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Application of the Project Based Learning Model to Increase Student Activity and Student Learning Outcomes in Basic Computer and Network Subjects

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ABSTRACT

The research aims to increase student activity and motivation in the subject of Computers and Basic Networks in class X TKI SMK Negeri 2 Bandung by using the Project Based Learning model. This research is Classroom Action Research (CAR) which aims to overcome existing problems in class. The research subjects were class X TKI students in the even semester of the 2019/2020 academic year, a total of 35 students. The research was conducted in two cycles and at the end of each cycle a reflection was made on the actions given. Data collection techniques in research is using observation sheets, questionnaires, and documentation. The results show that the implementation of learning using the Project Based Learning model in the Basic Computer and Networks subject can increase student activity and motivation. The result show that student activeness went from of 71.84% in Cycle 1 increased in Cycle 2 with 74.61%, and student completion rate went from of 78% in Cycle 1 to 100% in Cycle 2. It is proved that the Project Based Learning model can increase student activity in Basic Computer and Network Subjects.

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1. INTRODUCTION

Education in Indonesia is currently faced with demands to be able to produce quality human resources (HR), namely human resources who can adapt to the current era of globalization. Education is a decisive element in the development of human resources (Jerez-Gomez *et al*., 2005). Human resources in question are those who have the competencies in real life, especially the industry which is full of competition and challenges. Through education, human will be able gain knowledge and skill needed to survive the industry world. Thus, it can be seen clearly how important education is in improving the quality of human resources (Glewwe & Jacoby, 1994).

Improving the quality of formal education in schools is inseparable from the demands of success from the process of learning activities. The process of learning activities is influenced by several things that are interrelated with each other, including teachers, students, learning methods and supporting facilities (Gibson & Dembo, 2984). These four components have an important role in determining the success of the process of learning activities that will affect student activity and motivation. One of the said formal education is vocational high school.

SMKN 2 Bandung is a vocational high school that specializes in several expertise programs. There are several expertise programs or majors held at the school, while the expertise programs are Mechanical Engineering, and Computer and Information Engineering. In the computer and network engineering expertise program, the learning process applies to a new curriculum, namely the 2013 curriculum, the 2013 curriculum is often referred to as a character-based curriculum. This curriculum is a new curriculum issued by the Ministry of Education and Culture of the Republic of Indonesia that prioritizes understanding, skills, and character education, which implement student-centered learning. The students are expected to think actively, creatively, innovatively, and communicatively in the discussion and presentation process as well as developing good manners and discipline.

However, the implementation of the 2013 Curriculum has not been maximized, especially when carrying out the learning process in class. This can be seen from the low activity of students in the learning process. The students are less enthusiastic in receiving the lessons conveyed by the teacher in front of the class and it is known that students are reluctant ask either friends or the teacher during the lesson. The teacher has tried to apply innovative learning media, but the implementation in class is not as expected simply because the students do not understand what they are doing (Jaedun *et al*., 2014). In some cases, the teacher still dominates the learning process and make the student less involved in learning.

The same condition is also observed in class X TKI students at SMK Negeri 2 Bandung. It was found that the teachers use less varied methods and students are not actively involved in exploring, assessing, interpreting, synthesizing in learning activities. It makes for the low activity and learning motivation in students. The students tend to be passive in learning, lack respect for teachers, and do not fully understand the material presented. This condition hinders the student to achieve the predetermined passing grade of 75 in daily test of Computer Assembling subject

Teachers are required to have good teaching abilities, therefore, to comply with these demands a teacher must be able to choose and use appropriate learning methods and in accordance with the subject matter to be delivered, also considering the level of development of their students. The learning method used by the teacher should always pay attention to student factors that act as learning subjects, since the student has varying abilities and ways of learning. These differences lead to different needs of everyone. However, this does not

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mean that learning must be turned into individual learning, but learning is needed to fulfill the individual needs of students.

