

Effect of Instructional Model and Learning Motivation on Control System Learning Outcomes

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Abstract: This study aimed to determine the effect of instructional models and motivation on student learning outcomes on Control System material. The sampling technique was carried out using Multi-stage random sampling, which is a phased sampling based on random. One experimental class consists of 32 students, while the control group consists of 32 students. The next stage is that each group is sorted into two, namely groups consisting of students who have high learning motivation and groups consisting of students who have low learning motivation. Determination of the level of learning motivation of students in the population was carried out using a learning motivation test. The data in this study consisted of Control System learning outcomes data and data on learning motivation. Data on students' Control System learning outcomes were collected through the Control System learning outcomes test instrument. Meanwhile, data on students' learning motivation was collected through a learning motivation instrument obtained through a learning motivation questionnaire with four answer choices for students who were the research sample. The data analysis technique is a process of processing and interpreting data to make various information following its function so that it has clear meaning and meaning following the research objectives. The study results show differences in learning outcomes by using learning models and learning motivation. Students with low motivation who are treated with both models have no difference in learning outcomes, so teachers need to innovate to improve students with low motivation.

Keywords: Project Based Learning, Case Based Learning, Learning Motivation, Control system

INTRODUCTION

Instruction is a system comprising various interconnected components, namely objectives, materials, methods and evaluation (Jarudin et al., 2020). Educators must consider the four components in choosing and determining learning models used in learning activities (Rusman, 2010). The learning process will be effective, efficient and enjoyable if the learning model used by the educator is appropriate and follows the conditions of the students (Rohman, Ayuningrum, et al., 2020). Learning models have a very important role in determining the creation of an effective learning process. Learning design supported by the selection of the right learning model will provide optimal results in achieving students' expected motivation and competence (Rohman, Aziz, et al., 2020).

Motivation is a psychological condition that encourages a person to do something both within himself and from outside (Khodabandehlou et al., 2012). Learning motivation is a basic attitude students need in the learning process (Wospakrik et al., 2020). Students, educators, learning methods or processes, and the environment are elements that influence learning motivation. Learning motivation can cause a decrease in students' learning achievement, so educators need to increase students' learning motivation. Motivation can improve goals and objectives in the desired learning outcomes (Fatonah et al., 2020). Given the

importance of motivation for students to develop in achieving learning outcomes, the role of educators who can encourage motivation growth. Foster learning motivation in schools. There are several ways to do this, such as giving praise, prizes, and numbers, checking the assignments, using the right model in learning and giving punishment (Mardani et al., 2021). One of the Instructional models suggested in the 2013 curriculum was Project-based learning and case-based learning models.

Relevant research states that Project-Based Learning (PjBL) is a systematic learning model based on students' cognitive knowledge and skills (Inan et al., 2010). Growing complex cases apply PjBL for students to analyze. In this case, the teacher is a facilitator (Risky & Liana, 2022). The PjBL model is more appropriate for fostering creativity and improving learning outcomes (Seechaliao, 2017). The project is carried out to solve the problem of surrounding natural resources (Harizah et al., 2021). The PjBL strategy helps to enhance lifelong learning skills in an open, reflective, critical mindset and active learning. It facilitates successful problem-solving, communication, group work, and interpersonal skills better than other strategies (Gunawan et al., 2022). If students have high learning motivation, students will be more active and more determined to learn (Baidowi et al., 2021; Nasrah & Muafiah, 2020). The Case Based Learning (CBL) learning model can ask questions

and make comments during class and make learning more interesting (Fauziah et al., 2022). Case-based learning significantly improves student understanding (Dewi et al., 2022). Case-based learning is an effective and interesting learning approach (Wospakrik et al., 2020).

Based on observations made at the Jakarta Center for Refresher Education and Improvement of Shipping Science (BP3IP) with the object of research for Student Officers. The initial research results show that the learning process of the Control System System is very different from what is expected, and the learning outcomes are not satisfactory. This is because the learning process is still monotonous. The learning process with the lecture method and giving assignments, so that students are not enthusiastic in participating in learning. Students are passive and more silent and wait for the presentation of the material provided by the educator. Control System System material is a lesson that should motivate students to learn motivation. But because of, the selection of learning strategies that are not appropriate makes students bored and lazy to ask questions and hopes that the learning process is over soon. This makes teaching and learning conditions not optimal. Various kinds of reasons for students to be able to leave class to get rid of boredom. Thus, it shows that the learning process so far has not been able to make students motivated to learn optimally and tend to think passively, resulting in low student learning outcomes.

