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I Gede Budi Mahendra[1]
Jocke Jonathan Rapar[2]
Viverdy Memah [3]

IMPROVING LECTURE OUTCOMES OF ELECTRICAL TRANSMISSION SYSTEMS THROUGH PROBLEM-BASED LEARNING

Abstrak
Tujuan dari penelitian ini adalah untuk meningkatkan hasil perkuliahan Sistem tranasmisi listrik dengan model pembelajaran berbasis masalah di jurusan pendidikan teknik elektro universitas negeri manado. Metode yang digunakan yaitu Quasy eksperimental design. Kemudian rancangan yang dilakukan adalah Pretest-posttest control group design. Setelah dilakukan penelitian dan mendapatkan hasil, maka dapat disimpulkan selama kegiatan proses perkuliahan, ternyata penggunaan pembelajaran dengan model pembelajaran berbasis masalah berpengaruh dalam meningkatkan hasil hasil perkuliahan Sistem tranasmisi listrik mahasiswa dengan perolehan hasil n gain score > dari 0,7 yaitu 0,78 dan n-gain score persenya >0,76. Data yang digunakan dalam penelitian ini berdistribusi normal dan melihat nilai signifikansinya yaitu lebih dari 0,05 sebesar 0,56 dan 0,72. Sebelum diadakan uji asumsi dasar uji soal tes hasil perkuliahan sudah dinyatakan valid dan reliabel dengan tingkat reliabilitas cukup yaitu sebesar 0,52. Hasil ini terbukti dengan penggunaan model pembelajaran berbasis masalah perkuliahan Sistem tranasmisi listrik akan lebih mudah terserap pengetahuan yang diperoleh mahasiswa.
Kata Kunci: Model Pembelajaran Berbasis Masalah, Hasil Perkuliahan, Sistem Transmisi Listrik

Abstract
The aim of this research is to improve the results of lectures on electrical transmission systems with a problem-based learning model in the electrical engineering education department at Manado State University. The method used is Quasy experimental design. Then the design carried out was a pretest-posttest control group design. After conducting research and obtaining results, it can be concluded that during the lecture process activities, it turns out that the use of learning with a problem-based learning model has an effect in improving the results of students' electrical transmission system lecture results with n gain scores > 0.7, namely 0.78 and n -gain score percent >0.76. The data used in this research is normally distributed and the significance value is more than 0.05, 0.56 and 0.72. Before the test, the basic assumptions of the test questions were declared as valid and reliable with a sufficient level of reliability, namely 0.52. These results are proven by the use of a problem-based learning model in lectures. Electrical transmission systems will more easily absorb the knowledge gained by students.
Keywords: Problem-Based Learning Model, Lecture Results, Electrical Transmission Systems.

INTRODUCTION

Education is a universal activity (Yoridi & Pakereng, 2023). Where the function and purpose of education is to improve human resources. The rapid development of technology will influence changes in culture, thought patterns and lifestyles (Fahmizher et al., 2023). The changes that occur in society have the impact of increasingly tight market competition, requiring human resources who have skills and are competitive in the era of globalization. Human resources are one of the important components that the government must pay attention to to achieve educational goals. The essence of education is an activity carried out consciously and deliberately by adults for children so that they can develop their personality and abilities to reach maturity (Ulum, 2023). The importance of improving the quality of education to support

[1,2,3)] Jurusan Pendidikan Teknik Elektro, Fakultas Teknik, Universitas Negeri Manado
email: igedebudimahendra@unima.ac.id, jockewenas@unima.ac.id, viverdymema@gmail.com

the quality of human resources can have an impact on national development from various aspects. The quality of education that is directed and planned can be done by developing students personalities so that they are ready to work (Mukhzamilah et al., 2023).

Higher education is education at a high level that prioritizes developing student skills. The skills possessed are the result of learning on campus and in industry (Dewi et al., 2020). The application of the problem-based learning model to improve the results of lectures on electrical transmission systems is implemented in the Department of Electrical Engineering Education because students' understanding of the material and objectives of lectures on electrical transmission systems is not yet optimal. Therefore, it is necessary to apply a problem-based learning model in lectures on electricity transmission systems that can overcome these problems. With this learning model, students can increase their understanding in carrying out lectures on electricity transmission systems (Suhendar & Ekayanti, 2018). The application of the problem-based learning model is often associated with independent learning where students can learn independently with a little help from the lecturer (Samini et al., 2023). The aim of implementing this learning model is to simplify and clarify the delivery of material in improving electrical transmission system lectures for electrical engineering education students.