Project Based Learning (PBL) is a learning model that uses projects/activities as the core of learning. Students carry out exploration, assessment, interpretation, synthesis to produce various forms of learning outcomes. PBL is an in-depth investigation of a real-world topic. The steps for implementing project-based learning are determining fundamental questions, compiling project plans, compiling schedules, monitoring, testing results, and evaluating experiences. Project-Based Learning uses problems as a first step in gathering and integrating new knowledge based on experience in real activities.

Based on the existing problems, educational research was carried out to increase the learning activity and to improve the learning outcomes of class X TKI students through the application of the Project Based Learning model in the subject of Computers and Basic Networks computer assembly material at SMK Negeri 2 Bandung.

2. METHODS

The type of research being conducted was classroom action research (CAR). The data taken came from direct observation of the course of the learning process in class (Casey & Dyson, 2009). The data obtained were then analyzed through several stages of the action cycle. This classroom action research (CAR) places more emphasis on the ongoing process, where in the work procedure there is a reflection stage to find obstacles encountered in the research process and find solutions to these obstacles. This research was carried out collaboratively between researchers and teachers of computer engineering and networks within the school. Two methods were used in this study, namely quantitative and qualitative methods.

The use of these two methods is based on the research objectives to be achieved, namely changes and improvements in the teaching and learning process. This research was conducted in two cycles, namely cycle I and cycle II. In this classroom action research, the researcher adopted the model developed by Kemmis and Mc Taggart. The steps in this research are planning, acting, observing, and reflecting. The research cycle can be seen in **Figure 1**.

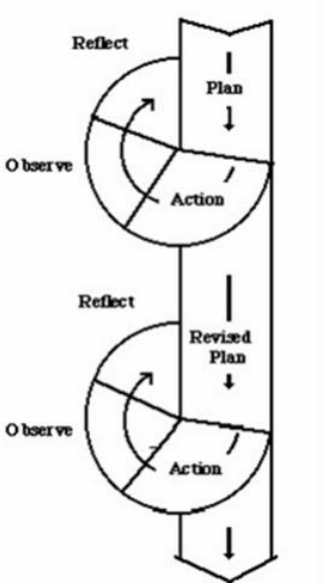

Figure 1. CAR Cycle According to Kemmis & McTaggart.

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2.1. Plan Stage

This stage consists of compiling the formulation of the problem, objectives and making an action plan, including making research instruments in a form of observation sheets, student learning activity questionnaires, and interview guidelines, as well as making learning planning document such as the syllabus (Surya & Syahputra, 2017).

2.2. Action and Observation Stage

This stage includes actions taken as an effort to build students' conceptual understanding, namely the application of the problem-based learning (PBL) learning model and observing the results or impact of implementing the problem-based learning (PBL) learning model.

2.3. Reflection Stage

This stage includes the act of reviewing or analyzing, viewing, and considering the results or impact of the actions taken based on the observation sheet filled in by the observer. This reflection stage is the decisive stage, which is to determine what action should be taken next, whether learning should be implemented in the next cycle or should be stopped because it has reached a predetermined target that is in accordance with the indicators of learning success.

2.4. Revision Stage

In this stage, the researcher designed a plan based on the results of the previous reflection stage. The revised plan is then carried out in the next cycle.

3. RESULTS AND DISCUSSION

Class action research (classroom action research) was carried out in 2 cycles. From each cycle, an assessment is obtained related to students' understanding of the material that has been delivered by the teacher.

3.1. Cycle 1

3.1.1. Planning

The first action taken at the planning stage is to prepare a lesson plan which contains the identity of the education program, core competencies and basic competencies, competency achievement indicators, learning objectives, learning materials, approaches, strategies, and methods, learning activities, learning tools and media, learning resources, assessment learning, knowledge, and skills items, and scoring guidelines. Syllabus is prepared based on materials that applies to basic computer and network subjects. In cycle I, the material provided is basic competence in analyzing video production, animation and digital music which is carried out during one meeting.

