Implementation of problem based learning to improve student learning achievement in turning machining lesson

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Abstract. The research aims to describe the application of project based learning (PBL) models to improve learning achievement, and to find an increase in learning achievement. This study uses a quantitative descriptive research approach to the type of classroom action research. The research data were obtained using an observation sheet of student learning activeness and a job grading sheet turning students. The application of PBL uses the model proposed by Carr and Kemmis where each cycle consists of four steps, planning, action, observation, and reflection. The results showed that the increase in student learning was illustrated in the pre cycle 46% (sufficient category) increased to 60.5% (good category) in cycle 1 and again increased to 79.7% (very good category) in cycle 2. Improved learning achievement students with a minimal completeness criteria score of 61% in the pre cycle increased to 75% in cycle 1 and again increased in cycle 2 to 93.8%.

1. Introduction
The Mechanical Engineering Majors of Ma'arif Salam Vocational High School has a fairly good and complete machining workshop. The completeness of the workshop is reflected in the number of turning machines in good condition with a total of 16 machines with machines that have a standard that is fit for use in the competency test of the Professional Certification Institute of 4 machines. The adequate machining workshop completeness if can be utilized optimally can help students to optimize the competencies obtained from learning of turning machining.

The completeness and quality of the facilities and infrastructures that support the learning process have not been aligned with the learning outcomes and achievements of the machining practices of the students' turning machining. This is indicated by the number of students in the class who have achieved the minimal completeness criteria in each job on average no more than 60% of the number of students in the class. These problems need to be analyzed further to get the right solution so that student learning achievement in learning turning machining can increase.

Student achievement is still low due to the inaccurate learning model applied in the implementation of learning turning machining. The selection of learning models that have not been right by the teacher resulted in students not getting a learning model that can develop their potential optimally [1]. The selection of learning models that are not yet right also results in students having difficulty in overcoming problems during the turning machining practicum. The difficulty of these students is in solving problems in practical activities, so students have the nature of dependence on teachers and friends to be able to overcome and get solutions to the problems that are being experienced. Improved
learning outcomes can be pursued with the innovation of applying appropriate learning models. Learning with the right model or strategy can improve the quality of education [2].

The learning process needs to consider several aspects of character building or soft-skills, such as cooperation, respect for opinions, ownership, responsibility, honesty, and willingness to sacrifice [3]. In the Turning Machining practicum activities, students can more quickly understand good turning techniques if students have more opportunities to experiment. More opportunities to experiment can be obtained by students if educators provide student-oriented learning models. Effective learning is learning that provides opportunities for students to learn independently, so that by doing learning activities students are able to gain an understanding independently [4]. The learning model that is oriented towards students and encourages students to experiment to solve the most appropriate problems is the Problem Based Learning model.

Problem Based Learning (PBL) is a learning method that is oriented to students. This method can be applied in practical turning machining activities that are being undertaken by students to directly present concrete and actual problems for students. The most prominent character of the PBL learning method is that it can develop students’ critical and innovative ways of thinking optimally to investigate existing problems and reason to solve the problems experienced [5]. It is hoped that PBL learning methods can improve achievement, creativity, and experience solving problems faster for students. PBL is an effective method for improving academic achievement, including knowledge retention, conceptual development, and attitude [6].

The implementation of problem-based learning to improve cognitive, psychomotor and affective learning outcomes of students at SMK Ma'arif Salam, shows that the application of PBL learning models can improve student learning achievement. The results showed: (1) student learning activeness has increased; (2) the category of student learning activeness becomes very high; (3) student learning outcomes in cognitive, psychomotor and affective aspects have increased; (4) student learning outcomes cognitive, psychomotor, and affective aspects that achieve minimal competence have increased after going through the application of problem-based learning [7].

The application of PBL in the teaching-learning process is a necessary solution, if we understand, as teachers, that to permanently have opportunities for adaptation, integration in the world of the students they live in or they will live, our students must continually develop and appreciate learning abilities how to learn [8]. PBL can increase student achievement in cycles 1 and 2 with an average increase in learning motivation of 5.46% and an increase in learning achievement increased by 1.5 with the number of students completing 100% [9].

This study aims to describe the application of PBL to improve student learning achievement in the Turning Machining practicum subjects and find out an increase in student learning achievement in turning machining subjects after applying the PBL model in the learning process. In this study will try to find out how far the positive impact of the application of the Problem Based Learning model for students class XI Mechanical Engineering major in Ma'arif Salam Vocational High School on learning activities of machining turning.