In choosing the right learning method, a lecturer must recognize the characteristics of each student (Keliat, n.d.). The application of the problem-based learning model is applied to lectures on electrical transmission systems, which is one of the important and mandatory courses for electrical engineering students at Manado State University. However, not all students have the same understanding, most students find it difficult to understand the material in the lecture on electrical transmission systems. So it is necessary to apply a problem-based learning model to help and improve students' understanding of the lecture material on electricity transmission systems (Suherman, 2023).

The learning process for students must be adjusted to the demands and characteristics of the students so that the lecturer who teaches can easily provide it to students and the students easily accept the material from the lecturer and are able to understand it because the lecturer who teaches can easily adapt to the student's spirit in the teaching and learning process (Pritandhari, 2017). Learning outcomes are shown by the achievements obtained by students (Suchyadi, 2020). This achievement takes the form of grades obtained when students attend lectures in class. This achievement is a process carried out by students that results in change. These changes include aspects of science, changes in attitudes, values and skills (Retnowati et al., n.d.). Ideal learning outcomes should not only be in the form of understanding. A learning process is said to be successful if the competencies that have been determined can be achieved by all students who take the lecture (Sukaris, 2017). This means that there is a change in behavior in students, both cognitive, affective and psychomotor, in a better direction than before the students received lectures (Jannah & Sulianti, 2021). Because learning is from not knowing to knowing, from bad to good, and from not being able to being able. The methods used by lecturers during the lecture process can influence the level of student learning outcomes (Hilaliyah, 2015).

The use of varied and relevant methods can stimulate student activity during the lecture process (Effendi, 2016). Lecturers must carefully choose the appropriate method to use in a lesson and should avoid using monotonous methods which can lead to boredom in students. Then the student's ability to accept lecture material delivered by the lecturer also influences student learning outcomes. Ideally, student learning outcomes must reach the standard of course completion. Students are said to be successful in their studies if the grades obtained by students meet the standards of course completion that have been set in the course (Dakhi, 2022).

Based on researchers observations during lectures on electrical transmission systems in the electrical engineering education department at Manado State University, it was found that students had a low level of critical thinking in solving problems related to lectures, students quickly felt bored and even sleepy during learning, and students had low creativity during the lecture process. Apart from that, the large number of students who repeat courses indicates that students understanding of the electricity transmission system course is not yet optimal, so a good approach model is needed to improve student learning outcomes.

Based on the background of the problem, researchers are interested in studying the use of problem-based learning models in an effort to improve the lecture results of electrical engineering education students in electrical transmission systems courses. The formulation of the problem in this research is whether the application of a problem-based learning model can improve lectures on electrical transmission systems for students majoring in electrical engineering education at Manado State University? The aim of this research is to improve the results of lectures on Electrical Transmission Systems with a problem-based learning model in the Department of Electrical Engineering Education, Manado State University.

RESEARCH METHODS

This research is a type of experimental research with a quantitative approach . This research was conducted to obtain data results and objectives to be achieved using a descriptive quantitative approach. For the experimental and control classes, a quantitative approach was used. The research method used is quasi experimental design. Then the research design carried out was a pretest-posttest control group design. This research will be carried out at the Department of Electrical Engineering Education, Manado State University with a research duration of 2 months. On this occasion the researcher only used research subjects from 5th semester electrical engineering education students in classes A1 and A2. The sampling technique used is pursive sampling (Sugiyono, 2013).

Control class A1 is a class that is given lecture treatment using a problem-based learning model. For experimental class A2, this is the class that is given lecture method treatment with conventional learning.

Data collection is carried out by means of observation or direct observation, and written tests. Observation is a technique or way of collecting data by observing ongoing activities. Pay attention to the focus of the research, what activities must be observed, both general and specific. General activities mean that everything that happens in the classroom must be observed, commented on and recorded in field notes. Meanwhile, special observations occur in the classroom, such as certain activities or certain learning practices.

