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Implementation of Project-Based Learning Model in Lathe Machining Technique Subjects to Improve Student Learning Outcomes

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Abstract

Education is the most critical point in the perfection of learning, one of which is the learning model given to students. Learning outcomes are an aspect of achievement in a student's success in the classroom. Especially in student test scores conducted at the end of the semester exam shows the ability of students who have not obtained the minimum completeness value limit (KKM), so it can assume the acquisition of the results of the learning value of Lathe Machining class XI TP A at SMK Dhuafa Padang is still not as desired. This research was conducted through classroom action research. The research subject is the XI grade machining engineering students with 20 students. The research was conducted in May-June 2023 and had two cycles. This research instrument uses multiple choice test questions for the cognitive level and project observation sheets at the psychomotor level. The results of the observation of cycle one and cycle 2 prove the increase in student learning outcomes with an increase between cycles. The implementation of the first cycle obtained a score of 66.67 which increased to 78.13 in the second cycle. The percentage of classical Completeness in cycle 1 obtained a value of 60%, and there was an increase in cycle 2 to 85%. The research success indicator set is 75 with 75% classical completeness. Therefore, there is a conclusion that applying project-based learning in Lathe Machining Engineering subjects can develop motivation and improve student learning outcomes.

Keywords: Learning Model, Project Based Learning, Learning Outcomes, Lathe Machine

Introduction

Education is one of the processes of fostering oneself in improving knowledge, skills, and attitudes of human personality. Education is one of the drivers to carry out and spread the quality of human resources (De La Torre et al., 2022; Farooq et al., 2022). Education, in addition to the official category, can be termed in the form of basic abilities and has a plan to achieve the desire for a learning atmosphere and learning process. Besides that, as stated, learning is one form of a complete fundamental process. It also affects the whole soul in covering the Cognitive, Affective, and Psychomotor domains (Ekpenyong et al., 2022).

Achieving these educational goals requires quality education, so it is necessary to rearrange the learning model to get students' best potential. According to (Chuang, 2021), education is a perfect container because learning activities can always share elements and activities between students and the learning environment; one of the goals is to get changes in attitudes toward learning outcomes. The purpose of education is essential to bring about behavioral, intellectual, and moral changes in students (Meyer & Norman, 2020). The role of teachers, in this case, is very much demanded in answering the challenges of education. To maximize the quality of teaching, teachers must be able to develop students' potential and significantly influence learning outcomes so that they are helpful (Alam, 2022; Hanif, 2020; Oliveira et al., 2021).

Learning in the classroom is the most essential key to achieving the desired educational goals. So this indeed cannot be separated

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from the role of the teacher to guide students through the implementation of learning models with clear objectives (Azorín, 2020). Learning models are used in learning carried out in the classroom and are expected by teachers and students in carrying out directed learning (Geng & Law, 2019; Loeng & Story, 2020; Yasmin et al., 2019). The teaching journey should be carried out by linking the active role of students (Timm & Barth, 2021). So that students' learning activities are not limited to listening, writing, delivering educators, and doing exercises but also include all other activities such as mental, oral, motor, emotional, and other activities. Learning activities are physical and mental. To improve the performance of students' learning outcomes, teachers should be able to interact with students in learning and build good relationships (Syauqi et al., 2020). The learning process at SMK Dhuafa Padang is an approach in applied learning focused on the teacher, thus causing reduced student learning activities. The perfect science in learning focuses on students or learners who seek to develop knowledge and are actively involved in achieving information (Hernández et al., 2019; Qadir & Al-fuqaha, 2020). The project-focused learning model leads to a learning system centered explicitly on students who look at project implementation independently or collaboratively and know how to integrate natural and practical problems (Bhaduri et al., 2022). This aligns with the objectives of delivering SMK graduates ready to enter the industrial world and work as entrepreneurs.

Learning is the driving stage of each person's attitude, which automatically settles as a result of experience and establishes communication with the surrounding environment (Ratajczak & Ratajczak, 2020). Project-based learning (PBL) is also an impact approach in the learning process that is beneficial by applying various abilities to increase 21st-century skills. According to (Syahril et al., 2022, 2021), in the learning process, it is also necessary to produce innovative learning performance to boast and make students able to bring out creativity and also be able to improve the student knowledge process is by project-based learning (PjBL). Based on the author's observations, in teaching practice at SMK Dhuafa Padang, students still seem to be many who do not understand and lack the willingness to undergo the learning process. The learning methods educators implement do not change, so the impact on students becomes undeveloped.

