Project

Game media for kindergarten is product of student works on welding practice this demand by the public, the product was purchased by one of the government agencies. Another interesting point is the government agency also adds to the manufacturing orders kindergarten's game to students. Getting a chance like that students agreed to take the project offered. To find out what makes students able to take the project researchers conducted interviews to some students and the results of the interview can be researchers conclude that students are confident to be able to work on the project of the order of society, because they already have the knowledge and skills as well as experience in working on a project.

Based on these circumstances it can be concluded that the application of the PjBL model to make students confident to be able to work on projects from requirements or evolving challenges in the community in accordance with the scientific field. This is in line with the opinion of Jalinus & Ramli (2016, p. 8) "The PjBL is a working project which tasks the student or students to be able to overcome the real problems and issues of public importance outside the classroom, which they design projects emerging from important issues and required the community, but also to answer questions in the hearts of the students that they need competencies associated with growing issue".

According to the constitution of the Republic of Indonesia Number 12 of 2012 on

Higher Education article 1, paragraph 11 "Learning is a process of student interaction with faculty and learning resources in a learning environment" (Presiden Republik Indonesia, 2012). The PjBL is a systematic learning model, which involves students in learning knowledge and skills through the process of searching / extracting (inquiry) long and structured to authentic and complex questions and tasks and products designed with the utmost –heart (Direktorat Jenderal Pendidikan Tinggi, 2014, p. 62). Jalinus & Ramli (2016, p. 8) "Students are actively involved in learning and making the right choice as their project, project work that provides a space for students to choose and be creative even though they are still required to master the essential content of this lesson".

Excerpts from the Constitution, DIKTI and Nizwardi and Ramli means that the interlocking between the three main components of a learning environment, students as those who study more actively develop the skills of knowledge, attitudes and skills through interaction with faculty, peers, media learning and the environment and project tasks are removed from the regional potential to be richer and more meaningful learning experience. Lecturers as those who teach can implement the PjBL as models in the learning activities, because not only the ability of students are increasing but also the ability of professors, as the opinion of Jalinus & Ramli (2016, p. 8) "The PjBL also help the educator as co-learners to get experience students learn from the project".

CONCLUSION

Based on data analysis and research conducted, it is concluded that:

First, the PjBL model was implemented to the welding practical learning can improve student problem-solving abilities. Conclusions drawn from the analysis of assessment data, student problem-solving ability that has been done, that found an increase in problem-solving ability of students gradually next first cycles to cycle in the research that has been carried out.

Second, implementation of PjBL model to the welding practice is able to improve student competency skills that include knowledge, skills, work attitude and products

as a result student. Conclusions drawn from the analysis of the assessment data that has been done, where the increase in competency skills of students from first cycles to a subsequent cycle.

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