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Implementation of Project-Based Learning Strategies in Improving the Quality of Proposals and Student Learning Outcomes to Accelerate Thesis Completion

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Abstract

The purpose of this research is to apply and develop project-based learning strategies in the Educational Research Methods Course to improve the quality of research proposals, so as to accelerate the completion of thesis assignments in the Mechanical Engineering Education Study Program at Nusa Cendana University. Conditions in the field show that the completion of the thesis is still quite long on average 12 months or more, thus prolonging the study period of students. This research is quasi-experimental research with a Nonequivalent Control Group Design, which was conducted on students of the mechanical engineering education study program at Nusa Cendana University who programmed the educational research methods course. Consisting of an experimental class of 30 students who received project-based learning strategy treatment and a control class of 30 students with conventional learning strategy treatment. The analysis requirement test was conducted with normality and homogeneity tests. Data analysis techniques using descriptive analysis and t test. The results showed that: (1) the application of project-based learning strategies is superior in increasing the number of proposal products with good quality (22 proposals) compared to the application of conventional learning strategies (11 proposals); (2) the application of project-based learning strategies is able to improve learning outcomes (mean 80.233) compared to the application of conventional strategies (mean 74.367); (3) Another advantage of applying project-based learning strategies is that it can improve students' abilities in problem solving, collaborative teamwork, peer learning, and high self-confidence, as well as being responsible for timely proposal assignments which become the final product of the educational research methods course.

Keywords: *Project-based learning strategy, improving proposal quality, accelerating thesis completion.*

INTRODUCTION

In the process of education in higher education, especially in the S1 Mechanical Engineering Education Program at FKIP Nusa Cendana University (Undana), efforts have been made to provide education and mechanical engineering courses proportionally for eight semesters. This aims to produce graduates of the Bachelor of Mechanical

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Engineering Education who are professional, characterized, independent, and have a global outlook, in line with the vision of Mechanical Engineering Education FKIP Undana.

Efforts to improve the quality of education in the Mechanical Engineering Education Study Program of FKIP Undana continue to be made. Some of them include improving the academic qualifications of teaching staff from S2 to S3, updating learning facilities and infrastructure, developing partnership cooperation with industry and schools, and building information networks with stakeholders, including alumni. All of these efforts aim to improvethe quality of graduates and shorten the student study period.

Over the past five years, the Mechanical Engineering Education Study Program of FKIP Undana has successfully achieved B Accreditation with an average Grade Point Average (GPA) of 3.20 in 11 semesters of study [1]. Although it has achieved proud achievements, there are still challenges that need to be overcome, namely the relatively longstudent study period and the average GPA of graduates that need to be improved. The maincause of this is the length of the thesis completion process, which reaches an average of morethan 12 months. The long process of thesis completion is caused by several factors, one of which is the slow process of working on the thesis. Many students start from the stage of finding a proposal title, and only then proceed with making proposals, seminars, andresearch. This causes the completion of the thesis to be hampered and takes quite a long time.

To improve the quality of graduates and accelerate the study period, one solution that can be implemented is to encourage and spur the acceleration of thesis completion through the application of Project-Based Learning Strategies in Educational Research Methodology courses. This learning strategy is based on constructivism learning theory, which provides autonomous opportunities for students to construct their own knowledge, conduct investigations, solve problems, and produce meaningful products [2]. Byimplementing a project-based learning strategy, it is expected that students will be able toproduce high-quality proposals, which will later become the basis for preparing a thesis. Inaddition, the completion of the thesis will also be accelerated with the guidance of twosupervisors. Thus, it is expected that the thesis completion process can take place more efficiently and can be completed within 4-6 months.

The implementation of project-based learning strategies is expected to have a positive impact on the entire educational process in the Mechanical Engineering Education Study Program of FKIP Undana. Students will be more actively involved in the learning process, develop better research skills, and produce products that have a positive impact on society or related industries. In addition, students are also expected to complete the study period on time, so that it will reduce the cost and time required to complete the study.

Thus, the application of project-based learning strategies in the Educational Research Methodology course in the Mechanical Engineering Education Study Program of FKIP Undana is a concrete step in improving the quality of graduates and the efficiency of education in higher education. Hopefully, with this innovation, the Mechanical Engineering Education Study Program of FKIP Undana can excel and make a real contribution in producing graduates who are qualified, competent, and ready to compete at the global level.

METHODS

Research Design

This research is a quasi-experimental study with the design of Nonequivalent Control Group Design [14]. This research was conducted on VI semester students of Mechanical

Engineering Education FKIP Undana who programmed the 2019 Educational Research Methods course in class A (30 people) and Class B (30 people), so that the total number of research subjects was 60 people. The treatment in this study was the application of project- based learning strategies and conventional learning. To determine the experimental class and control class was done by drawing lots.

