Increasing Student Cooperation Through the Application of *Project-Based Learning* in Lathe Machining Engineering Course

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Abstract. The learning implemented by educators is still centered on teaching, which has an impact on low student teamwork and a lack of sense of responsibility in completing each assigned task. *Project-based* learning is very suitable to be applied to students because the learning model is creatious, innovative, and collaborative so that students responsibly complete projects with a team that it has formed. This study aims to improve the cooperation with the student team on the subject of lathe machining techniques through the implementation of *a project-based learning* model. This study used model *classroom action research.* The subjects of the study were 14 learners. The research instrument uses a student teamwork obser sheet using indicators of student cooperation success which are set at least 80% with good categories. The results of the observation of cycle 1 showed an average student cooperation of 56.4%. The research continued in cycle 2 with an average acquisition of student cooperation of 76.7% including the good category and in cycle 3 the average student work increased to 84.9% with the excellent category. The increase in student cooperation in each cycle has increased significantly. Indicators of research success have increased in cycles 2 and 3 as evidenced by the results of an increase in student cooperation by 8.2%. The conclusion derived from the research is that the application of *a project-based learning* model has succeeded in increasing student cooperation. *Project Based Learning* creates excellent cooperation carried out by students as well as students responsibly completing all the projects it provides well as directed by the teacher.

Keywords: Application · Cooperation · Project Based Learning · Lathe Machining Engineering

1 Introduction

Vocational High School is a formal educational institution designed to foster the skills, competencies, understanding, creativity, and teamwork attitudes that workers need to achieve and advance in fulfilling and productive work. According to "Vocational High School is a formal education that teaches principles and theories of applied work", and according to the education unit that guarantees students become graduates who are ready to work [1, 2]" in line with the vision of Vocational High School PK to produce graduates who are absorbed in the world of work and become entrepreneurs.

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The learning process in the classroom is the main key to achieving the desired educational goals, apart from the role of the teacher as an educator who regulates classroom learning with the application of learning models adapted during class, with the hope that educators and students can carry out interactive learning [3]. Educators as people who play a major role in the education sector can respond to the development of science and technology that is growing rapidly in social life [4].

Based on observations at Vocational High School 1 SUMBAR, the results of the researcher's observations carried out, especially in the subject of Lathe Machinery Engineering, the researcher pays attention to teaching and learning activities the learning model is applied with *teacher-centered* which means the lesson is centered on educators where *the job sheet* What will be done is from educators. Teacher-centered learning activities reduce student curiosity This makes learning less effective for developing student cooperation if it is only done with the teacher-centered method [5].

A team is a unit of two or more people who interact and coordinate a job and efforts to achieve a specific goal (Eva Silvani Lawasi, 2017). Cooperation is an activity aimed at group work between friends in which there are differences of opinion and can unite these opinions into one (Kusuma, 2018). Cooperation means a team that works together to achieve a common goal so that the work can run well. In learning, the priority is the advancement of students' academic and affective fields through cooperation skills (Nurnawati et al., 2012). By the activities, the activities that are realized are determined by a pattern that is mutually agreed upon.

Based on the responses of some students about the teacher-centered method used by educators in the teaching process, they tend to feel bored and saturated following learning, because the workpieces made during the practicum are less challenging which means that when they make the workpiece they are quickly saturated and boring, for that it is necessary to apply a new learning model with student-centered variations (*student-centered*). There are many project-based learning models, one of which is the model (*Project-based learning*). The PjBL learning model emphasizes contextual learning through complex activities, with innovative and creative learning models and approaches designed for complex and product-oriented problems [9].

Project based learning learning is very suitable to be applied to students because the learning model is creative, innovative, collaborative [10]. This project-based learning can provide opportunities for students to practice according to certain competencies, so as to be able to increase knowledge, skills, work attitudes and product results that involve students actively in completing project assignments. In line with the PJBL model research, [11], can increase the creativity of students who are done independently and in groups with the integration of practical and real problems. PJBL is learning that involves learners in preparing the design, manifesting, and demonstrating products for problems in the real world [12]. Project Based Learning is believed to be able to increase student creativity, cooperation, interest, and motivation through projects" [13]. For this reason, the purpose of this research is to implement the PjBL learning model to increase student creativity in turning engineering subjects.