Methods

Types of Research

The research carried out is PTK research, also often called classroom action research. This research describes both the process and the acquisition of results to improve the quality of classroom learning practice (Akimov et al., 2023). The research took place at SMK Dhuafa Padang in the even semester of January-June 2023. The subjects in this study were students of class XI Machining Engineering SMK Dhuafa Padang, totaling 20 people. The cycle has four stages: planning, action implementation, observation, and reflection. The research instrument uses test questions and observation sheets of students' project tasks.

Research Procedure

The syntax used in this research has four stages: planning, action implementation, observation, and reflection (Meyer & Norman, 2020). PTK has several stages of at least 2 hours of learning time per cycle. A two-session meeting should be held in each of the two cycles between the start of learning and the expected learning outcomes.

Data Collection Methods

How to obtain data objectively in problem-solving is researched through data collection and information (Aslan, 2021). Test questions are used as a data collection method in research with multiple choice questions with 20 questions per cycle. The purpose of this test is to determine the number of lessons that have been learned by each student using a project-based learning model. Before conducting research in class XI of Machining Technology, the researcher tested the questions in class XI of Machining Technology B. The researcher experimented with a research tool whose class average score was almost the same as the study class. Data was obtained by checking the research instrument for objective questions' accuracy, quality, difficulty, and distinguishability.

Data Analysis Techniques

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The learning objectives are learning outcomes (Daskan & Yildiz, 2020). Learning outcomes can be said to have been achieved if all aspects are fulfilled. The test scores applied at the end of each lesson at KKM 65 are used to evaluate students' learning outcomes. The formula used to get an overview used in each cycle:

$$\mathrm{NI} = \frac{\mathrm{T}}{\mathrm{SM}} \mathrm{x}\ 100 \quad (1)$$

Description:

NI = Individual learning completeness
T = score achieved
SM = Maximum score of the assessment

Table 1: Conversion of quantitative value index observations with scale

Grade Conversion			
Scale 1-100	**Scale 1-4**	**Predicate**	**Category**
86-100	4	A	Very Good
81-85	3.66	A-	
76-80	3.33	B+	
71-75	3.00	B	Good
66-70	2.66	B-	
61-65	2.33	C+	
56-60	2	C	Simply
51-55	1.66	C-	
46-50	1.33	D	Less
0-45	1	D+	

Classical learning completeness can be seen in Table 1. If≥75% of the score obtained by the class has been achieved. Therefore the students in the class are said to be complete with this research and will be completed.

Results and Discussion

Cycle 1

In applying the PjBL (Project Based Learning) model, the learning process flow passed in Cycles I and II had perfect results. The learning flow is described in the following table:

Table 2: Learning steps and activities

Cycle 1	PjBL model 7 Steps	Learning Activities
Debriefing Students' Knowledge and Skills		
Formulation of expected learning outcomes expected	Meeting 1	Discuss with students the relevance of the competencies of the subject with the future world of work.
Teaching Material Debriefing	Meeting 1	1. Form study groups of students, 2. Distribute learning modules to students, 3. Students learn and discuss in groups about the module
Skills Training	Meeting 1	Students can practice turning skills and reading drawings accompanied by the teacher.
Proyek		
Project Theme Design	Meeting 1	Guiding students in determining the theme of the project task so that there is alignment of

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		tasks between groups related to real-world conditions
Project Proposal Writing	Home Assignment	1. Students are given homework propose the project that each group has determined 2. The teacher checks and gives input and approve the group project assignments.
Implementation of Project Tasks	Meeting 2	1. The teacher monitors students' working and learning processes during group project work 2. Evaluate the process and results of students' work if there are irregularities in making the workpiece.
Project Presentation	Meeting 2	Students present the process and results of the project tasks that have been completed.

Furthermore, the learning assessment was conducted at the second meeting. From the cognitive perspective, learning outcomes are measured through test questions, while learning outcomes are measured through projects for the psychomotor aspect. Before conducting research, experienced lecturers in education refined and validated the test questions that would be used and understood Lathe Machining so that the statements derived from the questions were evaluated until they were applied to the learning outcomes assessment. Students complete cycle I project assignments according to the project assignments left behind; students can understand the topic of the task allowed in the cycle I session by students and teachers.