An effective learning process requires the right instructional strategies, methods and models. One of the efforts that educators can make to improve student learning outcomes in learning by selecting and using the right learning model. Learning outcomes or achievements are the realization or expansion of a person's potential skills or capacities. The learning outcomes that a person has can be seen from his behaviour. These learning outcomes can be seen from students' mastery of their subjects (Komariyah & Laili, 2018). A good educator must know the learning methods suitable for the material to be taught and will make students' learning outcomes decrease or not follow the graduation criteria (Jafar, 2021).

Based on the observation, the lack of total student involvement in learning is due to students not trying to find information themselves, reducing the meaning of active and effective learning. Students tend to learn to be able to answer test questions by memorizing subject matter instead of understanding, analyzing a problem, and solving problems that may be faced daily. Hence, their critical thinking is less trained. As a result, the cognitive aspect is also lacking, as evidenced in the

average acquisition of learning outcomes in the previous competency is still less than the minimum competency standard; not infrequently, educators have to do remedial. Efforts to overcome these problems must be carried out through practical learning activities in shaping students to learn independently without forgetting cognitive, affective and psychomotor aspects, one of which is using Project-Based Learning (Insyasiska et al., 2015).

In the control system subject, educators need to use an instructional model that can make students able to motivate learning according to what is needed by students and adapt to the conditions to achieve learning objectives. One of the actions that can be taken is to use the Project Based Learning learning model. The Project Based Learning model approach, according to (Saerozi, 2017) Project Based Learning (PjBL), is a learning model that provides opportunities for educators to manage to learn in the classroom by involving project work. Project-based learning is a comprehensive teaching approach where students are involved in ongoing inquiry activities.

This study aimed to determine the effect of instructional models and motivation on student learning outcomes on Control System material. The research hypothesis is that there is an effect of the use of learning models on student learning outcomes in Control Systems material. There is an interaction between learning models and learning motivation on student learning outcomes in Control Systems material. There are differences in learning outcomes between those taught the Project Based Learning model and those taught the Case Based Learning model in groups of students with high learning motivation on Control System material. There are differences in learning outcomes between those taught the Project Based Learning learning model and those taught the Case Based Learning learning model in groups of students with low learning motivation on Control System material.

METHODS

The method or type used in this research is comparative quantitative research through a quasi-experimental approach with treatment by level 2 x 2 design. The choice of this method is adjusted to the data you want to know according to the research objectives, namely, knowing the differences in student learning outcomes on Control System material as a result of the treatment given. The dependent variable in this study is student learning outcomes on Control System material. The first independent variable is instructional models, divided into two treatment

groups: learning using Project Based Learning models and Case Based Learning models. The second independent variable is student learning motivation, namely high and low learning motivation.

RESEARCH DESIGN

This research is experimental by manipulating one or more variables in one or more experimental groups. The results are then compared with the control group (which is not manipulated). This is quasi-experiment research

because not all variables appearing in experimental conditions can be strictly regulated and controlled (Yunitasari & Hanifah, 2020). In this study, the PjBL-type cooperative learning model was compared with the Case Based Learning model on the learning outcomes of Control System material regarding learning motivation. The analysis design used is 2 x 2 factorial consisting of 4 combinations, obtained from the product of 2 instructional models (the use of Project Based Learning and Case Based Learning) with two levels of learning motivation (high and low). The research design is presented in Table 1.

Table 1. Treatment by Level 2 x 2 research design

Learning Motivation (B)	Instructional Models (A)	
	Project-Based Learning (A1)	Case-Based Learning (A2)
High (B ₁)	A ₁ B ₁	A ₂ B ₁
Low (B ₂)	A ₁ B ₂	A ₂ B ₂

Sample Collection Technique

Sample collection was carried out using Multi-stage random sampling, which is a phased sampling based on random. Selecting class A is the Project Based Learning model class, and class B is the Case Based Learning model class. Determining each class into two groups with high and low learning motivation. Considering that this research uses a 2 x 2 factorial design, in the first stage, simple randomization is selected into two groups, namely the group of students who will be taught with the use of the Project Based Learning model as the experimental group and the group of students who will be taught with the use of the Case Based Learning model as the control group. One experimental class consists of 32 students, while the control group consists of 32 students. The next stage is that each group is sorted into two, namely groups consisting of students who have high learning motivation and groups consisting of students who have low learning motivation.

