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# The Influence of Vocational Theory Competency Test Results on Vocational Practice Competency Test Results

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**Abstract— This study aims to determine how much the results of the theory of vocational competency tests are related to the results of the vocational practice competency tests of TITL students at SMK Negeri 2 Manado. In addition, this study also analyzed how relevant the vocational theory competency test material was to the vocational practice competency test material. The method used in this study is a quantitative method with 56 students as research subjects. In practice, the researchers found that some students already understood electric motors, and some did not understand when the researchers gave practice; as a result, these students did not understand when the researcher or teacher was giving theory to them. When researchers teach theory and practice, they often provide post-tests or questions for students to work on to see whether they comprehend correctly. The results showed a positive and significant effect on the results of the vocational theory competency test and the results of the vocational practice competency test. In addition, the results of the analysis of the relevance of the material in the theory of vocational competency tests to the results of the vocational practice competency tests were 70% in the relevant category.**

**Keywords: theoretical competency test results, practical competency test results, electric motor installation**



## I. INTRODUCTION

Vocational High School (abbreviated as SMK in Indonesian) is an educational institution to improve the quality of individuals with intelligence, knowledge, personality, noble character, and skills to live independently and attend further education by their vocational (Setiyawami et al., 2020). SMK has characteristics that prepare students to work in certain fields. This preparatory process takes place through learning by doing and hands-on experience to prepare students for success in mastering skills in the world of work (Jackson et al., 2008).

SMK Negeri 2 Manado has several competency areas, one of which is the Electrical Engineering competency field, which aims to prepare mid-level graduates in the field of electric motor installation who can work independently, skillfully, and professionally in line with the demands of the world of work and the development of science and technology.

Implementing the practical competency test carried out in the field of competence for electric motor installation is to work on installing the start/stop sequence. In carrying out the productive competency test, in addition to cognitive abilities related to student's academic abilities, students must also have affective (work attitude) and psychomotor abilities related to practice (Purnawirawan et al., 2019).

The purpose of carrying out the competency test is to determine students' success in mastering one unit of competency concerning national competency standards (GLASS, 1978). Competency standards are abilities that students (graduates) must have in general. Competence is a statement that describes the appearance of a certain ability, which is a combination of knowledge and abilities that can be observed and measured (Chrisbiyanto et al., 2022).

In electrical engineering, students are given various theories to support their practical activities. Ideally, theoretical ability supports the ability to implement the practice (Mezirow, 1997). However, how far the student's ability is in mastering the material must be known, as must how students apply this theoretical ability in their practice (Mohammad Saleh et al., 2023). Few students have better academic abilities than their practical abilities; conversely, some students have more practical abilities than their academic abilities (Martens & Witt, 2004).

In the educational process at school, learning is the most important activity. This means that the success of educational goals is mostly determined by

how effectively the teaching and learning process can take place (Kuijpers et al., 2010). So that students are not only learning objects but also subjects who can experience, discover, construct, and understand concepts (Mustaro & Silveira, 2006).

So, one of the aspects that influence the implementation of the practical competency test is based on the readiness of the theory (Hrynchak & Batty, 2012). However, how much influence the results of the theoretical competency test have on the material about the practical competency test itself is still in question, so it deserves further investigation.

Two problems in this research can be identified. First, there is a tendency for students not to be able to apply the learning theory given to the practical implementation. Second, there is a tendency for the theory of vocational competency test material to be less relevant to the vocational practice competency test material. So the formulation of the problem of this study is: Is there any influence of the subject results of the vocational theory competency test on the results of the competency test of vocational practice in the Electric Motor Installation subject at SMK Negeri 2 Manado? The formulation of the problem is limited to two. First, the results of the theoretical vocational competency test and the results of the vocational practical competency test in the Electric Motor Installation subject for the 2021-2022 Academic Year are seen based on the final score of the results of the vocational competency test for students of SMK Negeri 2 Manado. Second, the students who will be studied are class XII students in the Electric Motor Installation subject taking the vocational theory competency test and vocational practice competency test for the 2021-2022 Academic Year at SMK Negeri 2 Manado.