Table 3: Learning score acquisition cycle i

Cycle Results 1	Score
The highest score	75
Lowest Value	55
Average	66,75
Number of Completed Students	13
Classical Mastery (%)	65%

From Table 3, we can see that for the acquisition of the learning outcomes of students in Class XI Lathe Machining Engineering in Cycle I, 13 students have a completeness value and a classical pass rate of 65%. In the first cycle, the indicator of the achievement of research completeness was still not achieved because the classical completeness value was following the desired 75%, so improvements were needed for the next cycle. This was due to the unachievement of learning outcomes based on the research achievement indicators, which resulted in the incompleteness of the students' project assignments and the low turning ability due to the lack of students turning. The knowledge that is still incomplete and turning still has many limited skills. Moreover, students lack collaboration among groups, resulting in less speed and accuracy in project completion.

Because of these obstacles, the teacher must take appropriate action to complete Cycle II learning, namely: 1) The teacher facilitates each group to discuss with each other, 2) The teacher provides a teaching module and will be a student handbook to help them implement knowledge in turn, 3) In cycle II students are required to perfect the project workpiece made according to the job sheet rules, 4) Students in groups are expected to have been able to complete their projects independently, 5) The teacher breaks some group members from 1 group of 4 people to 1 group of 2 people, 6) The teacher explains in front of the class about understanding or techniques for using a lathe and, 7) The teacher explains again in front of the class the trick of reading drawings and sizes on the job sheet.

Cycle II

In applying PjBL (Project Based Learning), the steps obtained in learning in Cycle 2 are carried out perfectly through the flow of changes in activities and learning actions towards the class; then, to see the results of reflection on Cycle 1:

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Table 4: Debriefing step knowledge and learning activities

Cycle 2	PjBL model 7 Steps	Learning Activities
Knowledge and Skills		
Formulation of expected learning outcomes expected	Meeting 1	The teacher exposes students' mistakes in reading drawings and maximizing the use of the lathe.
Teaching Material Debriefing	Meeting 1	1. Form study groups of students, 2. Provide an introduction and techniques for using a lathe, 3. Students were given time to exchange ideas and find solutions to the problems they were experiencing
Skills Training	Meeting 1	Students are allowed to practice turning and drawing skills.
Proyek		
Project Theme Design	Meeting 1	Students are emphasized to continue the project assignment in cycle one but to be more refined until they get maximum results.
Project Proposal Writing	Home Assignment	students continue to work on previously completed proposals.
Implementation of Project Tasks	Meeting 2	1. The teacher monitors students' working and learning processes during group project work 2. Evaluate the process and results of students' work if there are irregularities in making the workpiece.
Project Presentation	Meeting 2	Students present the process and results of the project tasks that have been completed.

During the second meeting, the process of assessing the learning that had been completed was carried out. Students' learning outcomes in the cognitive aspect were measured through test questions. In contrast, students' learning outcomes in the psychomotor aspect were measured through projects done by students based on the projects presented by the Cycle I group, and students were pressured to complete the project tasks. The test was made before the research, which material experts validated. This requires that the questions be improved so that the learning outcomes are measured. Table 5. Provides information about learning outcomes.

Table 5: Cycle II learning knowledge score

Cycle 2 Learning Outcomes	Value		
	Theory	Project	Final Grade
Highest Value	85	88,75	86,9
Lowest Score	40	81,25	61,3
Average	71,25	85	78,13
Number of Students Completed			17
Classical Completeness (%)			85%

Table 3. In the acquisition of the learning value of Lathe Machining, students showed a score of 71.25 through the question test. In the Psychomotor domain, students obtained a score of 85.0 while the final average value was 78.13 having the highest score of 86.9 and the lowest score of 61.3. The number of students who completed 17 people with a percentage of classical Completeness of 85% of these students showed an outstanding category, meaning that the research success indicators were very influential. The results showed that the "Project Based Learning" model could foster learning performance in the Lathe Machining Technique learning

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process. The increase in aspects in the cognitive and psychomotor domains in cycles one and two shows this in more detail, shown in the table below, and Table 6 shows the results.