At the planning stage, the researcher also prepare research instruments including activity observation sheets, motivational observation sheets, student questionnaire sheets. The activity observation sheet is used as material for viewing or assessing student activity during learning. Besides that, it also prepares a list of group names and documentation tools in the form of a digital camera that will be used to document activities that occur during the learning process with the Project Based Learning model taking place.

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3.1.2. Acting

The implementation of class action in cycle I was carried out on Monday, October 12, 2020, in the TKI class at SMKN 2 Bandung. The stages of the lesson plan are as follows:

(i) Introduction/Start Activities
   a. Create a pleasant learning atmosphere by giving greetings to students.
   b. Guide students to pray led by the teacher.
   c. Explains the material to be studied, namely the installation of application software. The teacher explains with the help of modules that are already owned by each student.
   d. Convey the benefits of installing application software in animation development.
   e. Convey an outline of the scope of application software installation in animation development and activities to be carried out.

(ii) Core activities
   a. Stimulation. The teacher provides stimulation to students regarding the material to be taught by asking questions to arouse curiosity in students. After that, the teacher can continue learning activities about application program installation materials that lead to preparation of problem solving and encourage exploration.
   b. Identification of problems. The teacher gives students the opportunity to identify relevant problems related to the application program installation material.
   c. Data collection. The teacher directs students to collect data related to application program installation materials both from searching for data and information from the internet, books and so on.
   d. Data processing. This stage is the activity of processing data and information that has been obtained by students at the data collection stage. All results of data processing will be processed, processed, clarified, and interpreted. This data serves to draw conclusions, so students gain new knowledge.
   e. Proof. Students carry out careful examinations to prove whether the hypothesis is correct from the problem or information collected by students from the results of data collection and processing. Teachers guide in proving the information they get about the installation of application programs.
   f. Conclusion. The teacher guides students in drawing conclusions, so that the conclusion goes well and does not deviate from the material being taught. Teachers and students reflect on any information obtained by these students about the material they have studied.

3.1.3. Observation

This observation stage is carried out simultaneously with the implementation of the action. At this stage, the researcher have the teacher to join the Google Classroom learning activities, assisted by interactive multimedia from the internet. The teacher's job as the observer is watch the ongoing learning and provide suggestions and input to the researcher. During the teaching and learning process using the Google Classroom, researchers used assessment and observation sheets. Before the learning activities is carried out, the researchers held a pre-test. The assessment obtained from the pretest can be seen in **Table 1**.

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Table 1. Test Results in cycle 1

No	Student's name	F/M	Score	Passing grade 72
1	Student 1	M	80	Complete
2	Student 2	M	70	Not Completed
3	Student 3	F	78	Complete
4	Student 4	M	85	Complete
5	Student 5	F	68	Not Completed
6	Student 6	F	62	Not Completed
7	Student 7	M	85	Complete
8	Student 8	F	80	Complete
9	Student 9	F	85	Complete
10	Student 10	F	80	Complete
11	Student 11	F	62	Not Completed
12	Student 12	M	68	Not Completed
13	Student 13	F	80	Complete
14	Student 14	F	85	Complete
15	Student 15	F	80	Complete
16	Student 16	F	68	Not Completed
17	Student 17	M	60	Not Completed
18	Student 18	M	80	Complete
19	Student 19	M	80	Complete
20	Student 20	M	85	Complete
21	Student 21	M	68	Not Completed
22	Student 22	F	72	Complete
23	Student 23	M	78	Complete
24	Student 24	F	80	Complete
25	Student 25	F	85	Complete
26	Student 26	M	85	Complete
27	Student 27	F	80	Complete
28	Student 28	M	80	Complete
29	Student 29	F	80	Complete
30	Student 30	M	68	Not Completed
31	Student 31	M	80	Complete
32	Student 32	F	72	Complete
33	Student 33	F	80	Complete
34	Student 34	M	85	Complete
35	Student 35	F	80	Complete

The teacher who did the observation on the student filled student activity assessment sheet. The results of student observations during cycle 1 activity are shown in **Table 2**. A score consisted of 1-3 was given depending on student's attitude and activeness.

