

The Urgency of Electrical Power System Competency Test in Electrical Engineering Bachelors

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Abstract. Passing the competency test is one of the requirements for undergraduate graduates from the Department of Electrical Engineering Education in the Electrical Engineering and Electrical Engineering Education Study Program. Students can take the competency test after taking a minimum of 115 credits. The electric power system competency test includes core courses in the areas of expertise in electric power systems which cover basic electrical circuits, power system networks and electrical machines. The competency test will measure the level of ability of graduates of Electrical Engineering Education in the field of power system competence. The level of ability based on the results of the competency test is the basis for predicting the ability of graduates in self-development after engaging in the real field or as a basic provision in continuing to the next level of education.

Keywords: Competency test, electric power system, electrical engineering graduate.

1 Introduction

Competency testing is one of the requirements for students who will take part in undergraduate graduations and to accompany diplomas for undergraduate graduates within Universitas Negeri Medan. The Department of Electrical Engineering Education is one of the departments at Universitas Negeri Medan which has 3 study programs, namely Electrical Engineering Education, Electrical Engineering Study Program and Informatics and Computer Engineering Education Study Program. The Electrical Engineering Education Study Program and the Electrical Engineering Study Program have the same knowledge group in the field of electrical systems. The difference lies in the output of graduates, where the Electrical Engineering Education Study Program aims to produce education graduates as teaching staff in vocational high schools in the field of electricity, while the Electrical Engineering Study Program produces electrical engineering graduates who will work as knowledge developers or apply their electrical knowledge in industry.

Standard tests are tests used to determine a person's abilities based on established standards. Determination of competency standards depends on the institution that sets limits on the

competency abilities that test participants must achieve. Industry or educational institutions in general, when recruiting new workers, require that participants must pass a skills test set by the institution. It is assumed that applicants who have passed the test are predicted to be able to complete their job duties and can thrive in the workplace. The goal of a Standard Test is to assess either student achievement or aptitude in an unbiased manner [4].

In general, a person's competence covers all aspects, namely knowledge, skills and attitudes. A person's competency abilities have an impact on work ability and career development in the workplace. That person's competency profile includes the knowledge, skills and attitudes required for work [7]. Competency testing is also to determine the development of a person's abilities in the work environment. Person's competency abilities arise from their potential abilities in the work environment and at the same time specifically using relevant knowledge in relation to the problem [12].

Graduates' competency abilities can be determined by carrying out a series of tests on someone. The competency tests can be used to determine whether a person is competent or not which includes 5 abilities, namely: (1) physical or intellectual abilities, skills or both; (2) performance capacity in doing and knowing the job; (3) Determination of observable performance; (4) performance standards with levels of "adequate", "fair", "appropriate", "suitable", or "Very suitable"; and (5) Development [8].

The problem with competency testing, especially for graduates of the Electrical Engineering study program, is finding a form of test that can provide an overview of the quality of graduates of the Electrical Engineering Study Program. This is because there are quite a lot of competency test participants and there is time available for the test organizers and the results can be known immediately. Various ways to determine the level of competency are through knowledge tests or skills tests or attitude tests or a combination of several of these tests. Each testing method has advantages and disadvantages.

The advantage of knowledge and attitude tests is that there is an answer key sheet with a clear assessment scale in the assessment process, which will provide fast feedback for both small and large populations. The weakness in this test is that there are still aspects of learning that require improvement or development that are not covered in the test instrument. The alternative is with additional assessments such as observation, portfolio, and reflection, but this requires a lot of energy and time [5]

The function of the results of standard tests is to see the extent of weaknesses in the learning outcomes undertaken by students, so that they become material for analysis to improve teaching and learning process activities. Apart from that, standard tests can also be used for curriculum development so that the level of achievement of student learning outcomes can be maximized. Anthony M. Wanjohi [2010] stated that the results of the tests are used as a measure to determine eligibility for special education and identification of strengths and weaknesses in school learning. The results also help professionals to plan instructions by identifying curriculum areas in which students fail to perform as well as their peers [2].

