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The influence of project based learning on student's intrinsic learning motivation

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Abstract

The lack of total student involvement in the learning process is due to a lack of effort in finding information independently and not achieving active learning. The purpose of this study was to investigate the effect of intrinsic motivation on project-based learning in the automotive engineering education student workforce transfer system course. The method used was a quasi-experimental research design with a 2x2 factorial. The population used was students of the Automotive Engineering Department, Faculty of Engineering, Padang State University, 2020/2021 academic year. The results showed that students who applied project-based learning had higher learning outcomes than using conventional methods. This was based on the value of F_{count} greater than F_{table}, 7.866 > 3.34 at the 0.05 significance level. There is an interaction between learning methods and students' intrinsic motivation towards learning outcomes, this is evidenced by the value of F_{count} is greater than F_{table}, 7.602> 3.34 at the 0.05 significance level. There is a significant difference in student learning outcomes between project-based learning and conventional learning which has high intrinsic motivation. The final research result is that there is no significant difference in student learning outcomes between project-based learning and conventional learning which has low intrinsic motivation.

Keywords: Intrinsic Motivation, Project-based Learning, Quasi Experiment, Two-way Anova

1. Introduction

Automotive engineering education is a learning experience that gives students the opportunity to complete a career in education and have both academic and technical skills [1]. Lectures in this study program are not only in the classroom, but can be found in the laboratory (workshoop), outside the campus and so on [2]. The higher a person's learning motivation, the higher the learning outcomes should be [3]. Motivation is divided into two, namely intrinsic motivation and extrinsic motivation [4]. Intrinsic motivation refers to the direction of the involvement of individual behavior in acting either satisfying or pleasing [5]. Extrinsic motivation is an impulse that arises because there are things outside the individual that cause motivation to do something [6]. This means that intrinsic motivation will arise in a person if someone is interested in doing something without coercion from other parties, while extrinsic motivation appears when there is an external push.

Observation data in the automotive engineering education study program show that learning activities use learning strategies that keep students away from the center of attention of learning. Students get knowledge and material that is packaged using lecture techniques and small discussions. There are also some who have developed a learning model but have not maximally applied it to the classroom environment. It was found that the learning outcomes of the energy transfer system course were classified as low, seen from the student learning outcomes which can be seen in table 1 below:

Based on table 1, it can be seen that 5 students who did not complete below the value of 50 or 17.24%. Meanwhile, those whose values were limited to 65 - 55 were 14 people or 48.28. The lack of total student involvement in the learning process is due to a lack of effort in finding information independently, thereby reducing the meaning of active and effective learning.

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Table 1. Learning Outcomes of the Power Transfer System Subject

No.	Quality Score	Number of Students	%	Information
1.	85 - 100	0	0,00	Completed
2.	80 - 84	2	6,90	Completed
3.	75 - 79	3	10,34	Completed
4.	70 - 74	5	17,24	Completed
5.	65 - 69	10	34,48	Completed
6.	60 - 64	3	10,34	Completed
7.	55 - 59	1	3,45	Completed
8.	50 - 54	1	3,45	Not complete
9.	40 - 49	1	3,45	Not complete
10.	0 - 39	3	10,34	Not complete
	Total	**29**	**100,00**	

Intrinsic motivation will result in individual satisfaction to complete the task [7]. Motivation is important to make individuals creative and will affect their education[8]. Student-centered learning activities will require students to be more active and motivated [9]. It can be concluded that with good intrinsic motivation in students, student-centered learning will be easier to implement. With a good learning strategy, the ability and progress of students can increase intrinsic motivation [10]. Using project-based learning, it is hoped that this can be resolved. This is because project-based learning is an interesting learning model [11]. This learning can improve student competence [12]. The concept of problem solving and giving meaningful tasks so as to produce real products [13]. Based on these findings, the best way is to use intrinsic motivation to use deeper learning.

There are many factors that influence a person's learning outcomes one of them is student learning motivation which is seen as a dominant factor to be found. Lecturer duties in the learning process is to motivate students both in the classroom, campus environment and should extend beyond the campus environment is a teaching process [14]. In order for students to be active in carrying out activities, especially in learning, there must be encouragement in order to achieve the expected goals, the motivation is called motivation [15]. If an individual is motivated or motivated to do something, it means that he has the power to gain success in his future life [16]. Motivation is divided into two types, namely intrinsic motivation which originates from within the individual and the second is extrinsic motivation which is a drive from outside the individual himself [17]. Intrinsic motivation is a condition which reflects a tendency of individuals as humans to learn while extrinsic motivation is a drive created from outside that changes the individual in completing his work [18].