The implementation of the research, including: a) conducting pretests for experimental and control classes; b) the research process, the experimental class was treated with a project- based learning strategy, while the control class was treated with conventional learning. Both research classes were given the task of making a proposal as the final product of the course assignment; c) after the learning process was carried out for 13 meetings, then at the 14th and 15th meetings a research proposal seminar was held, to assess the quality of the proposal; d)at the 16th learning meeting, a posttest of learning outcomes was conducted in both classes, to collect data on learning outcomes in the educational research methods course.

Research Instruments

For the purpose of this study, a test instrument for learning outcomes of educational research methods and measurement of proposal quality was developed. This test instrument was prepared based on the subject matter in the syllabus of the educational research methods course, then developed into learning outcome indicators, then questions were made to measure the learning outcome indicators. The device for making this test instrument is arranged in the form of a lattice of educational research methods learning outcomes test instruments. Meanwhile, the proposal measuring instrument instrument was adapted from measuring instrument instrument journal International Education Studies (2019) [15].

To test the validity and reliability of the test instrument, the test instrument needs tobe tested first on students who have passed the educational research methods course. To measure the validity of the test instrument items, the product moment correlation formula is used and to measure its reliability, KR20 (Kuder Richardson 20) analysis is used [16]. After the test instrument is valid and reliable, it is used to measure the learning outcomes of the educational research methods course.

Research Data Analysis

Before the experimental treatment, the two groups of research subjects were given a pretest, to obtain an overview of the initial abilities of the two groups. To measure the quality of the proposal, a measuring instrument adapted from the International Education Studies (2019) journal measuring instrument [15] was used,

Table 1: Instruments to Measure Proposal Quality

5=Excellent 4=Good 3=Average 2=Below Average 1=Poor	
Items	Grade
Contribution to existing knowledge	1 2 3 4 5
Organization and readability	1 2 3 4 5
Soundness of methodology	1 2 3 4 5
Supporting journals	1 2 3 4 5
Adequacy of literature review	1 2 3 4 5

Furthermore, if the value of the proposal is ≥13, it is stated that it meets the expected quality standards and if the value is <13, it is stated that it lacks quality. Then, a percentage comparison was conducted between the proposals produced from the project-based learning class and the conventional learning class.

To see the quality of learning outcomes between experimental and control classes, the analysis requirements test was carried out using: 1) normality test with Kolmogrov-Smirnov test and 2) homogeneity test with Levene's test. After the data was declared normal and homogeneous, continued with data analysis with descriptive analysis and t test analysis. To analyze the data, it was processed with the help of the SPSS for windows version 16.0 computer program.

RESULTS

Pretest Learning Outcome Data

Table 2. Results of Descriptive Analysis of Pretest Data

Group Statistics

Learning Strategy		N	Mean	Std. Deviation	Std. Error Mean
Pretest	Project Based Learning (Experiment Class)	30	41.1000	4.88029	.89102
	Conventional Learning (Control Class)	30	42.8333	4.95555	.90476

Furthermore, the pretest data was given a normality test with the Kolmogorov- Smirnov test, the results for project-based learning were 0.200 and conventional learning was 0.112. This result is greater than 0.05, so both groups of pretest data are declared normally distributed. The test results with the Levene Test on the basis of Mean, obtained the number (SIG) 0.891> 0.05, so the pretest data is declared homogeneous.

Then the t-test analysis of two independent samples was carried out, the result was the price of t = -1.365, and the significance value for the learning outcomes of educational research methods (pretests) between project-based learning classes (experimental classes) and conventional learning classes (control classes) amounted to (Sig) 0.178 (p>0.05). Thus, the learning outcomes (pretest) between the experimental class and and the control class have no significant difference (equal).

Posttest Learning Outcome Data

Proposal Product Results of Experimental and Control Classes

Table 3. Proposal Product Results of Experimental and Control Classes

Proposal Quality	Experiment Class	Control Class
Good (accepted)	22 Proposals (≥13)	11 Proposals (≥13)
Not good (rejected)	8 Proposals (<13)	19 Proposals (<13)
Total	30 Proposals	30 Proposals

From the results of the study, it is known that the application of project-based learning strategies produces more good quality proposals (22 proposals) compared to conventional learning strategies (11 proposals).

Learning Outcomes of Experimental Class (Project Based Learning Strategy)

Based on the measurement results during the research conducted in the experimental class with a project-based learning strategy, it is known that the mean student learning outcomes are 80.233 with a standard deviation of 5.7934.