Tabel 2. Observation sheet of student activity cycle 1.

No	Observed aspect	Score		
		1	2	3
I	**Preparation**			
	Physical preparation of students in participating in learning		√	
	Preparation of study equipment		√	
	Preparation of student performance		√	
II	**Implementation**			
	Initial activity			
	Students answer the teacher's greeting and pray together			√
	Students answer the news with enthusiasm			√

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	Students respond to questions given by the teacher in apperception activities	√	
	Students pay attention to the motivation given by the teacher	√	
	Students pay attention to the teacher in conveying learning objectives and implementing them	√	
III	**Core activities**		
	Students listen to the teacher's explanation in the form of a stimulus about the material to be taught	√	
	The teacher gives directions to students to explore/search for information related to learning materials		√
	Students explore/search for information or data related to the material either with books or the internet		√
	The teacher guides if the student has difficulty processing the data obtained during data collection		√
IV	**Final activities**		
	Students answer questions given by the teacher	√	
	Students and teachers make conclusions from the learning process at that time		√
	Students pay attention to the reinforcement delivered by the teacher	√	
	Students work on the posttest sheet given by the teacher		√
	Students get motivation from the teacher to learn the next material	√	
	Students read a prayer together to close the lesson at that time		√

This data was taken during the learning process through observing students' understanding of the learning material being taught using observation sheets that had been prepared by the researcher. The score is obtained with the following calculation:

$$Score = \frac{score\ obtained}{max\ score} \times 100\% = \frac{44}{63} \times 100\% = 71{,}84\%$$

To see the percentage figures, the determination is used with the assessment determination of student understanding as seen in **Table 3**. From **Table 3**, the results of student learning activities during learning are 71.84%, which means it is included in the "Good" criteria. Since the learning activity is carried out online with the help of interactive multimedia (remote), some students are still difficult to control because the student and teacher cannot interact directly. Some students also lack focus in participating in learning properly due to noisy surroundings, slow internet connections and various other factors.

Table 3. Criteria percentage.

Percentage Score (%)	Criteria
76%-100%	Very Well
51%-75%	Good
26%-50%	Enough
<26%	Not Good

3.1.4. Reflecting

The reflection stage is the stage in processing the data obtained during the observation. The reflection stages of cycle 1 are carried out after learning activity is done. **Table 4** shows the data that has been processed by the researcher. At the reflection stage, the researcher and the observer will evaluate the learning that has taken place. In the assessment table above, the average student score is 77.85 which indicates that this cycle is "Not Completed". Some students whose scores are below the passing grade (namely 78), around 10 students whose scores are below the passing grade, and there are several other students who have standard scores.

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Table 4. Results in cycle 1.

Description	Score
Lowest Value	70.00
The highest score	85.00
Average	77.85
Number of students who completed	25.00
Number of students who did not complete	10.00
Completeness percentage	78%

Therefore, cycle 2 is carried out so that the ten students can improve their grades to achieve the passing grade that has been determined and is expected to increase students' understanding of the material. Researchers analyze the data related to learning that has been taught and try to find solutions so that students' grades and understanding can increase in cycle 2 later.

3.2. Cycle 2

3.2.1. Planning

The first action taken at the planning stage is to prepare a lesson plan which contains the identity of the education program, core competencies and basic competencies, competency achievement indicators, learning objectives, learning materials, approaches, strategies, and methods, learning activities, learning tools and media, learning resources, assessment learning, knowledge, and skills items, and scoring guidelines. A syllabus is prepared based on the material that applies to basic computer and network subjects. In cycle 2, the material provided is basic competence in analyzing video production, animation and digital music which is carried out during one meeting.

At the planning stage also prepare research instruments as data collectors including activity observation sheets, motivational observation sheets, student questionnaire sheets. The activity observation sheet is used as material for viewing or assessing student activity during learning from prayer activities to group discussions. Besides that, it also prepares a list of group names and documentation tools in the form of a digital camera that will be used to document activities that occur during the learning process with the Project Based Learning model taking place.