From the problems that have been described, there are three points of the purpose of this study:

1. To find out the results of the vocational theory competency test in the Electric Motor Installation subject for SMK Negeri 2 Manado students.
2. To find out the results of the vocational practice competency test in the Electric Motor Installation subject for SMK Negeri 2 Manado students.
3. To find out the results of the vocational theory competency test on the results of the vocational practice competency test in the Electric Motor Installation subject for students of SMK Negeri 2 Manado.

Understanding learning is a business process carried out by a person to get a new change due to his experience interacting with his environment (Fosnot & Perry, 2005). In this case, change is done consciously (intentionally) and aims to get something better than before. The definition of learning is a process of change in human personality which is shown in the form of increasing the quality and quantity of behavior, such as improvement (Anwar, 2015).

Competence is a person's ability or skills in carrying out a job or task in a certain field following the position he holds (Le Deist & Winterton, 2005). Another opinion says competence is a certain skill, knowledge, basic attitude, and value in a person, reflected in the ability to think and act consistently (Bird & Osland, 2017). In other words, competency is not only about one's knowledge or abilities but the willingness to do what is known to produce benefits. There are six aspects contained in the concept of competency, namely, knowledge, understanding, abilities, values, attitudes, and interests (Sumiarsi & Pendidikantarakan, 2015).

Etymologically the word "kompetensi" is adapted from English, namely competence or competency, which means skill, ability, and authority. As a result, competence is defined as a person's mix of knowledge, abilities, and personality traits that enable him to enhance his performance and contribute to his company's success (Hoffmann, 1999). Competence is a person's ability or capacity to perform various tasks in a job, where intellectual and physical factors determine this ability (Nurasniar, 2021). The meaning of competence is a human characteristic related to performance effectiveness, which can be seen in behavior, way of thinking, and acting style (Le Deist & Winterton, 2005). According to Charles E. Johnson, competence can be divided into three parts (Johnson, 1978), namely;

1. Personal Competency, namely, the ability of individuals to develop their personality.
2. Professional Competency, namely the ability of individuals in matters relating to the implementation and completion of certain tasks in work.
3. Social Competency, namely, the ability of individuals in matters relating to life and social interests.

Learning is a series of events that affect students, so the learning process can occur easily. Learning is not limited to events carried out by the teacher but includes all events that may directly influence the student learning process. Learning includes events derived from printed materials, pictures, radio programs, television, films, slides, or a combination of these materials. There are nine principles of Competency-Based Learning: student-focused, integrated, individualized, completeness, problem-solving, and experienced-based learning. There are five competency-based learning models: Contextual Learning Models, Cooperative Learning

Models, Complete Learning Models, Problem-Based Learning Models, and Computer Based Learning Models (CBI/CAI) (Voorhees, 2001).

The purpose of competency-based learning is very important. Competency-based learning is a form of implementing the Competency-Based Curriculum (abbreviated as KBK in Indonesian). As a result, competence is defined as a person's mix of knowledge, abilities, and personality traits that enable him to enhance his performance and contribute to his company's success (Henri et al., 2017). On the other hand, implementing a competency-based learning approach relates to the national educational goals outlined in Law Number 20 of 2003 Article 3.

Four competencies must be possessed by students today (Zhu et al., 2013), namely:

1. Critical thinking and solving problems,
2. Creativity,
3. Communication skills, and
4. Ability to work collaboratively.

