VANOS
JOURNAL OF MECHANICAL ENGINEERING EDUCATION
http://jurnal.untirta.ac.id/index.php/vanos
ISSN 2528-2611, e-ISSN 2528-2700
Vol.2, No.1, Juli 2017, Hlm.1-10.

IMPLEMENTATION OF PROJECT BASED LEARNING MODEL FOR IMPROVING STUDENTS LEARNING OUTCOMES OF ADVANCED MACHINING ENGINEERING IN UNIVERSITAS SARJANAWIYATA TAMANSISWA

Setuju
Mechanical Engineering Education, Faculty of Teachers Training and Education,
University of Sarjanawiyata Tamansiswa
Jl. Kusumanegara No. 157 Yogyakarta 55165
setuju@ustjogja.ac.id

Received: 1 Juni 2017. Accepted: 1 Juli 2017. Published: 30 Juli 2017

ABSTRACT

This research was conducted to improve learning outcomes through project-based learning model in the course of advanced machining in the department of Mechanical Engineering Education. This research was motivated by the low students learning outcomes in the advanced machining course, whereas the results of the study subjects was the vital thing for the students who will have production expertise. The research method was Classroom Action Research (CAR) with Kemmis and Mc Taggart model, by pointing in cycle, and consists of four stages: planning, implementation, observation, and reflection. Subjects were student of Mechanical Engineering Education production option that follows the advanced machining course for academic year 2014/2015. Data were collected by instruments such as observation sheet during the action takes place, the observation sheet practical activities for learning outcomes. Data was analyzed using quantitative descriptive. Project Based Learning (PjBL) model can improve learning outcomes in affective and psychomotor abilities of students. The increase in affective reaches 9.41 and psychomotor abilities enhancement from the first cycle to the second cycle reaches 6.6.

Keywords: project based learning, learning outcomes, student

INTRODUCTION

The quality of graduates has relevance to the needs of the field, professionalism and quality oriented and oriented to the Indonesian national qualification framework (KKNI). This course requires all parties or stakeholders who are mutually supportive synergies in the noble goals of the study program. Learning process is one of the most important elements in the process of achieving that goal. Student learning outcomes are an interpretation or benchmark of the achievement of student competence, thus in achieving student learning success required a variety of innovations in learning, both courses that are theoretical and practical.

Machining course is one of the subjects that must be taken by students of production machine production engineering education. Subjects that have 3 credits with a load of 1 credits theory and 2 credits of practice. Students in advanced machining courses are required to solve problems, plan or design, manufacture certain components or products.

Judging from the weight of SKS can be seen that the psychomotor competence becomes the orientation of learning.

During this advanced machining course learning, has been attempted well. Lecturers have given job sheets for the direction of practice activities. The effort is felt by lecturers need to be improved so that students' opportunities in creating and thinking more broadly and students can be more active in planning and determining the work steps, not just doing. Based on the results of thought and consideration, the effort that will be taken to improve the quality or the result of student learning in advanced machining courses are the application of Project Based Learning (PjBL). In the application of this learning model, the students will be invited to perform the learner's performance in collaboration with the lecturer acting as client / order provider, solving the problem by discussing with fellow student or lecturer, planning, organizing, negotiating, and making step in making the product systematically.

The problem in this research is how the implementation of the PjBL model to improve student learning outcomes in advanced machining courses in Engineering Education Department of UST academic year 2014/2015. So, this study conducted to improve student learning outcomes through PjBL in advanced machining courses in Mechanical Engineering Education

LITERATURE

Machining course is one of the subjects that must be taken by students of production machine production engineering education. Subjects that have a weight of 3 credits with a load of 1 credits theory and 2 credits of practice. Students in advanced machining courses are required to solve problems, plan or design, manufacture certain components or products. Judging from the weight of SKS can be seen that the psychomotor competence becomes as the orientation of the learning.

One of the competence standard in advanced machining course with lathe or turning are: (1) to determine the working requirements with the indicator: identify the lathe parts and their functions, read the working drawings, execute and create a sequence of work processes, identify the type and number of equipment corresponding to the type of work; (2) to lathe by using all machine aids with indicator: perform the installation of work piece correctly, calculate the speed of the engine rotation in accordance with the diameter of the work piece lathe facing (facing), drill with a lathe turning machine; (3) to tapered with indicator lathe: checking the outer and inner thinner with the correct procedure; and (4) to lathe screw triangle with indicator: perform threaded triangle unit screw metric and inch according to standard specification requested working drawings with the correct procedure.