The population with a learning motivation score around the average (middle group) is not taken as a research sample because it is less able to identify trends whether the population is included in high or low learning motivation. A total of 32 students of high or low learning motivation groups from experimental and control classes were taken as samples.

Data Collection Technique

The data in this study consisted of Control System learning outcomes data and data on

learning motivation. Data on students' Control System learning outcomes were collected through the Control System learning outcomes test instrument. While data on student learning motivation is collected through learning motivation instruments obtained through learning motivation questionnaires with four answer choices for students who are research samples.

Before compiling the instrument, first synthesize the theories, resulting in conceptual definition indicators, operational definitions, instrument grids, and preparation of instrument items. The next step is to test the content and construct validity by several experts on the instruments made. The last is to conduct a trial to determine the validity and reliability of the instrument before being given to the research subjects.

The lattice of test instruments is prepared based on learning objectives with the abilities that students will achieve and outlined in the learning scenario. The test material is the subject matter of direct online starting. Power Diagram material and direct online starting system Control Diagram. Consists of 20 questions. This study's form Control System learning outcomes instrument is a test with multiple choice questions. The teacher, assisted by the researcher, conducted the test. This was done so that the data obtained was more objective. The lattice of learning outcomes instrument material Power Diagram direct online starting and system Control Diagram direct online starting can be seen in Table 2.

Table 2. Learning Outcomes Instrument Grid

Basic competencies	Subject	Sub Subject	Cognitive aspects	Item of Number
Analyze the direct online starting method AC electric motor.	Power Diagram direct online starting (DOL)	Control diagram	C4	1,2
		Load current safeguard (MCB)	C3	3,4,5
		Magnetic Contactor	C2	6,7,8
		Overcurrent safeguards (TOR)	C2	9,10
		Control diagram	C4	11,12
		Overcurrent safeguards (MCB)		13,14,15,16
		Control system Push button	C2	17, 18
		direct online starting (DOL) Auxiliary box of contactor	C2	19
		Sign light	C2	20

The lattice of learning motivation instruments contains indicators or aspects used as the basis for making question items whose purpose is to determine students' learning motivation and whether these students have high or low motivation. Learning motivation in this study was

collected through non-test techniques, namely using a questionnaire. The questionnaire used in this study is a closed questionnaire type because the respondent chooses one of the answers provided by the researcher. The instrument lattice can be seen in Table 3.

Table 3. Learning Motivation Instrument Lattice

No.	Indicator	Description	Item of Number
1.	Perseverance	Attendance at school	1, 2, 3, 4, 5
		Participation in learning	5, 6, 7, 9
		Independence in learning	10, 11, 12, 13, 14, 15
2.	Tenacity	Attitude towards difficulties	16, 17, 18
		Efforts to face difficulties	19, 20,
3.	Interest and Attention	Attitude in following the lesson	21, 22, 23, 24,
		Passion in learning	25,26

With the provision that in a positive statement, if you state Strongly Agree (SS) is given a score of 5, Agree (S) is given a score of 4, Undecided (R) is given a score of 3, Disagree (TS) is given a score of 2, and Strongly Disagree (STS) is given a score of 1. As for negative statements, if you state Strongly Agree (SS) is given a score of 1, Agree (S) is given a score of 2, Undecided (R) is given a score of 3, Disagree (TS) is given a score of 4, and Strongly Disagree (STS) is given a score of 5 (Riduwan, 2013: 13).

Data Analysis Technique

The data analysis technique is a process of processing and interpreting data to make various information following its function so that it has clear meaning and meaning following the research objectives. The data that has been obtained in the

research process is processed systematically to determine the results of the research. The data analysis technique used to process the research results is using quantitative data analysis techniques. The quantitative technique is a characteristic of a variable whose values are expressed in numerical form (Sugiyono, 2015). Quantitative data analysis techniques in the form of data from student evaluation results, results of learning motivation questionnaires, and observation results are processed into numbers. The data that has been processed is used to observe changes or improvements that occur in each cycle. Changes can be seen by comparing the results before and after given actions related to learning outcomes and learning motivation of ATT students at the Center for Refresher Education and Improvement of Shipping Science (BP3IP) on Control System material.