A written test is a number of questions asked to a person or a number of people to reveal the state or level of development of one or several psychological aspects (achievements, interests, talents, attitudes, etc.). Based on data collection techniques, researchers prepared instrument tools including Lecture RPS, Observation Sheets, Lecture Results Tests, SPSS 25.0, and Excel 2019

Data analysis was carried out in several stages, the first stage was Data Quality Testing. Data Quality Testing is carried out using Validity Test and Reliability Test. The method used in this validity test uses corrected item-total correlation where the measuring instrument is said to be valid if rcount > rtable (Sugiyono, 2013). Reliability test is an index that shows the extent to which a measuring instrument can be trusted or relied upon. Reliability shows the consistency of a measuring instrument in measuring the same symptoms, in several times implementing the Cronbach Alpha measuring technique, where the measuring instrument is said to be reliable if the Cronbach Alpha value is > 0.50 (Sugiyono, 2013).

The second stage of data analysis is the Basic Assumption Test. The basic assumption test is carried out using the Normality Test. The Normality Test is used to evaluate whether the residual values resulting from regression are normally distributed or not. To test whether it is normal or not, use the Kolmogorov Smirnov Test.

The third stage of data analysis is Hypothesis Testing. Hypothesis testing is carried out using the N-Gain Score Test. The normalized gain test (N-Gain) was carried out to determine the increase in students' cognitive learning outcomes after being given treatment. This increase is taken from the students' pre-test and post-test scores. Normalized gain or abbreviated as N-Gain is a comparison of the actual gain score with the maximum gain score. The actual gain score is the gain score obtained by the student, while the maximum gain score is the highest possible gain score that the student can obtain (Richard R. Hake, 1998).

The calculation of the normalized gain score (N- Gain) can be expressed in the following formula:

$$< g > = \frac{<Sf> - <Si>}{100 - <Si>} x\ 100\%$$

Information :
g = normalized gain (N-Gain)

Sf = Posttest Score
Si = Pretest Score
N-gain score division category

Table 1. N-gain score distribution categories

N-Gain Value	Category
g > 0,7	High
0,3 ≤ g ≤ 0,7	Currently
g < 0,3	Low

Categories for interpreting the effectiveness of the N-Gain score can be seen in table 2 below.

Table 2. Categories for interpreting the effectiveness of the N-Gain score

Percentage (%/)	Interpretation
<40	Ineffective
40-55	Less effective
56-75	Effective enough
>76	Effective

RESULTS AND DISCUSSION

Descriptive Analysis

Research on the results of these students' lectures was carried out by researchers in the electrical engineering education department, by taking research samples in two classes, namely class A1 for the control class with a total of 20 students and class A2 for the experimental class with a total of 17 students. Control class A1 is a class that is given lecture treatment using a problem-based learning model. For experimental class A2, this is the class that is given lecture method treatment with conventional learning.

The data taken in this research is data from student lectures in the Electrical Transmission Systems course. The test used by researchers in looking for data on students' lecture results is by making a test before the lecture (pre-test) and after the action (post-test). The range of pre-test and post-test scores is 1-100. The researcher carried out the data processing using Microsoft Excel 2010 and SPSS version 22.0 software. The following is data on student lecture results obtained by researchers after conducting the research:

Table 3. Pre-test and post-test data for control class A1

Respondent A1	Pre-Test	Post-Test
Respondent 1	4	90
Respondent 2	4	95
Respondent 3	4	85
Respondent 4	4	80
Respondent 5	4	80
Respondent 6	3	75
Respondent 7	3	75
Respondent 8	3	75
Respondent 9	3	75
Respondent 10	3	75
Respondent 11	2	80
Respondent 12	2	80
Respondent 13	3	75
Respondent 14	2	80
Respondent 15	4	75

Respondent 16	3	25
Respondent 17	4	90
Respondent 18	3	80
Respondent 19	4	75
Respondent 20	3	75

The data in table 3 shows the acquisition data for control class A1 before and after treatment.

Table 4. Pre-test and post-test data for experimental class A2

Respondent A2	Pre-Test	Post-Test
Respondent 1	3	70
Respondent 2	3	75
Respondent 3	4	85
Respondent 4	4	85
Respondent 5	4	75
Respondent 6	3	75
Respondent 7	2	25
Respondent 8	2	70
Respondent 9	3	75
Respondent 10	2	75
Respondent 11	2	25
Respondent 12	3	80
Respondent 13	3	75
Respondent 14	4	80
Respondent 15	3	75
Respondent 16	3	25
Respondent 17	2	90

The data in table 4 shows the acquisition data for control class A2 before and after treatment.