Project Based Learning (PjBL) according to the Project Based Learning Guideline (MONE 2011) is a learning method that uses projects / activities as a medium. Learners do exploration, assessment, interpretation, synthesis, and information to produce various forms of learning outcomes. Bell (2010: 39) argued that "Project Based Learning is a key strategy for creating independent thinkers and learners. Children solve real-world problems by designing their own inquiries, planning their learning, organizing their research, and implementing a multitude of learning strategies".

Wena (2011: 145) suggests that "Project-based learning as a learning model involving learners in knowledge transfer". PjBL resembles with problem-based learning. This is because the beginning of learning based on the problems revealed, and learning activities are collaborative or in groups that emphasize the environment of learners to be active. The difference lies in the object, where the problem-based learning is required the formulation of the problem, data collection and analysis whereas in project-based learning, learners are more encouraged in project-based learning, learners are more encouraged in designing or designing activities ranging from: formulating jobs, calculate, carry out the work and evaluate the results.

The learning achievement in this study is identified with the learning outcomes, which include cognitive, affective, and psychomotor learning outcomes. Student learning outcomes in learning activities can be seen by evaluating the eyes of the training that has been taught to the students. Evaluation itself is a deliberate process planned to obtain information or data; Based on these data then tried to make a decision (Ngalim Purwanto, 2002: 3).

Project-based learning focuses on the central concepts and principles of a discipline, engaging students in problem-solving activities and other meaningful tasks, enabling students to work autonomously constructing their own learning, and to producing valuable and realistic students' project products (Okudan Gul E. and Sarah E. Rzasa, 2004).

Assessment of learning by Project Based Learning model should be addressed thoroughly to the attitudes, knowledge and skills acquired by students in implementing PjBL. PjBL Assessment may use assessment techniques developed by the Education Assessment Center of the Ministry of Education and Culture I.e. project appraisal or assessment.

RESEARCH METHOD

The design of research is using Classroom Action Research (CAR), because this research is done to improve the quality of learning conducted in the classroom. CAR can be defined as a reflective form of research by taking certain actions to improve and improve classroom teaching practices in a higher quality so that students can better

achieve better learning outcomes (Mohamad Ansori, 2007: 6). The model used in this research is Kemmis and Mc Taggart model which is spiral and consists of planning, implementation, observation, and reflection.

This research was conducted in UST engineering education program. In the even academic year 2014/2015. Data were collected by observation or direct observation during the ongoing action process on skills. Data collection method in this research is the result of practice / product. Besides, to see the activity during the lecturing process used observation method. The instruments used in this study are worksheets in the work steps, assessment guidelines and observation sheets. Data analysis technique in this research is descriptive quantitative. The indicator of the success of the implementation in this study is if the quality of learning of Advanced Machining Courses increases by 5%, while the success criteria of the implementation of this action is at least 80% of the students who take advanced engineering courses get more than 85 (A-).

RESEARCH RESULT AND DISCUSSION

The results of this study were obtained from initial conditions on learning Advanced Machining, pre-cycle action cycle, action cycle I, action cycle II. Result of action cycle I, II is result. Action research is carried out in 2 planned cycles. The pre-cycle activity is based on documentation of previous student study results that the average B + advanced machining score. And from previous observations on the implementation of the lab found that students in doing the lab does not make work planning or work steps, it identifies that students are less systematic in making the product. The assigned Jobsheet still lacks of competence in the advanced machining courses.

Implementation of Cycle II

Research preparation begins with:

1. Preparing the prepared syllabus.
2. Determining the job or work project embodied with the worksheet.
3. Create a worksheet to arrange the work steps.
4. Validate job or work project and worksheet to expert lecturer.
5. Establish assessment guidelines.

Implementation of cycle I action the activity of Cycle I is an early action in Advanced Practice Research using a project-based learning model. The action of cycle I was implemented as an effort to improve and solve problems faced by students on learning practice of advances machining course. Implementation of learning is expected to attract learning activities and student learning outcomes, because the method used to stimulate the mind, improve understanding, solve problems, motivation, creative and independent.