3.2.2. Acting

The implementation of class action in cycle II was carried out on Tuesday, October 13, 2020, in the TKI class at SMKN Bandung. The stages of the lesson plan are as follows:

(i) Introduction/Initial Activities:
   a. Create a pleasant learning atmosphere by giving greetings to students.
   b. Guide students to pray led by the teacher.
   c. Explains the material to be studied, namely the installation of application software. The teacher explains with the help of modules that are already owned by each student.
   d. Convey the benefits of installing application software in animation development.
   e. Convey an outline of the scope of application software installation in animation development and activities to be carried out.

(ii) Core activities
   a. Stimulation. The teacher provides stimulation to students regarding the material to be taught by asking questions to arouse curiosity in students. After that, the teacher can

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continue learning activities about application program installation materials that lead to preparation of problem solving and encourage exploration.

b. Identification of problems. The teacher gives students the opportunity to identify relevant problems related to the application program installation material.
c. Data collection. The teacher directs students to collect data related to application program installation materials both from searching for data and information from the internet, books and so on.
d. Data processing. This stage is the activity of processing data and information that has been obtained by students at the data collection stage. All results of data processing will be processed, processed, clarified, and interpreted. This data serves to draw conclusions, so students gain new knowledge.
e. Proof. Students carry out careful examinations to prove whether the hypothesis is correct from the problem or information collected by students from the results of data collection and processing. Teachers guide in proving the information they get about the installation of application programs.
f. Conclusion. The teacher guides students in drawing conclusions, so that the conclusions go well and do not deviate from the material being taught. Teachers and students reflect on any information obtained by these students about the material they have studied.

3.2.3. Observation

This observation stage is carried out simultaneously with the implementation of the action. At this stage, the researcher involved observers to observe the Google Classroom learning activities assisted by Interactive Multimedia. The purpose of the observer is to observe ongoing learning and provide suggestions and input to the researcher. During the teaching and learning process using the Google Classroom model assisted by Interactive Multimedia, researchers used assessment and observation sheets. After the learning activities is carried out, the researchers held a post-test. The assessment obtained from the post-test can be seen in **Table 5**.

Table 5. Test Results in cycle 2

No	Student Name	M/F	Score	Passing Grade >72
1	Student 1	M	95	Complete
2	Student 2	M	90	Complete
3	Student 3	F	90	Complete
4	Student 4	M	80	Complete
5	Student 5	F	95	Complete
6	Student 6	F	95	Complete
7	Student 7	M	90	Complete
8	Student 8	F	82	Complete
9	Student 9	F	95	Complete
10	Student 10	F	90	Complete
11	Student 11	F	80	Complete
12	Student 12	M	90	Complete
13	Student 13	F	85	Complete
14	Student 14	F	95	Complete
15	Student 15	F	90	Complete
16	Student 16	F	90	Complete
17	Student 17	M	82	Complete
18	Student 18	M	95	Complete
19	Student 19	M	95	Complete

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20	Student 20	M	90	Complete
21	Student 21	M	82	Complete
22	Student 22	F	95	Complete
23	Student 23	M	90	Complete
24	Student 24	F	90	Complete
25	Student 25	F	82	Complete
26	Student 26	M	90	Complete
27	Student 27	F	95	Complete
28	Student 28	M	82	Complete
29	Student 29	F	90	Complete
30	Student 30	M	90	Complete
31	Student 31	M	90	Complete
32	Student 32	F	80	Complete
33	Student 33	F	82	Complete
34	Student 34	M	82	Complete
35	Student 35	F	90	Complete

Referring to **Table 5**, the results of learning google classroom computer material and basic network for class X had good results, from the cycle II table that was carried out there was an increase in results where 9 students who experienced bad grades increased and this was a good achievement after acting cycle II. So that it can be concluded that google classroom learning has succeeded in achieving passing grade, the implementation of google classroom learning operating system material as an alternative in emergencies amid the COVID-19 pandemic can be concluded that the learning objectives have been achieved.

