

# Effectiveness of Problem-Based Learning Model The Use of the Spectrum Analyzer Teaching Materials Module on Student Learning Outcomes at the Aviation Polytechnic

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**Abstract**—Learning makes students the center of learning (student-centered), where students are encouraged and allowed to seek information from various sources, such as learning modules independently. Therefore, we need teaching material that can be used by students without depending on others in their learning. One of the learning media that can be used by students independently is the use of modules. The purpose of implementing this learning module is to determine the feasibility of learning modules that can be used in problem base learning methods and to determine the level of independent learning outcomes of students using practical learning modules. The method used in data collection is the library method collecting some written data from books, literature, and product trial results, as reference material and then analyzing solutions that can be taken in solving problems. The type of research used is the type of R & D research in producing modules and testing the use of the module using a one-group posttest-only design test for 20 students. The results of the study from data on learning outcomes of students who applied the PBL (problem-based learning) model using the spectrum analyzer module as a learning medium, the mean value in class EA-1 was 83.40 and EA-2 was 84.30. This value means that the average learning achievement of aircraft in class EA-1 is 83.40 and EA-2 is 84.30, so it can be concluded that aircraft learning outcomes in class EA-2 are higher than class EA-1 and the results of the calculation of the average difference test are two the data in Levene's Test for Equality of Variances column has a significant value of 0.384 ( $p > 0.05$ ) and F of 0.797, so it can be concluded that the two variances are the same. At equal variance assumed to compare the population average in the T-Test test, the t-value is 0.398 with a significant level of 0.695. These results indicate that  $p > 0.01$ , meaning that there is no difference in learning outcomes between classes EA-1 and EA-2.

**Keywords**— module, Spectrum Analyzer, PBL

## I. INTRODUCTION

The development of information technology is increasing so that every individual is encouraged to find and utilize technology with rapid adaptation, especially communication technology [1]. Where today's communication technology is increasingly varied in form, function, and use. Building a communication system, in general, takes at least three stages, namely the planning stage, the implementation stage (installation), and the testing stage. [2]. Of the three stages, each stage has a very important role. Therefore, careful calculations are needed, and must pay attention to the factors

that can affect the performance of the system. Of the three stages, the testing stage is the most decisive, this is because from this stage one can find out the shortcomings and performance of the system that has been made. At the module design stage, it is necessary to pay attention to the curriculum and syllabus to be practiced, as well as the practicum equipment to be used.

A spectrum Analyzer is a measuring instrument used to determine the amount of energy distribution of a frequency spectrum generated by an electrical signal [3]. A spectrum Analyzer is a device that is reliable enough to analyze or test the condition of a system in a communication network. Besides that, Spectrum Analyzer is also very useful in planning and testing radio frequency circuits. In software, especially the creation of a simple spectrum analyzer, applying the theory of the fast Fourier transform algorithm which is used to convert the signal into a spectrum quickly and efficiently. [4]. However, the high price of a Spectrum Analyzer causes not all parties to be able to have it. One solution to overcome this is to create a hardware/prototype that can perform the same work function as the Spectrum Analyzer but at a relatively cheaper price.

Learning by making students as learning centers (student-centered), where students are encouraged and allowed to seek information from various sources, such as textbooks independently. The use of learning models by optimizing student activities and creativity, as well as fun, will have positive implications for one's learning success [5]. Therefore, we need a teaching material/module that can be used by students without depending on others in their learning. One of the teaching materials that can be used by students independently is a module. The module has the characteristics of work activities which are marked by the presence of activity sheets or work activity instructions. So, the learning module that is compiled contains not only subject matter but also includes work activities that can be used by students as a guide for conducting practicals. Structured problems found in the classroom or laboratory can be solved with textbook guidance [6]. Where the results of the preparation of the module need to be validated by experts to determine the level of readability and acceptability of the content [7]. The main purpose of this implementation stage is to guide students to achieve learning objectives, occurrence of a problem-solving process or solution to overcome the gap in learning outcomes, and finally

ensure that at the end of the program students have the competence of knowledge, skills, and good attitudes, so that through the process of This education is a means of preparing students to be able to enter the world of work by implementing their competencies.

## II. METHOD

The technique or method used in data collection is the library method collecting some written data from books, literature, and product trial results, as reference material and then analyzing solutions in problem-solving. The type of research used is the type of research and development research.

Quantitative data were obtained from the results of the assessment of experts (material experts and media experts), the results of the assessment of student response questionnaires as test subjects, and the results of the posttest of students on learning devices or teaching materials modules for electronic Aircraft subjects with the Problem Base Learning approach. The research instrument used by the experts was in the form of a closed questionnaire whose answers were already available so that the respondents chose directly, with a direct questionnaire using a multilevel scale. The stratified scale in this questionnaire uses a modified Likert scale with 4 (four) answer choices, namely strongly agree, agree, disagree, and strongly disagree. To measure the learning outcomes of students using one group without a comparison group. Thus, the design that the researcher uses is a one-shot case study or one-group posttest-only design. In the final stage of learning using the module, a normality test is carried out using a posttest [8].