Intrinsic motivation can be described as a person's desire to encourage him to solve certain problems or tasks [19]. That push will come because of each personal [20]. This means, the desire to get things done comes from the person himself. The importance of intrinsic motivation in learning will affect the morale of students in completing the assignment given [21]. This will make students more active and not feel bored in learning both in the classroom and outside. With intrinsic motivation, it is hoped that learning activities will be fulfilled optimally.

The influence of learning will consider it as an increase in student motivation to learn [22]. This project-based learning has been successful and applied in various countries such as Japan and America [23]. The advantage of this learning is that it involves students directly in learning. Another advantage is the direct interaction between lecturers and students [24]. This learning activity enabling students to work in a team or group environment to produce tangible and usable products [25]. This learning is an approach that is built on activities that provide real assignments to students so that there is a feeling of being challenged in solving problems or finding solutions to these problems [26]. Students can form discussion groups to solve the problems that have been given at the beginning of the lecture and together to complete the assignment given [27]. The final result is a project assignment of accountable quality [28].

Students' motivation to learn will increase along with the use or application of project-based learning and being able to do higher-order thinking is to solve a given problem [29]. This learning will have a positive influence on the wearer so that there is a spirit of motivation that arises from within students to improve cooperation skills between students [30].

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2. Methods

In an effort to obtain the results of the influence of intrinsic motivation on project-based learning that the researcher has planned, the type of research used is quasi-experimental. Quasi-experimental is a research method that is close to a real experiment, it is impossible to exercise strict control in determining the validity that is within the limits [31]. The goal is to find out the effect of the independent variables on the dependent variable [32]. There are two kinds of learning methods used, namely project-based learning and conventional learning which is part of the independent variable and intrinsic motivation is the independent variable and the learning outcomes of the power transfer system are the dependent variable.

The research was conducted at the Automotive Engineering Department, Faculty of Engineering, Padang State University. The research time starts from preparation to conduct research until completion, which is around April 2020 to September 2020. This study used a 2x2 factorial design. The treatment that will be done is to compare the experimental group (project-based learning) with the control group (conventional learning). The population in this study were all students of the automotive engineering education program FT UNP semester 1 of the 2020/2021 academic year. The sample used is two groups (classes). The reason for using two classes as a sample of research is because all classes in the population are homogeneous, the entry process has been filtered and also to make it easier for researchers to focus more on what is being done.

The technique used to collect research data is in the form of a questionnaire or questionnaire, with the aim of finding out the intrinsic motivation level of automotive engineering education students. The scale used for this questionnaire is the Likert scale [33]. The power transfer system learning outcomes test consists of 30 multiple choice items. For the research questionnaire, after testing the students, it was found that 15 statements were considered valid or invalid from 60 statements, so that the questionnaire statement items used to continue to the research stage were 45 statements.

3. Result

The data obtained in this study are data about learning outcomes and students' intrinsic motivation in the learning process.

3.1 Project based Learning (A_1)

The following is a description of project-based learning that has been processed using SPSS, which can be seen in table 2.

Table 2. A_1 Data Description

Data Description	Project based Learning
N	30
Mean	74.40
Median	75.00
Mode	78
Std. Deviation	6.563
Variance	43.076
Range	23
Minimum	62
Maximum	85
Sum	2232

Based on table 2, it is obtained the number of classes and class lengths so that after being arranged it can be seen in in Figure 1:

Based on Figure 1, the results of the experimental class data processing with values ranging from 62-65 are 2 people, values of 66-69 are 6 people, values ranging from 70-73 are 4 people, values ranging from 74-77 are 7 people, values with the range of 78-81 were 6 people and the values ranging from 82-85 were 5 people.

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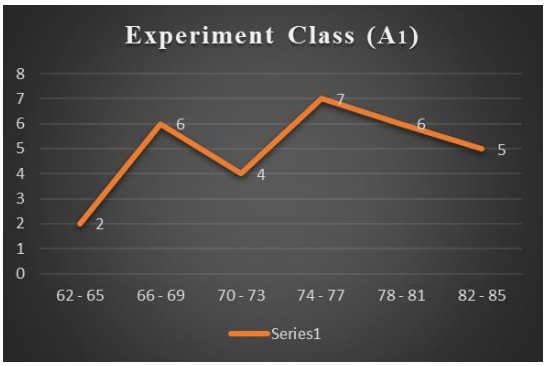

Figure 1. Experimental Class Histogram

3.2 Conventional Learning (A_2)

The following is a description of conventional learning that has been processed using SPSS, which can be seen in table 3.