The teacher who did the observation on the student filled student activity assessment sheet. The results of student observations during cycle 2 activity are shown in **Table 6.** Data collection that was carried out related to the preparation and implementation of learning and students' understanding of the material being taught. A score consisted of 1-3 was given depending on student's attitude and activeness.

Table 6. Observation sheet of student activity cycle 2.

No	Observed Aspect	Score		
		1	2	3
I	Preparation			
	Physical preparation of students in participating in learning			√
	Preparation of study equipment		√	
	Preparation of student performance			√
II	Implementation			
	Initial activity			
	Students answer the teacher's greeting and pray together			√
	Students answer the news with enthusiasm			√
	Students respond to questions given by the teacher in apperception activities		√	
	Students pay attention to the motivation given by the teacher		√	
	Students pay attention to the teacher in conveying learning objectives and implementing them		√	
III	Core activities			
	The teacher gives directions to students regarding presentations about interactive multimedia projects that have been made			√
	Students hear the teacher's directions for a presentation of an interactive multimedia project they have created			√
	Students wait quietly for their turn to present an interactive multimedia project			√
	Students presented the project well with the theme each student took			√

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	Final activities		
	Students answer questions given by the teacher		√
	Students and teachers make conclusions from the learning process at that time		√
	Students pay attention to the reinforcement delivered by the teacher		√
	Students get motivation from the teacher to learn the next material	√	
	Students read a prayer together to close the lesson at that time		√

The score is obtained with the following calculation:

$$Score = \frac{Acquired\ score}{\text{Max}\ score} \times 100\% = \frac{46}{63} \times 100\% = 74{,}61\%$$

To see the percentage figures, the provisions used with the assessment provisions for student understanding are used as shown in **Table 7**.

Table 7. Criteria percentage table.

Score Percentage (%)	Criteria
76%-100%	Very well
51%-75%	Good
26%-50%	Enough
<26%	Not good

3.2.4. Reflection

The reflection stage is the stage in processing the data obtained during the observation. Researchers reflected and analyzed cycle 2. Researchers also discussed with observers and received input from them as supervisors, as well as related lecturers as supervisors of classroom action research (CAR). Seeing the results of the student assessment table in cycle 2 shows that there is an increase in student understanding regarding the material for making interactive multimedia products based on hyperlink pages.

Based on **Table 8**, the student's average score is 87.54 which indicates that the student has been achieved completion in learning. Each of these students scored above the passing grade, which was 78. The researchers assessed the aspects and criteria of the interactive multimedia created by these students. Even though there were some students who did not get high scores, their scores were above the passing grade, and these students already understood the material that had been taught. It is suggested that some improvements may be given by the teacher as a reference for students so that the interactive multimedia that has been made by students can be better.

Table 8. Test Results in cycle 2.

Description	Score
Lowest Value	82.00
The highest score	95.00
Average	87.54
Number of students who completed	35.00
Number of students who did not complete	0.00
Completeness percentage	100%

In accordance with the indicators desired by researchers in cycle 2, which can increase student understanding. When compared to cycle 1 with 5 students with scores below the passing grade, there was an increase in the scores of each student by fulfilling the Passing

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grade. The student completion rate is 100%, meaning that all student had pass the passing grade of 78.

4. CONCLUSION

Based on the results of the research and discussion, classroom action research (CAR) on computers and basic networks for class X TKI SMK Negeri 2 Bandung can be concluded that subjects using the Project Based Learning model in class can increase student activity and also increase student motivation. It can be seen on the result of student activeness, it went from of 71.84% in Cycle 1, and increased in Cycle 2 with 74.61%. In student's completion result, there is also an increase. It can be seen on the result that in term of student completion rate, it went from of 78% in Cycle 1 to 100% in Cycle 2.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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