Implementation of Advanced Machining learning through the application of project-based learning model. The implementation of this learning aims to make it easier for

students to understand the given job sheet. Implementation of a Project Based Model to improve activity and learning outcomes, with project-based student learning expected to plan work through Work Preparation sheets (WP) systematically and solve problems in making products. Students not only follow lecturers' direction, but students also get other experiences such as work together, train self-confidence, and others. The task of researchers in this activity is to observe the learning process and perform assessment after the learning ends.

The material on the execution of cycle I is on the worksheet 1 which is flat and multilevel. Advanced Machinery Practice Learning uses the application of the Project Based Model to improve student activity and learning outcomes as follows.

1. Delivering syllabus
2. Discussion with students about job or project.
3. Discussion with students in making work steps.
4. Socialization of practice assessment guidelines.
5. Distribute job jobs and worksheets in preparing work steps.
6. Students make a work step in every job.
7. Students discuss work steps.
8. Observation on students in practice.
9. Provide guidance in practice assistance.
10. Conduct assessment of Job 1 practice results with practice guidelines.

In the implementation of this activity, the lecturer acts as a companion of the learning activities in the workshop.

Table 1. Data of student learning outcomes cycle I

Aspect	Affective Score	Product Score	Score	category
Fendi L	80	83	82	B+
Albertus	70	83	77	B
Herlambang	80	85	83	B+
Anton S	80	85	83	B+
Argian A	80	87	84	B+
Arif W	80	87	84	B+
Donny	90	86	88	A-
Egi Taqiya	80	86	83	B+
Ria Bery	80	86	83	B+
Rahmad N	70	83	77	B
Azwan S	80	83	82	B+
Rata-rata	79	85	82	B+

Based on the results of learning cycle I, the score of affective results obtained through assessment of work preparation and psychomotor score obtained from the product assessment can be known the average student scores 82 or B +. Thus, the students who get a minimum score of A- by 9%.

Reflection

Reflection activities are conducted to remember, reflect, understand the process, problems, problems, and real constraints in strategic action. Reflection activities in the first cycle is done with the aim to find out some problems or obstacles related to the implementation of the learning process and find solutions taken to overcome the problems or obstacles. From the results of observation cycle I can be identified some of the problems found in the following students,

1. Not systematic student in making planning or step work in making product.
2. Students are still shy to ask questions

3. Many students are less confident in practice, it can be seen from each other to ask colleagues even though they have made work step. So this causes the time in completing the 1st job beyond the planned time.
4. Students have not yet seen everything actively in responding to the explanation of the lecturer.

Based on the problems that occur during the learning process in cycle I, it is necessary to carry out the next action in cycle II. Action in cycle II is implemented to overcome the problems or constraints faced by students on learning cycle I as consideration of improvement on the implementation of cycle II. Based on the score of learning achievement of students in the first cycle has not reached the predetermined success indicator, then the study continued on the second cycle.

Implementation of Cycle II

Action cycle II is implemented after the learning in cycle I is analyzed. The action in cycle II as a continuation of the action of cycle I that is less successful, so that the next action to improve the learning process. Before the implementation of the action in cycle II, first the researchers do an analysis of the work steps that have been made before, conduct product assessment with the guidance of assessment.

Preparation

After the identification or findings of cycle I into consideration in the second cycle. The plan to be used in cycle II is as follows:

1. Conducting a joint discussion between lecturers and students in solving problems in the previous product and product or job to 2.
2. Students make systematic work or work preparation steps and consult with lecturers.

The second cycle planning stage includes the following activities.

1. Researchers or lecturers develop learning tools that include, determining the material to be used in the learning activities, making the second job, and preparing the assessment guidelines.
2. Discussion with students about job or project.
3. Discussion with students in making work steps.
4. Socialization of practice assessment guidelines.
5. Distribute job jobs and worksheets in preparing work steps.
6. Students make a work step in every job.
7. Students discuss work steps.
8. Observation on students in practice.
9. Provide guidance in practice assistance.
10. Conduct assessment of Job 1 practice results with practice guidelines.