Table 3. A_2 Data Description

Data Description	Conventional Learning
N	30
Mean	70.47
Median	71
Mode	64
Std. Deviation	5.277
Variance	27.844
Range	18
Minimum	62
Maximum	80
Sum	2114

Based on table 3, it is found that there are many classes and class lengths so that after being arranged it can be seen in Figure 2 below:

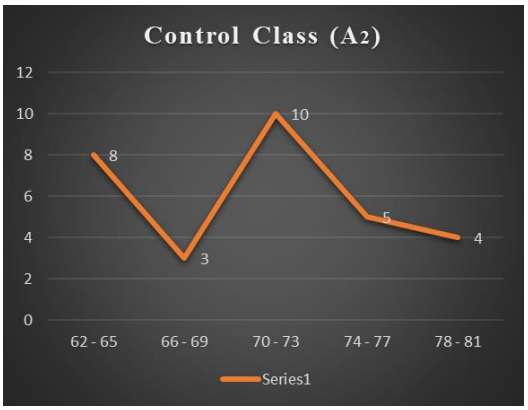

Figure 2. Control Class Histogram

Based on Figure 2, the results of the control class data processing with values ranging from 62-65 as many as 8 people, values from 66-69 as many as 3 people, values ranging from 70-73 as many as 10 people, values ranging from 74-77 as many as 5 people, and the value with a range of 78-81 as many as 4 people.

3.3 High Intrinsic Motivation (B_1)

The following is a description of the high intrinsic motivation to learn students who have been processed using SPSS can be seen in table 4.

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Table 4. Data Description B_1

Data Description	High Intrinsic Motivation
N	30
Mean	74.17
Median	73.5
Mode	64[a]
Std. Deviation	6.497
Variance	42.213
Range	22
Minimum	63
Maximum	85
Sum	2225

Based on table 4, there are many classes and class lengths so that after being arranged it can be seen in Figure 3 below:

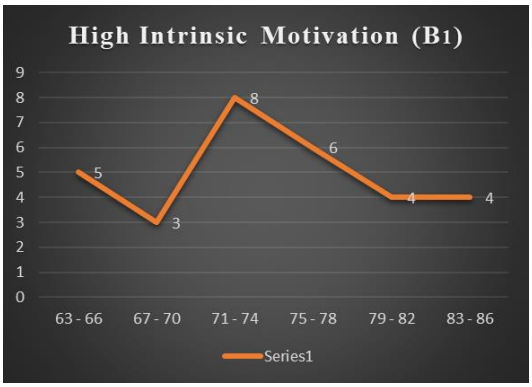

Figure 3. Histogram of High Intrinsic Motivation

Based on Figure 3, the results of high learning motivation data processing of students with values ranging from 63-66 are 5 people, values of 67-70 are 3 people, values ranging from 71-74 are 8 people, values ranging from 75-78 are 6 people, values ranging from 79 to 82 were 4 people and values ranging from 83-86 were 4 people.

3.4 Low Intrinsic Motivation (B_2)

The following is a description of the low intrinsic motivation to learn students who have been processed using SPSS can be seen in table 5.

Table 5. Data Description B_2

Data Description	Low Intrinsic Motivation
N	30
Mean	70.7
Median	70.5
Mode	64[a]
Std. Deviation	5.522
Variance	30.493
Range	18
Minimum	62
Maximum	80
Sum	2121

Based on table 5, there are many classes and class lengths so that after being arranged it can be seen in Figure 4 below:

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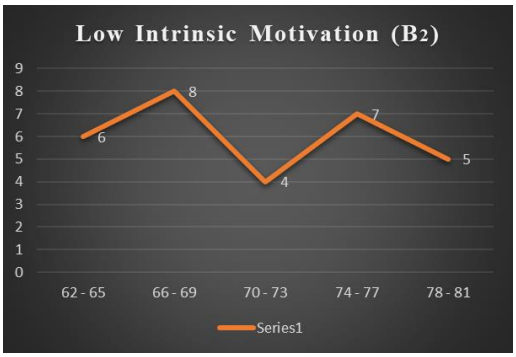

Figure 4. Low Intrinsic Motivation Histogram

Based on Figure 3, the results of data processing on low learning motivation of students with scores ranging from 62 to 65 are 6 people, grades 66-69 are 8 people, values ranging from 70-73 are 4 people, values ranging from 74 to 77 are 7 people, and scores ranging from 78-81 to 5 people.