2 Research Methods

The type of research used by classroom action research. Classroom Action Research is the study of social conditions to develop the quality of action [14]. Research conducted by educators in their classes through self-speculation [15]. The goal is to change the quality of learning practices in the classroom. In classrooms [16] action research, it can build and develop the quality of learning with cycles that should not be less than two cycles. At the implementation stage, following the project-based learning syntax which consists of seven steps, including formulating the desired learning outcomes, understanding teaching theory, competency training, preparing project themes, compiling project proposals, carrying out project assignments, and presentation project reports. The subject of the study was a class XI TP-2 student with a total of 14 people. Each cycle has four stages, namely the stage of preparation of actions, the manifestation of actions, and observation and reflection. The research instrument uses an observation sheet student cooperation, as well as data collection techniques by direct observation by observers (Table 1).

Planning starts with the researcher coordinating with the lesson teacher, then determining the projects carried out by students, preparation of lesson plans according to the basic competencies set, preparing observation sheets for student learning creativity, planning the timing of action implementation, and compiling a series of action plans comprehensively. In accordance with the material used, namely studying the lathe parts according to the use, function, and type of lathe used, students are given the task of creating a project starting from making designs, and work steps, to becoming products. in the form of chess pieces. Student product results are checked, and product results must meet the established competency standards, namely, there are lathes facing, multilevel, champer, and drill.

The observation process of researchers in the *support* of two observers who worked to pay attention to the cooperation of students using student cooperation observation sheets during the use of *project-based learning learning* models with data on the level of monitoring sheets of student cooperation which were quantitatively analyzed in percentages (Table 2).

The last stage is reflection where the reflection stage is a representation of what has been carried out during the application.

Table 1. Student Cooperation Observation Sheet Grid

Variable	Indicators
Student cooperation	1. Shared Responsibility in Completing Work
	2. Contributing to Each Other
	3. Trust Each Other and Understand Each Other
	4. Maintaining Relationships With Friends
	5. Facing Problems Together

Source: M. Huda [17]

Table 2. Student cooperation categories

Rank	Value
Excellent (SB)	81–100
Good (B)	61–80
Sufficient (C)	41–60
Low (R)	20–40
Very Low (SR)	0–20

Source: Suharsimi [18]

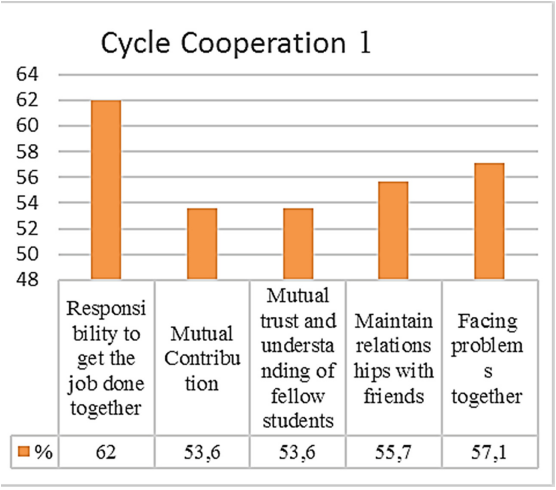

Fig. 1. Percentage of Student Cooperation Cycle 1

3 Results and Discussion

3.1 Cycle 1 Research Results

Based on the results of monitoring the creativity of students in cycle 1, it shows that the level of student cooperation carried out by students has been sufficient. The observation results showed that the average creativity value of students in cycle 1 was 56.4%. The percentage of learners' creativity is shown in Fig. 1.

Based on the figure, it can be seen that the cooperation of students in the Shared Responsibility indicator is the same by 62%. the indicator contributed to each other by 53.6%. The indicator of mutual trust and understanding of fellow students was 53.6%. indicator of maintaining relationships with friends by 55.7%. And the indicator faces the problem of Together by 53.6%. It is known that with monitoring in the field, students are still not used to students in groups and also students are still said to be selfish in groups so that the assessment of cooperation in cycle 1 has not been maximized.