One of the requirements for graduates of a bachelor's degree in electrical engineering or a bachelor's degree in electrical engineering is to pass a competency test in the field of electrical engineering. The competency test that electrical engineering and electrical engineering education study program students must take is the electrical power system competency test

which includes knowledge about the basics of electrical circuits, electrical machines and electrical power system networks. This skills competency test requires a set of tests that can measure the extent of the ability of undergraduate graduates of Electrical Engineering Education and Electrical Engineering graduates with both cognitive and psychomotor knowledge. Competency tests are carried out 4 times a year according to Universitas Negeri Medan's graduation schedule, so a representative question bank is needed that can provide graduate assessments according to students' abilities. Thus, the need for standard test equipment is a requirement that must be prepared by the Department of Electrical Engineering Education.

This standard test can be supplemented with portfolio assignments so that results can be obtained measuring true student competency. The portfolio assignments as authentic assessments can provide a comprehensive assessment of the ability to achieve student competencies in carrying out industrial practical work [1].

2 Method

The results of developing standard competency tests that meet the requirements of validity, reliability, percentage level of item difficulty and differential power values are used to test the competency abilities of graduating students. Electrical engineering and is an expanded testing phase. Competency tests are given to students who will carry out proposal seminars and thesis examination trials. The exam was taken by 56 students majoring in Electrical Engineering Education. The sample uses the entire population (all students who are taking competency exams and there are no stamp restrictions). The test questions consist of 30 multiple choice questions and 5 essay questions.

Data analysis uses descriptive statistics, namely mean, median, mode and standard deviation. The results of descriptive analysis were compared with a standard curve to determine the category of student competency graduates, namely: not passed, good and very good. Based on the percentage of each category of graduates, further evaluation can be carried out, especially in improving teaching and learning process in the Electrical Engineering Education Department.

Implementation competency test for electrical engineering study program students can be divided into 3 categories, namely passing very competently, competently, and not competently. The determination of this category is based on an ideal normal curve with a scale of 100. Based on this scale, the ideal average score is 50 with an ideal standard deviation of 16.67, so based on this ideal score, the minimum score for a student is said to be passed if they reach a score of 66.67 or above or $M + 1SD$. Based on this provision, the grouping criteria for passing the competency exam are as follows: a) not competent if the score is less than 66.67 ($M + 1SD$ or below); b) competent if you have a score of 66.67 to 83 ($M + 1SD$ to $M + 2SD$) and; c) very competent if you have a score of 83.3 to 100 ($M + 2SD$ and above). Students who have a score below 66.67 are in the failed category and must take remedial exams until they reach a minimum score of 66.67.

3 Results and Discussion

3.1 Research Results

The competency exam results from May to July 2023 of 60 students majoring in Electrical Engineering Education obtained the following score distribution: the lowest score was 16 and the highest score was 90.4; average value 68.5; standard deviation 17.8. Based on the average value, it is still in the good category. Based on the data distribution, the distribution is: a) 18 students or 30% failed; b) 35 students or 58.3% passed the good category; and c) 7 students passed the very good category or 11.7%. In other words, only 70% of those who passed the competency test in that period reached 70%. This shows that the level of competency of graduates still needs to be improved.

Based on the average score obtained, it indicates that the level of mastery of knowledge of the main material in electrical power systems is still in the medium category. Based on the standard deviation, it can be seen that the distance between students who do not pass (lowest score 16) and those who pass is very large, namely exceeding the ideal standard deviation value (16.67). This shows that students' ability to absorb key knowledge in electrical power systems still needs to be improved with various relevant learning methods and the provision of better infrastructure.

The category of student competency test in the medium category regarding knowledge of electrical power systems can influence competitiveness with graduates of other universities both regionally, nationally and internationally. The results of this competency test are used as evaluation material for lecturers teaching the main subject of electrical power systems to try out how to improve the ability to master the main material of electrical power systems for students majoring in Electrical Engineering Education. Mastery of the main material in the electric power system is very important considering that when recruiting workers in industries/companies an entrance test (quality screening) will be carried out. Apart from that, developing a career path will require competence in the field, so that in entrance selection this is part of the consideration along with other abilities (attitudes).