Table 4. Student Learning Outcomes of Experimental Class

No.	Learning Outcomes	Absolute Frequency	Relative Frequency
1	0 - 69	1	3,33 %
2	70 - 79	14	46,67 %
3	80 - 89	13	43,33 %
4	90 - 100	2	6,67 %
	Total	30	100 %

Learning Outcomes of Control Class (Conventional Learning Strategy)

Based on the measurement results during the research conducted in the control class with a conventional learning strategy, it is known that the mean learning outcomes are 74.366 with a standard deviation of 5.0547.

Table 5. Control Class Student Learning Outcomes

No.	Learning Outcomes	Absolute Frequency	Relative Frequency
1	0 - 69	4	13,33 %
2	70 - 79	21	70,00 %
3	80 - 89	5	16,67 %
4	90 - 100	0	0,00 %
	Total	30	100 %

Data Analysis Results

Analysis Requirement Test Results

The results of the analysis requirements test with the Kolmogrov-Smirnov test for the experimental class learning outcomes data obtained (SIG) 0.200>0.05 and the control class obtained (SIG) 0.095>0.05, so that the research data (learning outcomes) are normally distributed. For the homogeneity test, (SIG) 0.369>0.05 was obtained, so the research data (learning outcomes) were homogeneous. Because the data is normally distributed and homogeneous, it can be continued with the t test statistical analysis.

Hypothesis Testing Results

From hypothesis testing, the results are shown in Table 6.

Table 6. Analysis of t Test for Learning Outcome Data Experimental Class and Control Class

		Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Result Learn	Equal variances assumed	58	.000	5.86667	1.40374	3.0567	8.67657
	Equal variances not assumed	56.953	.000	5.86667	1.40374	3.0556	8.67767

From the research results, for the experimental class (project-based learning) the number

of research subjects is 30 people with a mean of 80.2333 and the control class (conventional learning) with 30 research subjects with a mean of 74.3667. From the results of the independent sample t test analysis (table 6) obtained the t valueis 4.179 and the p value (Sig 2 tailed) is 0.00. With a significance level of $\alpha = 0.05$, the p value (sig 2 tailed) 0.00 <0.05. This means that the learning outcomes (posttest) between the experimental class and the control class show a significant difference ($p<0.05$).

DISCUSSION

From the results of the test data analysis, it is known that the experimental class and the control class have equal initial abilities. Then, from the results of the application of project-based learning strategies, it gives a superior effect, where it produces 22 proposal products with good quality, making it possible to be continued into a thesis under the guidance of 2 supervisors. From here it can be expected that the process of accelerating the completion of the thesis, so that the student's study period can be on time or even faster. Furthermore, from the results of the independent sample t test analysis of the learning outcomes of the experimental and control classes, it can be seen that there are significant differences in learning outcomes. From these data, it can be concluded that the application of project-based learning strategies has a better effect on the acquisition of learning outcomes compared to the application of conventional learning strategies.

With the application of project-based learning strategies, students are more interested and active in learning. This is because this learning strategy has a basic foundation in constructivist learning theory, where students must construct knowledge in their own minds. The role of the lecturer is only to facilitate the learning process, by providing opportunities for students to discover or apply their own ideas. Lecturers only provide stairs (guiding) towards higher understanding, but students themselves must climb the ladder of understanding [17]. Therefore, this learning strategy can help students to have creative thinking, problem solving, and interaction and help in investigations that lead to solving real problems [18].

Good project-based learning appears in the process of achieving results in the form of products, which make students have internal motivation as a source of the emergence of a project. This is difficult to achieve individually but with collaboration and working together cooperatively with other friends. According to Donaldson [19]: "Learning together' is one of the hallmarks of professionalism and will be essential if the aspirations of Curriculum for Excellence are to be achieved.". From this, it can be interpreted that project-based learning is based on collaborative learning strategies. This method stems from the belief that in the learning process, many students want to work together even at different levels, because it makes it easier for them to achieve academic goals. In the learning process students work in groups to solve challenging, authentic, curriculum-based and interdisciplinary problems, ultimately creating a product. Thus, this project-based learning strategy is very suitable to help students improve the quality of learning and the quality of the proposal as the final product of the educational research methods course.