There are several processes in competency-based learning. The learning process must provide opportunities for students to participate in the learning process directly. Thus the teacher must act as a learning process manager, not as a source of learning. Teachers need to provide opportunities for students to reflect on what they have done. Thus learning does not only encourage students to take the actions they have done. This is very important, both for the formation of attitudes and for examining the various weaknesses and shortcomings of all of their actions (Kaligis & Dakhi, 2023). The learning process must consider individual differences. This is based on the assumption that no human being is the same regarding interests, talents, and abilities. Learning must provide opportunities for students to develop according to their talents and abilities (C. E. J. Mamahit, 2019). Thus slow students do not feel displaced by fast students; on the other hand, fast students do not feel hampered by slow-learning students. The learning process must be able to foster independence in addition to cooperation. This means that teachers are required to be able to provide learning experiences that allow students to be independent and work together with others. The learning process must occur in a climate conducive to both the social and psychological climate. Students will learn well when free from various pressures, both social pressure and psychological pressure. It is hoped that students will develop optimally according to their abilities through such a learning climate. The learning process managed by the teacher must be able to develop creativity and curiosity. This is only possible if the teacher does not place students as learning objects. For this reason, teachers must encourage active students to learn through the process of searching and observing.

According to the Regulation of the Minister of Education and Culture Number 20 of 2016, Graduate competency standards (abbreviated as SKL in Indonesian) are criteria regarding the qualifications of graduates' abilities, which include attitudes, knowledge, and skills (Rombot et al., 2022). That is why, every time a teacher conducts learning, he must refer to these standards. There are two SKL functions. First, it becomes an assessment guideline to show student graduation. Second, it becomes the basic foundation of intelligence, knowledge, personality, character, and independent living skills at primary and secondary education's general/ vocational level.

One of the main materials presented in the Electric Motor Installation lesson is Thermal Overload (TOR). Thermal overload is a circuit safety device from overcurrent caused by a load that is too large by breaking the circuit when a current that exceeds the setting passes through it. Thermal overload protects electrical and electrical circuits from damage due to overload. Thermal overload protects the circuit on its three phases (for three-phase circuits), both those using a bimetallic system and those using an electronic system without a separate supply (meaning that this electronic thermal overload does not require a special power source), and has a sensitivity to the loss of phases working with the system. Differential (indirectly tripping in the case of a single phase loss), but additional protection devices are needed if a circuit is required to trip immediately upon the loss of a phase.

Thermal overload is a safety component in the main contactor that protects the electric motor circuit from excessive current, which has the potential to cause damage to the circuit. The main component of TOR is bimetallic, two metal materials with different expansion coefficients mounted together. If there is heat, say when the current flowing into the bimetal is too high, the two metals will expand, causing them to bend. This property is used to cut off the electric current flowing. TOR is coupled to the contactor on the main contact prior to the electric motor (load). So, when a very large current flows through an electrical panel connected to a TOR, this TOR will bend and break the connection so that the current stops flowing. This thermal overload can be paired directly with the contractor or separately, making it very flexible for installation inside the panel. The choice of the thermal overload type is determined by the current rating/setting according to the nominal current of the circuit at full load and its trip class. For normal use, trip class 10 is used. Namely, the thermal overload will trip at 7.2 lr in 4 seconds.

## II. METHOD

The population used in this study were class XII TITL SMK Negeri 2 Manado students, totaling 2 classes, with details presented in Table 1.

**Table 1.** Student Data for Class XII TITL SMK N 2 Manado.

| No | Class | Number of Students |
|---|---|---|
| 1 | XII TITL 1 | 27 |
| 2 | XII TITL 2 | 29 |
| | Total | 56 |

The research sample used a simple random sampling technique, namely taking samples from members of the population using random without regard to strata (levels) in the population (Sugiyono, 2014). In this study, two classes were taken as samples, where Class XII 1 and 2 served as classes for data or research results.

The design used in this study is a true Experimental Design, namely a Posttest-only Control Design, which can be seen in Table 2.