Table 6: Summary of cycle 1 and 2 learning outcomes

Cycle Learning Outcomes 1 and 2	Final Grade	
	Cycle 1	Cycle 2
Highest Score	73,8	86,9
Lowest Score	58,1	61,3
Average	66,7	78,13
Number of Students Completed	12	17
Classical Completeness (%)	60	85

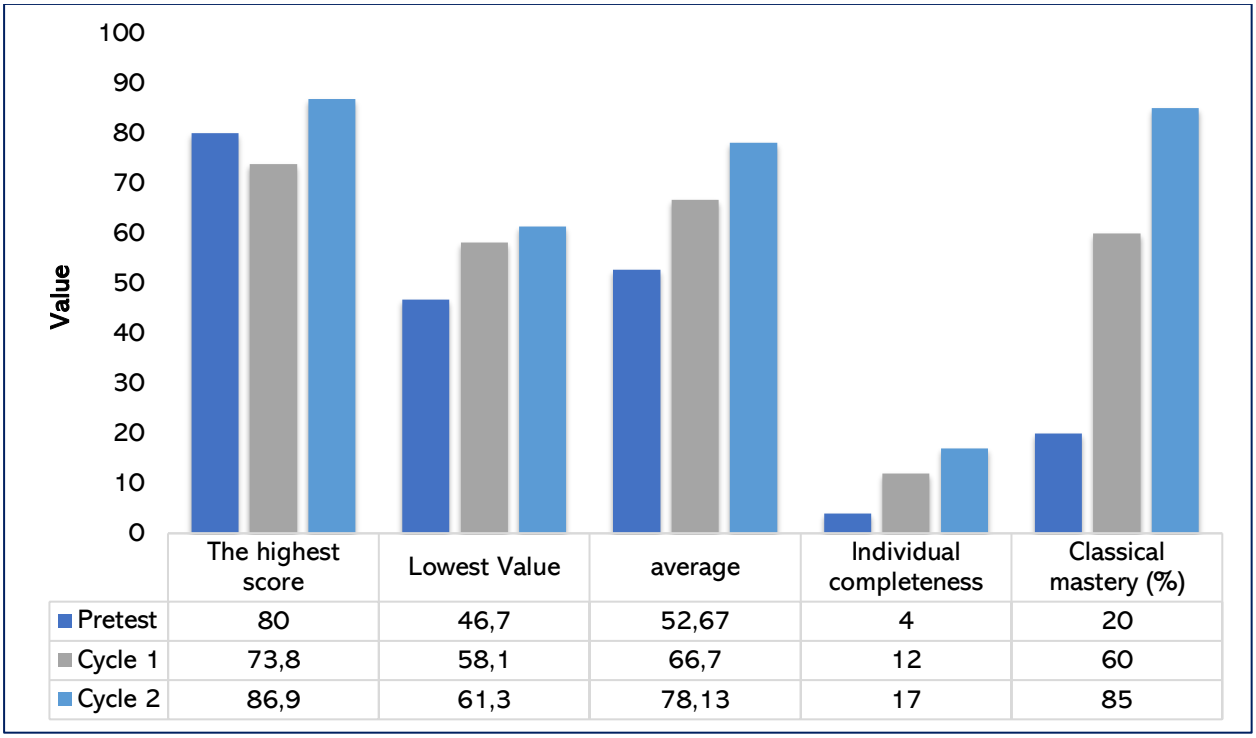

Figure 1: Gravelling of students' knowledge improvement

In Cycle 1, according to Figure 1 and Table 6, the average learning outcome of students in the XI Lathe Machining Technique was 66.7, where 12 students passed. Then for cycle 2, the student learning score was 78.13, showing that 17 students passed. Student learning outcomes meet cycle II's performance criteria, proving that this project-based learning model has been successfully implemented. Project-based PjBL learning is a learning model that emphasizes projects to develop regional potential by providing students with opportunities for skills, knowledge, and psychomotor attitudes.

Conclusion

Project-based skills learning implements the knowledge process in Lathe Machining Engineering in grade XI. This process can develop student learning outcomes. This process can be seen in the research data in all aspects studied in each cycle flow, which has cycle 1 data with the acquisition of a skill assessment score of 66.6 and has an increase in cycle 2 with the acquisition of a skill score of 85.0. The amount obtained for increased student skill assessment scores in cycles one and 2 resulted in 18.44. Moreover, the average student learning outcomes in cycle 1 of 66.7 consisted of 12 students whose scores were said to have passed. Moreover,

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in cycle 2, the average student learning outcome was 78.13, with 17 students getting a score declared to have passed.

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Declaration

Author's Contribution

Pres Megari was a researcher and data collector, Mulianti was the person in charge of the thesis process, starting from the creation, methods, and processes, and Yufrizal considered the results of the data that the researchers did.

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Conflict interest

The author states that there was no conflict when conducting the research.

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