The results of the competency test for 60 students in the Department of Electrical Engineering Education are as depicted in table 1, the frequency distribution of competency test scores, and depicted in the form of a histogram as in figure 1.

Table 1. The Frequency Distribution of Competency Test Scores

No	Interval	F	Fr (%)
1	0 - 16,67	2	3
2	16,67 - 33,65	3	5
3	33,66 - 50,03	2	3
4	50,04 - 66,71	11	18
5	66,72 - 83,51	35	58
6	83,52 - 100	7	11
Sum		60	100

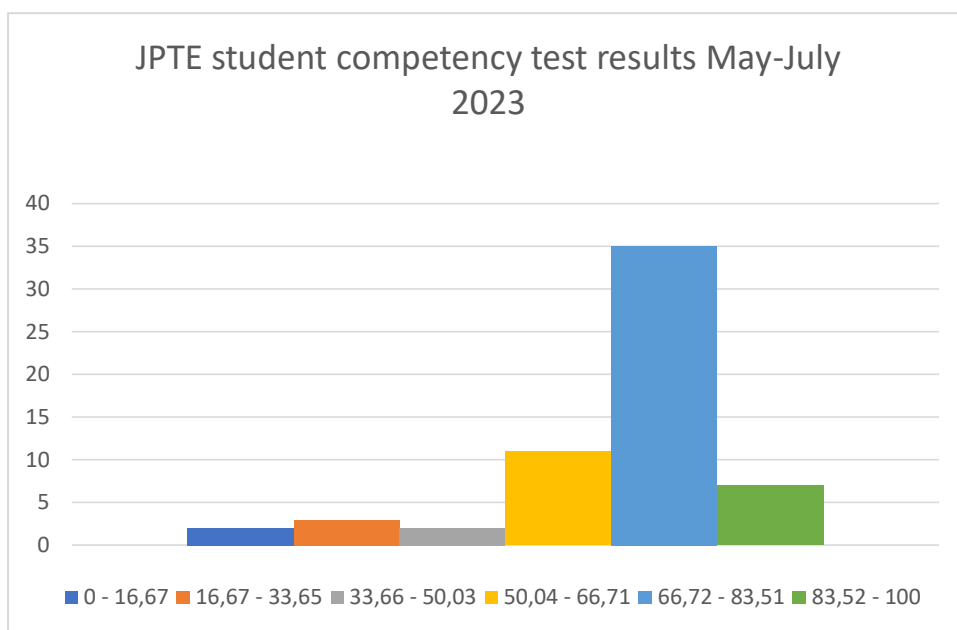


Fig 1. JPTE Student Competency Test Results May-July 2023

3.2 Discussion

Competency tests are needed to determine the extent to which prospective Electrical Engineering graduates have the basic knowledge of Electrical Engineering as a basis for further development. Competency test to ensure that graduating students have achieved the competencies required as professionals in electrical power systems who are ready to develop in accordance with developments in science and technology in the electrical power systems.

Based on the results of the analysis of learning outcomes in the Electrical Engineering education department, basic knowledge of electricity is required which graduates must master as a basis for developing in the field of electrical power systems, either as experts in the industrial field or to develop knowledge or continue to higher education including the field of electricity. Basic science in electrical systems includes: basic electronics, electrical circuits, electrical machines, lighting and electrical installations, electrical power system analysis, and microprocessors.

Electrical circuits include DC and AC circuits, basic electronics including power electronics, electrical machines including AC and DC generators, AC and DC motors and transformers, illumination and electrical installations including lighting and power installations and lighting systems, electrical power system analysis including transmission analysis and distribution of

electric power systems and microprocessors including basic microprocessors and control systems.

4 Conclusions

Competency testing of students graduating from the Electrical Engineering Study Program is very important to find out the extent of the student's abilities. The research results show that the competency abilities of the majority of Electrical Engineering Study Program students are still in the competent category (58%) and relatively few are very competent (11.7%) and those who are not yet competent are close to one third (30%).

It is necessary to carry out a comprehensive evaluation in preparing graduates so that they can achieve student competency.

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