3.5 Experiment Class and High Intrinsic Motivation

The following is a description of the experimental class and high intrinsic motivation for student learning that has been processed using SPSS can be seen in table 6.

Table 6. Data Description A_1B_1

Data Description	Project-based Learning and High Intrinsic Motivation
N	15
Mean	78.07
Median	78
Mode	75[a]
Std. Deviation	5.147
Variance	26.495
Range	15
Minimum	70
Maximum	85
Sum	1171

Based on table 6, there are many classes and class lengths so that after being arranged it can be seen in Figure 5 below:

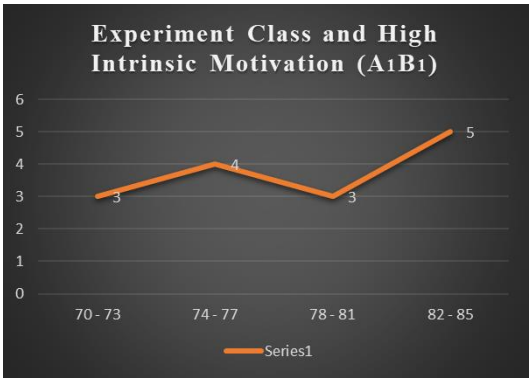

Figure 5. Project-based Learning Histogram and High Intrinsic Motivation

Based on Figure 5, the results of the experimental class data processing and high intrinsic motivation with values ranging from 70-73 are 3 people, 74-77 values are 4 people, values ranging from 78-81 are 3 people, and values ranging from 82-85 as many as 5 people.

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3.6 Experimental Class and Low Intrinsic Motivation (A_2B_2)

The following is a description of the experimental class and the low intrinsic motivation of student learning that has been processed using SPSS can be seen in table 7.

Table 7. Data Description A_1B_2

Data Description	Project-based Learning and Low Intrinsic Motivation
N	15
Mean	70.27
Median	71
Mode	64
Std. Deviation	5.325
Variance	28.352
Range	17
Minimum	63
Maximum	80
Sum	1054

Based on table 7, there are many classes and class lengths so that after being arranged it can be seen in Figure 6 below:

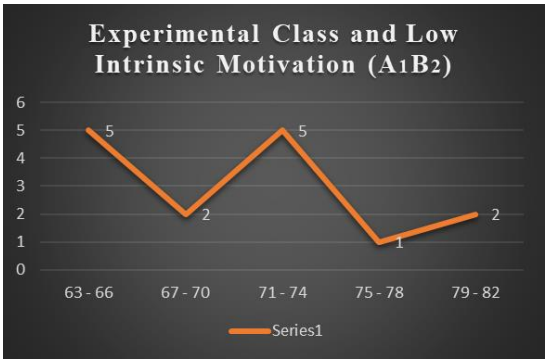

Figure 6. Experimental Class Histogram and Low Intrinsic Motivation

Based on Figure 6, the results of experimental class data processing and low intrinsic motivation with values ranging from 63 to 66 as many as 5 people, values ranging from 67 to 70 as many as 2 people, values ranging from 75 to 78 as many as 1 person, and values ranging from 79 to 82 as many as 2 persons.

3.7 Class Control and High Intrinsic Motivation (A_2B_1)

The following is a description of the experimental class and the low intrinsic motivation of student learning that has been processed using SPSS can be seen in table 8.

Table 8. Data Description A_2B_1

Data Description	Conventional Learning and High Intrinsic Motivation
N	15
Mean	70.73
Median	68
Mode	66[a]
Std. Deviation	5.824
Variance	33.924
Range	18
Minimum	62
Maximum	80
Sum	1061

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Based on table 8, it is found that there are many classes and class lengths so that after being arranged can be seen in Figure 7.

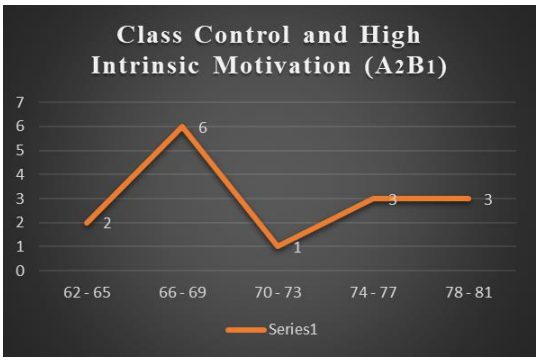

Figure 7. Histogram for Control Class and High Intrinsic Motivation

Based on Figure 7, the results of data processing from the control class and high intrinsic motivation with values ranging from 62 to 65 are 2 people, values of 66-69 are 6 people, values ranging from 70-73 are 1 person, values ranging from 74 to 77 are 3 people, as well as values ranging from 78-81 to 3 people.