For the results of hypothesis testing to be carried out, a hypothesis requirement test is first carried out, including a normality test and a data homogeneity test. The data normality test was conducted with the Lilliefors test, while the homogeneity test was conducted with the Barlett test. Data analysis in this study is needed to describe the research data in general and to test the research hypothesis. Descriptive statistics were used to describe the data in general while testing the hypothesis; because this research is experimental research with a Treatment by level 2 x 2 design, the data analysis used two-way ANOVA. Suppose the analysis of variance shows an interaction effect between independent variables in relation to the dependent variable. In that case, the analysis is continued with further analysis of variance through the Scheffi test to test further research hypotheses.

RESULTS & DISCUSSION

The results of this study based on testing the first independent variable is the use of instructional models (A), which is divided into two treatment groups, namely learning with the use of Project Based Learning models (A1) and the use of Case Based Learning models (A2). The second independent variable is student learning motivation (B), namely high (B1) and low (B2) learning motivation. Based on the results of this research hypothesis test was conducted using a two-way ANOVA and further tests using the Scheffe test. The results of the calculation of the two-way ANOVA test and the Scheffe test can be seen in Table 4.

Table 4. ANOVA and Scheffe Test Results.

Source	df	Mean Square	F	F-table	Sig.
Model (A)	1	1725.781	10.343	4.160	.003
Motivation (B)	1	2538.281	15.213	4.160	.001
Model (A)* Motivation (B)	1	3507.031	21.019	4.160	.000

Source	df	Mean Square	t	t-Table	Sig.
A1B1*A2B1	28	35.62	5.516	2,048	.001
A1B2*A2B2	28	-3.12	-0.484	2,048	.816
A1B1*A1B2	28	38.75	6.00	2,048	.001
A1B1*A2B2	28	32.50	5.032	2,048	.001

First Hypothesis

The results of the two-way ANOVA calculation obtained F-statistic = 10.343 > F-table = 4.160 or Sig. = 0.003 < α = 0.05, then the statistical hypothesis rejects H_0 . This shows that there are differences in the learning outcomes of students who are treated with the Project Based Learning learning model with the learning outcomes of students who are treated with the Case Based Learning model. The average score results show that the learning outcomes of students treated with the Project Based Learning learning model (average score A1 = 134.375) are higher than those treated

with the Case Based Learning learning model (average score A2 = 119.688).

Second Hypothesis

The results of two-way ANOVA testing obtained F-statistic = 21.019 > F-table = 4.160 or Sig. = 0.000 < α = 0.05, then the statistical hypothesis rejects H_0 . This shows an interaction between the learning model and learning motivation on the learning outcomes of the Control System. The form of interaction is the intersection of lines, as in Figure 1.

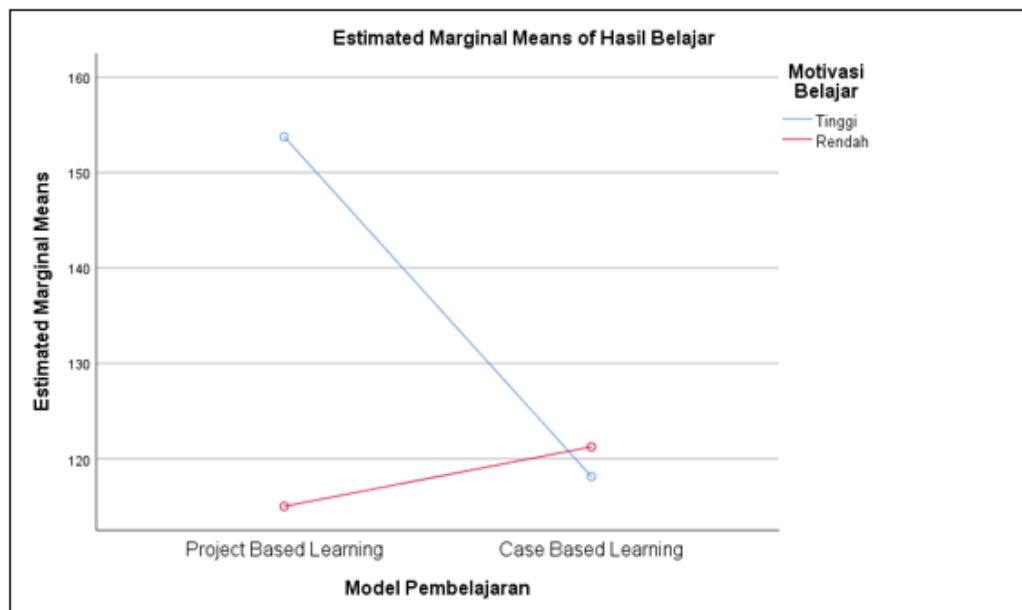


Figure 1. Interaction between instruction model and Learning Motivation on Control System Learning Outcomes