Validity and Reliability Test

The method used in this validity test uses corrected item-total correlation where the measuring instrument is said to be valid if rcount > rtable. Meanwhile, the reliability test is said to be reliable if the Cronbach alpha value is > 0.50. From the results of testing the validity of items on lecture results for control class A1 students, it can be concluded that the data is valid because the value of rcount > rtable. Meanwhile, for reliability testing, the data is reliable because the Cronbach alpha value is > 0.50, namely 0.052.

In testing the validity of the items from the lecture results of experimental class A2 students, it can be concluded that the data is valid because the value of rcount > rtable. Meanwhile, for reliability testing, the data is reliable because the Cronbach alpha value is > 0.50, namely 0.083.

Normality test

The normality test is carried out to see whether the data used is normally distributed or not. The normality test used was Shapiro-Wilk because the sample consisted of less than 50 respondents. The following are the results of the Shapiro-Wilk normality test.

Tabel 5. Shapiro-Wilk normality test

	Class	Shapiro-Wilk		
		Statistic	df	Sig.
Lecture results on Electrical Transmission Systems	Control class A1	.615	20	.560
	Experiment class A2	.689	17	.728

From the results of the normality test above, the data used is normally distributed because the significance value is more than 0.05, where for Control class A1 it is 0.56 and Experiment Class A2 is 0.72.

N-Gain Score Test

The normalized gain test (N-Gain) was carried out to determine the increase in students' cognitive learning outcomes after being given treatment. This increase is taken from the students' pre-test and post-test scores. The results of the normalized gain test (N-Gain) can be seen in table 6 below.

Table 6. N-Gain Score Test

	Min	Maxi	Mean	Std. Deviation
NGain_Score	-.88	.89	.7489	.35925
NGain_Score_persen	-87.50	88.89	76.89 39	35.925 47
Valid N (list wise)				

Based on the data obtained in table 6 above, the mean N-gain score in the table is > 0.748, which shows that the application of the problem-based learning model in improving student learning outcomes in the Department of Electrical Engineering Education is high. Then for the n-gain percent, a value of > 76.89 was obtained, which means that the use of the problem-based learning model was effective to implement.

Thus, there is an increase in student learning outcomes in Electrical Transmission Systems courses in the Department of Electrical Engineering, Manado State University. This is supported because through problem-based learning it can be seen that students are more active and creative in finding solutions to problems during the lecture process.

Reflection

The problem-based learning model applied in class A1 (control) and conventional learning applied in class A2 (experiment) in Electrical Engineering Education aims to determine whether or not there is a significant improvement in student learning outcomes in the Electrical Transmission Systems lecture.

From the research results obtained, the average post-test scores for the experimental class which used the conventional learning model and the control class which used the problem-based learning model were 75.20 and 85.80 respectively.

This is caused by differences in the level of student mastery of the material being taught after applying different learning models to the two samples, namely the problem-based learning model and the conventional learning model. So, it can be stated that the results of students' lectures in the control class which uses a problem-based learning model are better than those in the experimental class which uses a general (conventional) learning model.

From the results of hypothesis testing based on the N-Gain score, the mean N-gain score in the table is 0.748, which shows that the application of the problem-based learning model in improving student learning outcomes at Department of Electrical Engineering Education, Faculty of Engineering, Manado State University with the N-gain score is relatively high. Then for the n-gain percent, a value of > 76.89 was obtained, which means that the use of the problem-based learning model was effective to implement. It can be concluded that the problem-based learning model has a high influence in improving student learning outcomes in the Electrical Transmission Systems course at Manado State University's Electrical Engineering Education.

CONCLUSION

After conducting research and obtaining results, it can be concluded that during the learning process activities, it turns out that the use of learning with a problem-based learning model has an effect in improving students' basic electrical learning outcomes with n gain scores > 0.7, namely 0.78 and also n- the gain score percent is > 0.76. The data used in this research is normally distributed by looking at the significance value, namely more than 0.05, 0.56 and 0.72. Before the test was held, the basic assumptions of the test questions were declared valid and reliable with a sufficient level of reliability, namely 0.52.

These results are proven by using a problem-based learning model for basic electrical learning, the knowledge gained by students will be more easily absorbed because problem-based learning is able to make students more critical in finding solutions to problems. Apart from that, it can develop students' potential when studying material and assignments so that teachers can monitor the progress of learning activities at each meeting.

Based on the results of the research and discussion, here are some suggestions that researchers can convey: In learning, of course teaching staff are required to teach using learning methods that prevent students from getting bored quickly, in this case the researcher recommends a problem-based learning model so that it is hoped that they can solve learning problems at school.

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