## III. RESULTS AND DISCUSSION

The module-based learning media developed in this study refers to the 4D development model, namely the stages of defining, designing, developing, and disseminating [9]. The development of learning media in this study refers to two quality requirements, namely valid and effective. A good learning tool must meet the criteria for the validity of the expert validator [10].

The results of the validation in the form of suggestions and criticisms from the validator are then used as a reference in revising the media that has been developed. After revising the module, a module will be produced which will be tested in the field by deployment.

Limited to Makassar Aviation Polytechnic. The results of the expert validators' assessment of the teaching module media. The

results of the validator's assessment of the physical aspects of the module, obtained an average value of all items of 3.4 while the results of the validator's assessment of the language aspect and material assessment of the module obtained an average score of 3.7. The results of the module validation, namely the average value of the validity of the learning media in terms of the physical aspects of the module as well as the Language and Material Assessment Aspects given by the media validator is 3.4 - 3.7 which is in the valid category, from the average results of the assessment, it can be concluded that the module-based learning media has been feasible to be used and tested in the field with a limited scale.

The final stage of this research, practicum learning is carried out using the teaching material module, so the value of

learning outcomes from the PBL class is 20 students, where class EA-1 with code EA-1 to EA-10 while class EA-2 with code EA-11 to code EA-20 as shown in the following table;

TABLE I. LEARNING OUTCOMES OF PBL CLASS STUDENTS

Learners	Code	SCORE
1	EA-1	86
2	EA-2	84
3	EA-3	93
4	EA-4	80
5	EA-5	87
6	EA-6	75
7	EA-7	80
8	EA-8	82
9	EA-9	90
10	EA-10	77
11	EA-11	81
12	EA-12	88
13	EA-13	79
14	EA-14	84
15	EA-15	90
16	EA-16	82
17	EA-17	79
18	EA-18	83
19	EA-19	91
20	EA-20	86
Average		83.85

(SOURCE: DATA PROCESSING RESULTS)

Based on table 1 above, it appears that student learning outcomes use one group without a comparison group or measure the level of student learning success using a one-shot case study design. Test results with the method one-group posttest-only design for 20 students obtained a class average of 83.85

The data obtained from the learning outcomes of students who apply the PBL model (problem-based learning) using the spectrum analyzer module as a learning medium can be seen in Table 2.

TABLE II. LEARNING OUTCOMES BASED ON NORMALITY TEST

	Class	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Aircraft Electronic Learning Outcomes	EA-1	.125	10	.200 *	.979	10	.961
	EA-2	.128	10	.200 *	.935	10	.496

(SOURCE: RESULTS OF RESEARCH DATA PROCESSING)

Based on the results of SPSS in table 2, it appears that the number of research respondents (DF) < 50 samples so the table uses Shapiro-Wilk data because the sample data used is less than 50 samples, namely 20 samples. Because the significance of class EA-1 is 0.961 and EA-2 is

TABLE III. STUDENT LEARNING OUTCOMES

Group Statistics					
	Class	N	mean	Std. Deviation	Std. Error Mean
Aircraft Electronic Learning Outcomes	EA-1	10	83.40	5700	1,802
	EA-2	10	84.30	4.322	1.367

(SOURCE: RESULTS OF RESEARCH DATA PROCESSING)

Based on table 3, the mean value for class EA-1 is 83.40 and EA-2 is 84.30. This value means that the average learning outcomes for aircraft in the EA-1 class are 83.40 and EA-2 are 84.30, so it can be concluded that the aircraft learning.

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		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Aircraft Electronic Learning Outcomes	Equal variances assumed	.797	.384	-.398	18	.695	-.900	2.262	-5.652	3.852
	Equal variances not assumed			-.398	16,778	.696	-.900	2.262	-5.677	3.877

TABLE IV. THE RESULTS OF THE CALCULATION OF THE DIFFERENCE TEST

(SOURCE: RESULTS OF RESEARCH DATA PROCESSING)

Based on the results of the calculation of the difference in the two power averages presented in table 4, Levene's Test for Equality of Variances column has a significant value of 0.384 ( $p > 0.05$ ), so it can be concluded that the two variances are the same. At equal variance assumed to compare the population average in the T-Test test, the t-value is 0.398 with a significant level of 0.695. These results indicate that  $p > 0.01$ , meaning that there is no difference in learning outcomes between classes EA-1 and EA-2

## IV. AUTHORS' CONTRIBUTIONS

The author's contribution to this research is to design a simple and affordable spectrum analyzer significance of class EA-1 is 0.961 and EA-2 is 0.496, it means that the significance value is greater than sig.0.05 so that the probability data generated can be stated to be normally distributed.

Outcomes in the EA-2 class are higher than those in the EA-1 class. After the normality test was carried out, it was

continued with a different test using the statistical technique of the independent-sample T-test. The results of the different tests can be shown in table 4

Practicum tool by utilizing the RTL-SDR to fulfill practical tools that are not yet available in the laboratory and to develop a practicum learning module as a learning medium by applying the problem base learning model so that the participants' learning outcomes learning can be measured.

teachers, and staff who has facilitated the implementation of the spectrum analyzer teaching materials module.

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