Third Hypothesis

The results of the Scheffe test calculation can be seen in the table obtained $t\text{-statistic} = 5.516 > t\text{-table} = 2.048$ at a significant level of 0.05, or we can see the results of the calculation of the Sig value. $= 0.001 < 0.05$, which means H_0 is rejected. This shows differences in the learning outcomes of students with high learning motivation who are taught using the Project Based Learning model and those taught using the Case Based Learning model. The learning outcomes of students with high learning motivation using the Project Based Learning model are higher than those taught using the Case Based Learning model. It can be seen from the average value of learning outcomes of students who have high learning motivation who are taught using guided inquiry learning strategies get an average value of 153.75, while the average value of learning outcomes of students who have high motivation who are taught using interactive expository learning strategies is 118.13.

Fourth Hypothesis

The results of the Scheffe test calculation obtained $t\text{-statistic} -0.968 < t\text{-table} 2.048$, at a significant level of 0.05, or we can see the results of the calculation of the Sig value. $= 0.816 > 0.05$, which means H_0 is accepted. It can be concluded that there is no difference between groups in the average value of students who have low motivation with the Project Based Learning model compared to the Case Based Learning model.

DISCUSSION

The results of testing the first hypothesis show differences in the learning outcomes of students taught using the Project Based Learning model and those taught using the Case Based Learning model. It can be concluded that students who are taught using the Project Based Learning (PJBL) learning model will quickly understand and understand project-based subjects. In contrast, the Case Based Learning (CBL) learning model for active students only can understand, while passive students will be slow to accept the subject matter presented.

These findings are supported by researchers Gormally, Brickman, Hallar, and Armstrong that there is a greater increase in science literacy and research skills among students who use PJBL. Besides, students exposed to PJBL gain confidence in their scientific abilities. Experimental class students spent more time reading science reports, designing their experiments, and evaluating experimental results in writing than traditional class students (Dewi Zakiyatus Sholihah et al., 2022). Reinforced by Mensah-Wonkyi & Adu's (2016) research, students in the PJBL group achieved better results than students in the CBL group. The PJBL group's perception of motivation in the classroom learning environment during treatment was higher than the CBL group (Kurniawati, 2021). Inan researchers also support that PJBL makes students think critically (Inan et al., 2010; Pérez et al., 2017; Tikhonova, 2015).

The results of testing the second hypothesis show an interaction between learning models and

learning motivation on Control System learning outcomes. In learning, motivation is one of the important things for students. With motivation, student learning will be more meaningful. What will be done to improve the learning outcomes of the Control System is through the use of an appropriate learning model. In addition to having high learning motivation, using learning models can also help students optimize the learning outcomes of the Control System. This time, the learning models used in learning the Control System are the PJBL model and the CBL model.

The Project-based Learning model for student-centred learning uses the principles of contextual, active student involvement in learning to achieve learning objectives through interaction and knowledge sharing. Applying PJBL strategies in learning provides opportunities for students to be directly involved and construct their knowledge. In addition, in science, PJBL strategies have also been tested. Project-based learning positively contributes to using real media (Goldstein et al., 2016). The project-based learning model is active learning where students participate independently, with the criterion that the learning also involves students' ability to use metacognitive thinking, such as motivation to learn about the project to be carried out using problems found by students. This project-based learning is authentic, so it indirectly involves students in constructive inquiry. It is hoped that through self-learning, students' responsibility can be better and creative ideas can be generated by students because when they carry out projects, they will have different work from traditional projects or traditional learning, which is a significant and challenging project task. While the CBL model is an active learning strategy, focusing on students as the centre of the learning environment to encourage community-based exploration and specific situations. Students focus on cases and engage in independent learning, scientific inquiry and collaboration with peers, developing critical thinking and problem-solving skills and integrating theory into practice. The urgency of implementing CBL in learning is to provide a practical model for students to connect content learning with practice and assist students in improving their ability to learn to collaborate, think critically and solve problems. Case-based learning in various curriculum and feedback received from students showed that CBL significantly improved students' understanding (Keiler, 2018). Of the two instructional models used in the learning process, student learning motivation is very influential in determining student learning outcomes.