11. In the implementation of this activity, the lecturer acts as a companion in the way of learning activities in the workshop Implementation of Action

The second cycle action was carried out after the learning on the first cycle action was analyzed. The action of this cycle II to continue the action I that was less successful so that the researchers take follow-up action. In job 2 this is the advanced competence of the previous competence. Competence in cycle 2, among others, lathe and frais competence. The sequence of implementation of learning activities to be implemented are as follows:

1. The lecturer opens the lesson by saying greeting and accepting the students.
2. Before conducting practicum activities the students are conditioned to be ready to follow the learning process and given a briefing about the practical learning activities that will be implemented.
3. Students are motivated to carry out practicum.
4. The lecturer gives an explanation of the competence to be achieved.
5. Students are given job 2 and valley work preparation.
6. The lecturer explains the appraisal guideline of job 2.
7. The lecturer leads the discussion in making a work or planning step.
8. The lecturer validates the WP and assesses it.
9. Students conduct lab work first with WP validated.
10. Lecturers make observations.
11. Conduct product assessment by referring to the assessment.

After the students finished the practice continued assessment of the results of practices or products. The results of the work preparation and product assessment are as follows.

Table 2. The results of student learning cycle II

Aspect	Affective Score	Product Score	Score	category
Fendi L	85	90	88	A-
Albertus	90	95	93	A
Herlambang	90	92	91	A
Anton S	90	93	92	A
Argian A	90	90	90	A-
Arif W.	85	85	85	A-
Donny	90	95	93	A
Egi Taqiya	90	90	90	A-
Ria Bery	88	94	91	A
Rahmad N	85	90	88	A-
Azwan S	90	93	92	A
Rata-rata	**89**	**92**	**90**	**A-**

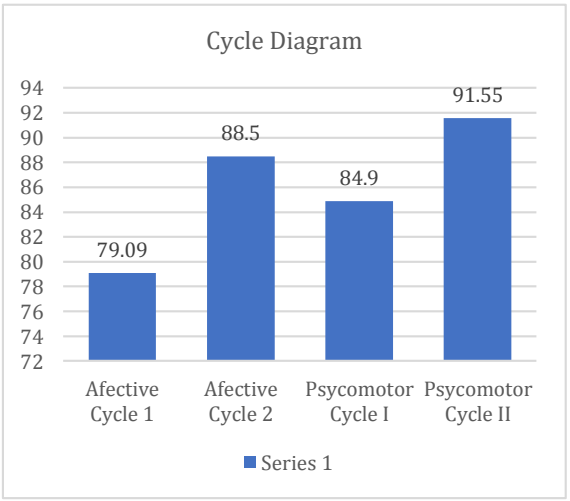
Based on the results of learning Cycle II, the score of affective results obtained through assessment of work prepraration and psychomotor score obtained from the product assessment can be known the average student scores 90 or A-number. Thus, the students who get a minimum score of A- by 100%.

Reflection

Based on the implementation of the action in cycle II, it can be concluded that the project-based learning process has been running systematically and conducive. This condition is marked by the increasing understanding of students in making work planning by making work preparation (WP)

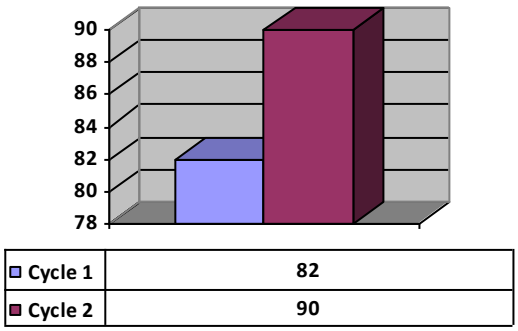
and improving the results of practice in making the product / job. In the observation results it is known that students are more independent and confident in the lab. Thus, the weaknesses in cycle I can be solved. Students can make systematic work steps so that they can work in accordance with the right time of product results better, utilize time efficiently. Students who initially have low ability in making work planning and have less competence in lab work, finally able to make step work well. That is, the whole learning process using project-based learning can improve affective skills and practical learning outcomes in further machining courses.

Based on the data of learning outcomes conducted in the pre-cycle stage, cycle I and cycle II can be seen that there is increasing affective and psychomotor abilities in Mechanical Engineering Education students who take Advanced Engineering course by applying the model of project-based learning. The following data attainment of affective and psychomotor abilities in advanced machining courses in cycle I and cycle II.