3.8 Class of Control and Low Intrinsic Motivation (A_2B_2)

The following is a description of the control class and the low intrinsic motivation of student learning who have been processed using SPSS can be seen in table 9.

Table 9. Data Description A_2B_2

Data Description	Conventional Learning and Low Intrinsic Motivation
N	15
Mean	70.67
Median	72
Mode	74
Std. Deviation	5.407
Variance	29.238
Range	17
Minimum	62
Maximum	79
Sum	1060

Based on table 9, there are many classes and class lengths so that after being arranged it can be seen in Figure 8 below:

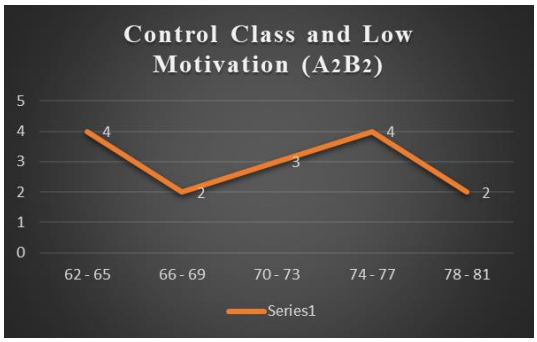

Figure 8. Histogram for Class Control and Low Intrinsic Motivation

Based on Figure 8, the results of data processing from the control class and low intrinsic motivation with values ranging from 62 to 65 are 4 people, values ranging from 66 to 69 are 2 people,

values ranging from 70 to 73 are 3 people, values ranging from 74 to 77 are 4 2 people, and 2 people in the range of 78-81.

3.9 Normality Test

The following is a normality test that has been summarized in the table using the Kolmogorov-Smirnov test which can be seen in table 10.

Table 10. Summary of Normality Test

Group	N	Asymp.sig	α	Conclusion
A_1	30	0.907	0,05	Normal
A_2		0.648		Normal
B_1		0.954		Normal
B_2		0.737		Normal
A_1B_1	15	0.922		Normal
A_1B_2		0.902		Normal
A_2B_1		0.499		Normal
A_2B_2		0.933		Normal

Based on table 10, it can be concluded that the asymp.sig price for the three variables is greater α = 0.05. This means that H_o is accepted for the three variables, so that the conclusion is that the data from the three variables come from a normally distributed population.

3.10 Homogeneity Test

The following is a normality test that has been summarized in the table using the Levene test which can be seen in table 11.

Table 11. Summary of Homogeneity Tests

Group	Sig.	α	Conclusion
A_1 with A_2	0.205	0,05	Homogeneous
B_1 with B_2	0.617		Homogeneous

Based on table 10, it can be concluded that groups A_1 and A_2 using SPSS resulted in a value of 0.205, which value > 0.05 means that the two classes are not significantly different so that it means that the variance of the two classes being compared is homogeneous. Whereas in group B_1 and B_2 using SPSS the value was 0.617, which means that the value was > 0.05, which means that high intrinsic motivation and low intrinsic motivation were not significantly different, so it means that the intrinsic motivation variance compared was homogeneous.

3.11 Hypothesis Test

The results of data analysis that researchers get using two-way ANOVA analysis can be seen in Table 12.

Table 12. Two-Path Anova Learning Outcomes

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	412.333	2	206.167	6.263	.003[a]
Residual	1876.4	57	32.919		
Total	2288.733	59			

Based on table 12, it can be concluded that the hypothesis is accepted, meaning that the learning method used and intrinsic motivation have an effect on the learning outcomes of the power transfer system. This is because the sig. smaller than the significance level of 0.05 and based on the F test, where F_{count} is greater than Ft_{able}.

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4. Discussion

The first hypothesis states that there are significant differences in the learning outcomes of the energy transfer system taught by project-based learning with conventional learning. The results of the calculation show that F_{count} is greater than F_{table} 7.866 > 3.34 at the significance level (α) = 0.05. It can be concluded that there is a significant influence between project-based learning and conventional learning on the power transfer system course.

The group of students who took project-based learning (experimental class A_1) had an average learning outcome of 74.4 while conventional learning (control class A_2) had an average learning outcome of 70.47. Based on this, it shows that project-based learning has higher learning outcomes than that following conventional learning.