2. Methods

This type of research is the Classroom Action Research model Carr and Kemmis which consists of four steps of unity that are carried out repeatedly in each cycle. The four steps are planning, action, observation and reflection. Classroom Action Research is carried out by implementing PBL. Planned actions in the form of the application of learning through PBL to improve student learning achievement in the subject of machining turning class XI in Mechanical Engineering Majors.

The research was conducted at Ma'arif Salam Magelang Vocational High School. Geographically, the location of the Ma'arif Salam Vocational High School is in Citрогaten Village, Jl. Yogjakarta-Magelang, Salam District, Magelang District, Central Java Province. The study was carried out at a specified time based on agreement with the school. The study was conducted in the even semester of the 2018/2019 school year for two months starting April 15 until June 15, 2019.

The subjects in this study were students of class XI TPA in Mechanical Engineering majors at the Ma'arif Salam Vocational High School 2018/2019. Whereas for the objects in this study are the whole
process and learning outcomes using PBL learning models to improve student achievement in the turning machining subject of class XI TPA in mechanical engineering majors at Ma'arif Salam Vocational High School. This study will describe how to apply the PBL learning model to improve student achievement in turning machining subjects of class XI TPA majoring in machining engineering at Ma'arif Salam Vocational High School and know of an increase in student learning achievement in learning turning machining.

The study was conducted starting from the observations and documentation of student achievement in the Turning Machining subject at the Ma'arif Salam Vocational High School, which later found a problem. The problem is examined to obtain appropriate problem solving. Problem solving is by applying PBL learning models to the subject of Turning Machining in Ma'arif Salam Vocational High School.

This study uses a class action research model according to Wilfred Carr and Stephen Kemmis which is an adaptation of Kurt Lewin using 4 steps in each cycle, namely (1) planning, (2) action, (3) observation, and (4) reflection. Wilfred Carr and Stephen Kemmis think about how the concept of action research is applied to the field of education which then produces a cycle of classroom action research as shown in figure 1 [10]. Classroom action research uses Carr and Kemmis models because in addition to being simple, according to him, it can also improve practical learning, and improve understanding of practical learning.

Classroom Action Research is an examination of learning activities in the form of a learning action, which is deliberately raised and occurs in the classroom. Classroom Action Research aims to improve the practice of learning on an ongoing basis which basically involves the implementation of an educational mission carried out by a teacher. [11].

![Class action research cycle according to Carr and Kemmis](image)

The planning stage is the stage in which the researcher makes a learning design that contains the ultimate goal of learning, organizing the class, and making learning steps. The researcher also determines the problems that will be used in applying the Problem Based Learning model (PBL), making questions based on basic competency, making lesson plans, and taking action. The problem that will be raised in this study is compiling a work plan and applying it to various types of turning work to get the work done in accordance with the work drawings. The problem was raised by the author because students have difficulty in achieving competence in obtaining workpiece dimensions according to the work drawings.
The application of action in this study used 3 initial cycles as a starting cycle in research activities. The initial cycle includes pre cycle, cycle 1, and cycle 2. Pre cycle was carried out to find out whether the actions to be taken can be carried out well while cycle 1 and cycle 2 are the core actions to be given. Each cycle includes 4 stages such as the CAR model developed by Carr and Kemmis as explained earlier.

Research data obtained through the assessment of student learning outcomes and direct observation of student learning activities during learning in each cycle. If in a research action, the initial 3 planned cycles before carrying out the research have not yet achieved success, then proceed with planning the following cycles and carrying out the actions until the research success is achieved. The cycle will stop or succeed if 80% of the total students reach minimal completeness criteria ≥76%.

This research data is quantitative data in the form of numbers. The data is data on student learning activeness and turning job score students. The data was obtained using an observation sheet of student learning activeness instruments and job assessment sheets turning students which had been previously validated by expert judgment. Data collection techniques are done in two ways, namely by direct observation of students during the learning activities and summarizing the values obtained by students after carrying out the assessment of workpieces of practical results.

This research data is quantitative data in the form of numbers. This data was obtained from the measurement results of student achievement outcomes through assessment sheets and observations of student learning activities with predetermined scoring. The data obtained is then grouped based on the type of measurement scale used to be interval data. Interval data is data that has the equality interval with data that has been sorted. This data was obtained from the measurement results of student achievement outcomes through assessment sheets and observations of student learning activeness using observation sheets that have been validated by expert judgment.

Scores data analysis techniques use descriptive statistics that describe or provide information about a data or situation based on quantitative data. Descriptive statistics only function to explain the situation, symptoms, or problems [12]. Conclusions drawn on descriptive statistics are only aimed at existing data sets. Based on the scope of the discussion, the descriptive statistics in this study are frequency distributions with distribution charts that illustrate learning outcomes in each cycle. The calculation of the number of students with a successful category is determined from the minimal completeness criteria score limit of 76, then students whose grades do not reach the minimal completeness criteria are not counted.