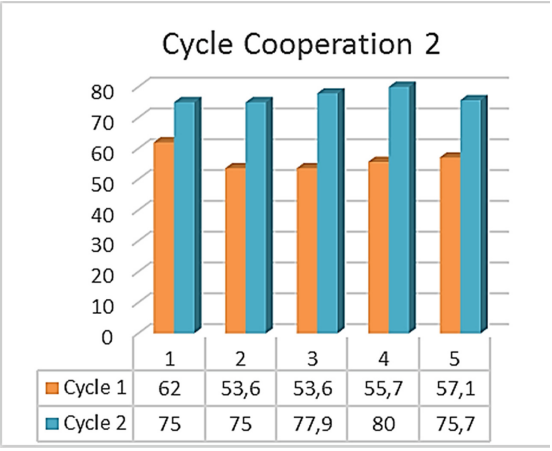

Fig. 2. Percentage of Student Cooperation Cycle 2

3.2 Cycle 2 Research Results

Based on observations on student cooperation in cycle 2, it proves that the cooperation carried out by students has increased from cycle 1 with good categories. Based on the observation results, it shows that the average value of the students in cycle 2 totaling 76.7% is categorized as good. The percentage of student cooperation is shown in Fig. 2.

Based on the figure, it can be seen that the cooperation of students in the Shared Responsibility indicator is the same by 75%. The indicator of mutual trust and understanding of fellow students was 77.9%. indicator of maintaining relationships with friends by 80%. And the indicator faces the problem of Together by 75.7%. It is known that by monitoring in the field of students thus cooperation between students can begin to increase. Students have already begun to get used to cooperation in fellow teams. Start with attention to responsibility for work. The cycle is continued to cycle 3 because it has not reached the success criteria.

3.3 Cycle 3 Research Results

Based on the results of observations on student cooperation in cycle 3, it shows that the cooperation carried out by students has increased from cycle 2 with a very good category. Observations showed the average value of student cooperation in cycle 3 was 84.9% with an excellent category. This is an excellent category and already meets the criteria of indicators of research success and the cycle is stopped. The data on the results of cooperation are presented in Fig. 3.

3.4 Discussion

Based on the results of research that has been obtained the learning cycle stops at cycle 3. This is after the success indicator is achieved, which is 80%, where in cycle 3 the increase has reached 84.9%. This increase occurred because students in completing a

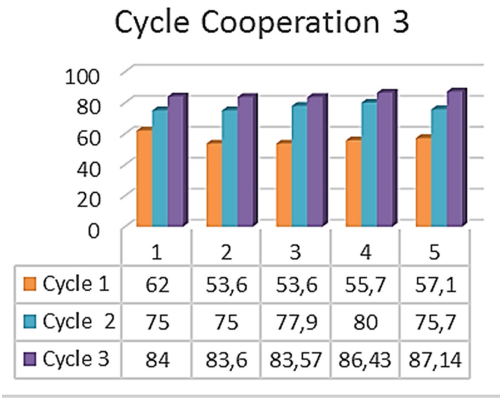

Fig. 3. Percentage of Student Cooperation Cycle 3

given project were carried out in groups, students exchanged knowledge in learning. This project-based learning model is proven to increase student cooperation activities in the learning process. In collaborative learning, project based learning models are good to use, especially for practical activities that require teamwork in making a product. Research [19] states that project based learning has proven effective in improving student cooperation attitudes. Project-based learning models assisted by edutaiment methods can improve cooperation skills and student learning outcomes [20].

The project-based learning model is considered suitable to increase student cooperation because in this learning model students are invited to complete tasks in groups. Using the project-based learning model, students can fully participate in learning, because this model is required to be able to construct their knowledge [21]. Each group member has their respective responsibilities in carrying out project assignments, so that no one is considered to be relying on other members and is always supervised by the teacher so that the learning process goes according to directions. Research [22] states that cooperation skills are very important to be developed from early childhood can train children's sensitivity, train children's ability to communicate, train the child to establish relationships and train the child to be able to value others. The use of the PjBL learning model is also able to increase motivation in working together. Research [23] ICT-assisted PBL with authentic problem projects also gives motivation and awareness to students about the importance of statistics and its implementation in real life and the development of another science.

4 Conclusion

Based on the results of the study it can be concluded that the use of project based learning learning models can increase student cooperation in the learning process. This is evidenced by the increase in the percentage of student collaboration up to 84.9% at the end of learning after the implementation of the project based learning model. One factor in the project based learning model that is very influential is cooperation in groups. It is

hoped that educators will always use learning models in providing learning materials to students in order to create self-reliant student learning on an ongoing basis.

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