In project-based learning, students are grouped into small groups. Each group member helps each other and gives ideas in solving problems. Learning in groups can also increase student social interaction and facilitate class management because having one person with higher academic ability in each group will be able to help students who are still less capable.

The second hypothesis states that there are significant differences in learning outcomes of energy transfer systems that have high intrinsic motivation and those that have low intrinsic motivation. The results of the calculation show that F_{count} is greater than F_{table} 6.110 > 3.34 at the significance level (α) = 0.05. It can be concluded that there is a significant influence between students who have high intrinsic motivation and students who have low intrinsic motivation on the power transfer system course.

The results of the calculation showed that the group of students who had high intrinsic motivation (B1) had an average learning outcome of 74.17 while those who had low intrinsic motivation (B2) had an average learning outcome of 70.07. Based on this, it shows that students who have high intrinsic motivation have higher learning outcomes than students who have low intrinsic motivation.

Describing the hierarchical relationship and various needs, in the realm of the first need is the basis for arising the next need [34]. If the first need has been satisfied, then humans begin to want to satisfy the next need. The performance of the teacher or lecturer as an educator must know what the students want [35]. This is also an assessment for teachers and also the need for student achievement, because every student has different needs for achievement from one another. Not a few students who have low intrinsic motivation, they tend to fear failure and do not want to take risks in achieving high learning achievement.

The third hypothesis states that there is an interaction between learning methods and students' intrinsic motivation towards learning the energy transfer system. The results of the calculation show that F_{count} is greater than F_{table} 7.602 > 3.34 at the significance level (α) = 0.05. It can be concluded that there is a significant interaction between the learning method and intrinsic motivation on the power transfer system course in the automotive engineering education program.

In a teaching and learning process, two very important elements are teaching methods and teaching media. Use of teaching media in the teaching and learning process can generate new desires and interests, generate motivation and stimulation of learning activities, and even bring psychological influences on students [36].

The fourth hypothesis states that there is an interaction of differences in learning outcomes between project-based learning groups and conventional learning in students who have high intrinsic motivation to learn. The critical value for Qtable is 3.055 at the significance level (α) = 0.05. The results of calculations using the Tuckey test show that the value of Q_{count} is greater than Q_{table} = 5.562 > 3.055 at the level of significance (α) = 0.05 then H_o is rejected and H_a is accepted. It can be concluded that there is a significant difference in student learning outcomes of energy transfer systems between project-based learning and conventional learning in students who have high intrinsic motivation in learning.

Intrinsic motivation has a very decisive role and encourages students to study attentively and concentrate in receiving lectures, so as to achieve the goals expected by students, namely learning outcomes indicated by learning outcomes will increase. The higher the intrinsic motivation, the learning outcomes achieved will increase, conversely, the lower the intrinsic motivation, the learning outcomes achieved will decrease.

The fifth hypothesis states that there is no interaction between learning outcomes differences between project-based learning groups and conventional learning for low learning motivation. The results of calculations using the tuckey test show that the value of Q_{count} is smaller than Q_{table} = 0.048 <

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3.055 at the significance level (α) = 0.05, so H_o is accepted and H_a is rejected. It can be concluded that there is no significant difference in student learning outcomes of power transfer systems between project-based learning and conventional learning for low intrinsic motivation.

5. Conclusion

Based on the results of the research the effect of intrinsic motivation on project-based learning of automotive engineering students, it can be concluded: 1) there is a significant difference between the application of project-based learning with conventional learning on the learning of energy transfer systems in the automotive engineering education study program; 2) there is a significant influence between students who have high intrinsic motivation and students who have low intrinsic motivation on the power transfer system course in the automotive engineering education program; 3) there is a significant interaction between the learning method and intrinsic motivation on the power transfer system course in the automotive engineering education study program; 4) there is a significant difference in student learning outcomes of the power transfer system between project-based learning and conventional learning in students who have high intrinsic motivation to learn; and 5) There is no significant difference in student learning outcomes of energy transfer systems between project-based learning and conventional learning for low intrinsic motivation.

The attainment of the abilities for each level in each domain has implications for determining the type of learning method. The accuracy of selecting the method will result in high quality learning outcomes, and can even achieve high levels of efficiency. To achieve a stated ability, it is not necessary to use a variety of methods that are too complicated, but for example, it is sufficient to use a method that is only for conveying information. But on the other hand, if the expected learning ability involves high psychomotor, then it must use a variety of methods if the learning community can display or practice certain abilities.

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