In addition, project-based learning is also supported by experiential learning theory [20], whichis a comprehensive learning approach to engage students continuously in investigating topics and issues related to everyday problems. This learning approach has several advantages for both students and lecturers. This is in line with the research results of Wong et al [21] who identified several advantages of this approach for students and lecturers. There are many skills that students learn throughproject-based learning, where students can cooperate with others, make wise decisions, take initiative, and be able to solve complex problems. Furthermore, this condition will make students: (l) have anawareness of the dynamics of working in a team; (2) gain work experience on projects on a wider scale(one complex project with a schedule, cannot be done alone); (3) have a better awareness of the responsibilities and tasks related to the role being

carried out; (4) have experience of changing ideas that arouse people's enthusiasm for working together; (5) show professional behavior such as punctuality, responsibility, delegating as necessary, and meeting at the appointed time; (6) learn and help each other in the group. As for lecturers, they can take on a variety of roles, for example as trainers, facilitators, and discussion partners for students. Plans, drafts, prototypes, and final proposal products all make for excellent conversation around which lecturers and students can discuss course material or proposalproducts.

Many sources describe that a project-based learning environment will make students more innovative and successful in solving complex problems, provide opportunities to work autonomously to construct their own knowledge, and culminate in producing real products [22]. In project work, students are trained to practice how to organize projects, make allocations of time and other resources to complete the project. Students can develop higher-level cognitive skills because they have been trained to complete the tasks of finding and solving problems. In project work, students will get used to working independently in completing complex tasks. Students can also improve their skills in managing existing resources. Moreover, taking into account the tendency of the XXI century, the industrial era 4.0, which is characterized by an increase in the complexity of technological equipment, and the emergence of a corporate restructuring movement that emphasizes a virtual combination of technological and human qualities, causes the world of work to require people who cantake initiative, think critically, creatively, and are capable of solving problems. The "man- machine" relationship is no longer a mechanistic relationship but a communicative interaction that demands high-level thinking skills. Therefore, a project-based learning strategy is neededin order to fulfill the demands of the 21st century development. This is because project-based learning has great potential to improve higher-order cognitive skills, self-efficacy, communication skills, and teamwork, then produce products (especially proposals) that are inaccordance with the current conditions of the world of work [23].

Thus, the implementation of project-based learning will be able to develop students' competencies in order to develop themselves comprehensively. This is because students become more active and creative in learning, and many skills are successfully developed, such as team building skills, team management, cooperative decision making, individual and group problem solving [24]. These skills are of great benefit when later entering the work environment and are skills that are difficult to teach through traditional learning. This is in line with the results of his research Mohsen et al [25], revealed that significantly studentswho were treated with a project-based learning strategy had better self-directed learning skills than students who were treated with conventional learning strategies. Therefore, the learning outcomes of students who were treated with project-based learning strategies were superior. Then, from the results of his research Gerhana et al [26], showed that project-based learning strategies are more effective for producing superior student math learning achievement. This is because, in this strategy students are more able to think actively and creatively, because they are in a pleasant atmosphere to solve problems in everyday life. Furthermore, Dahlian et al [27] in their research concluded that the application of project-based learning strategies will lead to lower levels of academic procrastination compared to students treated with conventional strategies. This means that students who are treated with project-based learning strategies have a habit of being more diligent and timelier in doing their learning tasks.

From the description above, it can be concluded that the application of project-based learning strategies is able to increase student learning motivation, problem solving skills, collaborative group work, and better self-directed learning skills, thus creating a more diligent habit in completing proposal assignments which are the final product of learning in educational research methods courses. Thus, the application of this strategy is able to increasethe number of proposals with good quality and more superior learning outcomes. Therefore, it can be suggested to lecturers to be able to consider the use of

project-based learning strategies in their teaching and learning activities, because it has many advantages.

CONCLUSIONS

The results showed that the application of project-based learning strategies was superior in increasing the number of proposal products that met the good criteria, reaching 22 proposals, compared to the application of conventional learning strategies that only produced 11 proposals. Thus, it can be expected that the application of project-based learning strategy will contribute in accelerating the completion of students' thesis more efficiently. In addition, this study also revealed a significant difference in learning outcomes between the experimental class treated with project-based learning strategies (mean 80.233) and the control class applying conventional learning strategies (mean 74.367). The results of the t-testanalysis with the SPSS 16.0 program show the t value of 4.179 and the significance value of probability $0.00 < \alpha$ (0.05). Therefore, it can be concluded that the application of project- based learning strategies in educational research methods courses provides superior learning outcomes.

Not only that, the implementation of project-based learning strategies also provides other benefits for students. In this context, students develop skills in problem solving, collaborative teamwork, peer learning, as well as increasing self-confidence and responsibility for timely proposal assignments. All these abilities become the final product of the educational research methods course that emphasizes project-based learning strategies. With the various benefits offered by the application of project-based learning strategies, it can be concluded that this approach is a very relevant alternative in improving the learning process in the Mechanical Engineering Education Study Program of FKIP Undana. Hopefully, through the application of project-based learning strategies in educational research methods courses, it will help improve the quality of graduates, shorten the study period, and have a positive impact on the progress of education at the tertiary level.

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