3. Results and Discussion

3.1 Pre Cycle Results

Turning job scores obtained by students in pre-cycle are spread out in 7 grades. The value groups are 61-65, 66-70, 71-75, 76-80, 81-85, 86-90, and 91-95. The distribution of student grades is summarized and presented in the graph in figure 2. The score of students' learning activeness in pre-cycle is divided into 2 categories. The distribution of learning activity score categories is in the sufficient and good categories where 23 students are in the sufficient category and 8 students are in the good category.

Job assessment result turning students on a pre-cycle of 31 students who attended and worked on turning 1 is only 19 students (59.4%) who met the minimal completeness criteria. This is caused by the low ability of students to solve problems. This is evident from the students who are still having difficulty in preparing work plans as a form of problem solving. Difficulty learning of students in solving problems is also known from the results of observations of student learning activeness which shows that student learning activeness is still in the sufficient category.
3.2 Cycle 1 Results

The value obtained by students in cycle 1 is spread into 6 grades. The value groups are 66-70, 71-75, 76-80, 81-85, 86-90, and 91-95. The distribution of student grades is summarized and presented in the graph in figure 3.

Job assessment results turning students on cycle 1 that is from 30 students who attended and worked on turning 2 as many as 24 students (75%) met the minimal completeness criteria. Learning outcomes in cycle 1 is an increase in learning achievement which is quite good compared to pre-cycle. This is due to the increased ability of students to solve problems. This is evident from students who no longer have difficulty in preparing work plans as a form of problem solving. Reduced student learning difficulties in solving problems is also known from the results of observations of student learning activeness which shows that student learning activeness has increased and is in the good category.

3.3 Cycle 1 Results

The scores obtained by students in cycle 2 are spread out in 6 grades. The value groups are 66-70, 71-75, 76-80, 81-85, 86-90, and 91-95. The distribution of student grades is summarized and presented in
the graph in figure 4. The score of students’ learning activeness in cycle 2 is divided into 2 categories. The distribution of learning activity score categories is in the good and very good categories. Where only 1 student is in the good category and the remaining 31 students is in the very good category.

![Distribution Graph](image)

**Figure 4.** Distribution graph of thread dan taper turning job 3 scores in cycle 2

Job assessment results turning students on cycle 2, from 32 students who attended and worked on turning 3 as many as 30 students (93.8%) met the minimal completeness criteria. Learning outcomes in cycle 1 are an increase in excellent learning achievement compared to cycle 1. This is due to the high ability of students to solve problems so students are able to do the job well. This is evident from students who no longer have difficulty in preparing work plans and students' fluency in solving problems. The reduced learning difficulties of students in solving problems is also known from the results of observations of student learning activeness which shows that student learning activeness has increased again and is in the very good category.

3.4 Discussion of Student Learning Achievement

Student learning achievements in terms of results are in the form of the acquisition of turning jobs that have been done by students. In conducting the assessment, the researcher uses an assessment sheet that has been validated by expert judgment. The success of the study is seen from the percentage of the number of students who have achieved the minimal completeness criteria score of more than 80% of the number of students.

Overall indicators of the success of the Classroom Action Research by applying the PBL method to learning of turning machining can be stated to have been achieved. Achieving this success includes improving student achievement in terms of the process and also in terms of learning outcomes. From the observations of student learning outcomes in each cycle it can be seen that student learning outcomes in the form of job values turning students always increase. This is illustrated by the percentage of the number of students whose grades reaching minimal completeness criteria always increase in each cycle. The percentage of the number of students who achieved the minimal completeness criteria score at the pre cycle was at 59.4% increased to 75% in cycle 1 and again increased to 93.8% in cycle 2. Improved student achievement is presented in the graph in figure 5.
4. Conclusion
The application of PBL learning models to improve student learning achievement in Turning machining subjects in class XI TP A in Mechanical Engineering majors which was carried out achieved success targets. The success target has been achieved in cycle 2, namely the number of students who have achieved the minimal completeness criteria score of 93.8\% of the total number of students with an initial target of 80\%. This success is also aligned and supported by data on the
percentage of students' activeness in participating in learning that is always increasing. In cycle 2 the percentage of students' learning activeness has reached 79.7% and is in the very good category. For this reason, it can be concluded that the application of problem based learning models can improve student learning achievement in machining subjects in class XI in Mechanical Engineering majors at Ma'arif Salam Magelang Vocational High School.

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