Picture 1. Affective and psychomotor abilities of cycle I and cycle II.

Based on the above diagram it can be concluded that there is an increase in affective ability from cycle I to cycle II of 9.41 and improvement of psychomotor ability from cycle I to cycle II of 6.65. While increasing the final value of advanced machining courses as follows:



Picture 2. Achievement of the average final grade of Advanced Machinery Course

Based on Figure 1 can be seen that the use of Project Based Learning (PBL) or project-based learning model can improve learning outcomes in students' affective and psychomotor abilities in which there is an increase from cycle I to cycle II. An increase in affective ability of 9.41. Affective ability is

measured by using the planning sheet to make the work step, in the first cycle students make job 1 that has the competence of the lathe length and level. Before the students do the job 1 in advance by making work preparation (WP), the making of student work step is still less systematic, so the student in doing the job 1 is not maximal this can be seen during the long job 1, the still Many out of tolerance, the level of subtlety of rough work, students are still asking a lot of other friends. In the second cycle students do job 2 with the work competence lathe and the competence of frais. With a job that has a higher competence, students with learning in the first cycle experience then students in making work preparation or planning more systematic, this is because students before making the work step to discuss in solving problems on the project. Systematic planning can be measured with the students doing job 2 faster even though the competence is higher, the tolerance of the size more thorough, the level of fineness can be achieved.

The improvement of psychomotor ability from cycle I to cycle II was 6.65 with an average end score of 90 or A- and from table 2 shows that the students who get the final grade of advanced machining less than A- at 100%. Thus project-based learning for advanced machinery courses provides a better learning experience for students. This can be known from the activities of the practice students, starting from the preparation by making the planning, the discussion with the lecturers as well as with other students in solving the problem, the students are more systematic in solving the problem or project, the students are more confident or independent in learning. Riyanto (2010: 181) mentions the most valuable thing in learning is how to learn. How to learn Is the result of a combination of how to absorb and then manage and process information. PBL learning model is one of the learning modes to realize learning outcomes by increasing activity in learning in accordance with the principle of how to learn actively.

CONCLUSION

The project based learning model of the machining course provides improved affective and practical or psychomotor abilities to students. This can be seen the results of student worksheets in making work steps on each job and job or work outcome of practical work. This can be seen in the second cycle there is an increase in the students' ability to make the work and practice and the students who get the final score in the advanced machining lesson at least A-100%.

REFERENCE

Bell, Stephanie. (2010). *Project Based Learning for the 21st Century: Skill for the future[versi elektronik].* The Clearing House, *83: 39–43. Taylor & Francis Group, LLC, DOI: 10.1080/00098650903505415.* Jakarta

_____(2012). *Project Base Learning*. Kementerian Pendidikan Nasional.

Kemdikbub. (2013). *Materi Pelatihan Guru Implementasi Kurikulum 2013*. BPSDMPK dan PMP.

Mohamad Ansori. (2007). Penelitian Tindakan Kelas. Bandung: Wacana Prima.

Ngalim Purwanto. (2002). *Prinsip-prinsip dan teknik evaluasi pengajaran*. Bandung: PT. Remaja Rosdakarya

Okudan. Gul E. dan Sarah E. Rzasa. 2004. A Project-Based Approach to Entreprenurial Leadership Education. J*ournal Technovation*. Desember. Volume XX. Page 1-16.

Purwadarminta, (1989). *Kamus Umum Bahasa Indonesia*. Jakarta: Balai Pustaka. Suharsimi Arikunto, 2002. *Prosedur Penelitian*. Jakarta: Rineka Cipta. PBL Guide .2013.

Rochiati Wiriatmadja. (2006). Metode Penelitian Tindakan Kelas untuk Meningkatkan Kinerja Guru dan Dosen. Bandung: Remaja Rosdakarya.

Santyasa, I W. (2006). Pembelajaran Inovatif: Model Kolaboratif, Basis Proyek, Dan Orientasi NOS. Makalah. Disajikan Dalam Seminar Di Sekolah Menengah Atas (SMA) Negeri 2 Di Semarapura.

Wena, Made. (2011). *Strategi Pembelajaran Inovatif*. Jakarta: PT. Bumi Aksara.