These findings are supported by Lin et al., researchers that instructional models and

motivation occur in improving learning outcomes (Rinto Alexandro, 2021; St. Onge & Eitel, 2017). In line with Lin et al.'s opinion, the instructional model and learning motivation improve independent learning outcomes (Georgiou & Kyza, 2018). This opinion is reinforced by Nicol opinion that the instructional model improves self-learning performance (Nicol, 2021).

The results of testing the third hypothesis show differences in the learning outcomes of students with high learning motivation who are taught using the PJBL model with those taught using the CBL model. Students in the learning process need high learning motivation. With high learning motivation, students will easily understand the learning material well to make learning more meaningful. Learning motivation will allow students to enjoy the learning process by using the appropriate instructional model.

By selecting an appropriate learning model and high learning motivation in students who learn, these students will easily understand the material provided. Learning outcomes will improve with students' understanding of the material provided by the teacher. Motivation and learning motivation are an important part of learning. The choice of the PJBL model compared to CBL and supported by high learning motivation from students will greatly affect the learning outcomes of Control Systems.

The results of testing the fourth hypothesis show no difference in the learning outcomes of students with low learning motivation who are taught using the PBL learning model and those taught using the CBL learning model. Motivation in learning will greatly affect how students understand the material presented. Learning motivation will bring students to enjoy the learning process by using the appropriate learning model. The characteristics of students who have low learning motivation are (1) lack of attention in learning, (2) passive involvement in classroom learning, (3) lack of enthusiasm and passion in doing learning and (4) lack of strong curiosity in receiving material in learning. Based on the above criteria, students who have low learning motivation will be able to follow the learning process in class if supported by motivation from a teacher in the learning process. This motivation means that it comes from outside or is called extrinsic motivation. The PJBL learning model here, although it requires student activeness in the learning process, requires the role of guidance from the teacher in its implementation. The teacher's job in this model is in the motivation process, so the findings of this study state that the CBL learning model can motivate students in learning and affect student learning outcomes.

Students who have high learning motivation will be able to adjust to the circumstances around them. Whatever way the teacher manages their learning, they can still maintain their learning outcomes. Based on the findings of this study, it can be concluded that learning motivation greatly affects students in the learning process. Students who have high motivation will get achievements in their learning. Conversely, for students with low motivation, the learning outcomes are not following what is expected. Motivation has an important position in achieving predetermined learning goals. The emergence of motivation is not solely from students themselves, but teachers must involve themselves to motivate student learning (Emda, 2017).

The motivation to learn generates and directs the drive that causes individuals to perform learning actions (Soegoto & Salutondok, 2015). In learning, the urge to understand learning will make it easier for students to digest and understand what has been conveyed by the teacher in class. Sardiman supports this opinion that learning motivation is the overall driving force within students that gives rise to learning activities, which ensures the continuity of learning activities and directs learning activities so that the goals desired by the learning subject are achieved (Dourado & Leite, 2013).

CONCLUSION

Based on the study's results, it is known that overall learning outcomes can be influenced by using learning models and learning motivation applied in the learning process. The results of this study impact the learning process as a whole. They can contribute to the selection of learning models teachers use and become an innovation for students who participate in the learning process according to student characteristics so that the learning process becomes interesting and not monotonous.

As has been found in the research results that there are differences in the learning outcomes of Control Systems of students who are taught using learning models and students who have learning motivation. Students who have high motivation will be able to follow the learning process using the Project Based Learning model because project-based learning requires students to carry out project tasks in an interdisciplinary manner, collaborate with the community, and solve structured problems openly and in real-world situations so that even though this model requires the active role of students in learning students will still be able to enjoy the learning process well. Likewise, the results of testing the fourth

hypothesis show no difference in the learning outcomes of students with low learning motivation using the PJBL model compared to the CBL instructional model. These results show that the role of the teacher is needed to be able to improve learning outcomes. Teachers need to innovate to improve students who have low motivation.

In this study, several efforts have been made to the maximum by the researcher, who has followed the procedures set out in the research methodology. However, there are still some factors that are difficult to control. Hence, this research has limitations, especially regarding implementation, involving 32 students (16 students treated with the PJBL instructional model and 16 students treated with the CBL instructional model). The small number of sample members is likely to affect the results of research and decision-making.

The amount of ineffective time for learning related to school activities in the experimental class will affect student concentration in learning even though the learning model has been adapted to the characteristics of students. Both of these are things that researchers face and are difficult to control, so if the study's limitations can be reduced, then maybe the research results will be even better. The limitations of this study are one of the things that need to be considered in similar further research.

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