**Table 2**. Research design

| | | | |
|---|---|---|---|
| **Theory** | R | X | $O_2$ |
| **Practice** | R | - | $O_4$ |

Description:
R : The research sample is chosen randomly
X : Effect of the results of the theoretical competency test on the practical competency test results
$O_2$ : Final test (post-test) on the results of the vocational theory competency test
$O_4$ : Final test (post-test) on the results of the vocational practice competency test

In this study, tests were used to measure students' cognitive learning outcomes in TITL 1 and 2 classes. The instruments used in this study were syllabi, lesson plans (RPP), lists of assessments taken from the results of theoretical competency tests, and the results of vocational practice competency tests. Before conducting learning, a learning plan must be prepared, outlined in the syllabus and learning implementation plan. The various learning designs prepared by the researchers were adapted to the 2013 curriculum. Testing the validity of the contents of the instruments was carried out with expert validity, namely validity adjusted to the curriculum and consulted and approved by experts. The moment product correlation formula (see Formula 1) calculates each item's validity.

$$\frac{N\Sigma XY-(\Sigma X)(\Sigma Y)}{\sqrt{(N\Sigma X2-(\Sigma X)2(N\Sigma Y2-(\Sigma Y)2)}} \quad (1)$$

(Sudjana, 2010)

Description:
$r_{xy}$ : correlation coefficient
N : number of subjects
X : item score
Y : total score

The classification of the reliability coefficient of the questions can be seen in Table 3.

**Table 3**. Classification Coefficient of Reliability

| Reliability Coefficient (r) | Interpretation |
|---|---|
| 0.00≤r<0.20 | "Very low" |
| 0.20≤r<0.40 | "Low" |
| 0.40≤r<0.60 | "Medium" |
| 0.60≤r<0.80 | "High" |
| 0.80≤r<1.00 | "Very high" |

To test the hypothesis, the researcher uses t-test statistics with Formula 2 and Formula 3.

$$t = \frac{\overline{X_1 - X_2}}{Sgab\sqrt{\frac{1}{n^1}+\frac{1}{n^2}}} \quad (2)$$

where:

$$Sgab = \sqrt{\frac{(n^1-1)S_2^1+(n^2-1)S_2^2}{(n1+n2)-2}} \quad (3)$$

Description:
$\overline{X_1}$ = average value of theoretical competence test results
$\overline{X_2}$ = average value of practice competency test results
$n_1$ = the number of samples from the theoretical competence test
$n_2$ = number of samples of practical competency test results
$S_1$ = standard deviation of the results of the theoretical competency test
$S_2$ = standard deviation of the results of the practice competency test

### *Analysis of Influence Between Variables*

Formula 4 analyzes the influence between variables (Sudjana, 2010).

$$rb = \frac{\overline{(Y_1\text{-}Y_2)\,pq}}{uSy} \quad (4)$$

Description:
Rb = biserial coefficient
$\bar{Y}_1$ = average value of cognitive theory competency test results
$\overline{Y_2}$ = average value of practical cognitive competency test results

$p$ = proportion of observations on the results of the theory competency test
$q$ = proportion of observations on practice competency test results
$u$ = ordinate height of the standard normal curve at the point z that cuts the standard normal area into p and q parts
$Sy$ = standard deviation of the results of the theory competency test against the practice

### *Determination of the Coefficient of Determination*

The coefficient of determination is a coefficient that states what percentage of the influence of an independent variable on the dependent variable in testing student competence regarding theory to practice (see Formula 5)

$$KD = rb2 \text{ X } 100\% \quad (5)$$

Description:
KD = coefficient of determination
rb = index of determination obtained from the squared price rb (coefficient of biserial)

## III. RESULTS AND DISCUSSIONS

Based on the value data obtained by the competency test results, which can be seen in Table 4.

**Table 4**. Student Competency Test Result Data

| No | Statistical | Statistical Value | |
|---|---|---|---|
| | | Theory Competency Test Results | Practice Competency Test Results |
| 1 | Mean | 84.81 | 76.03 |
| 2 | SD | 6.57 | 5.72 |
| 3 | $S^2$ | 43.23 | 3282 |

The average competency test results of the influence of theory on practice cannot be predicted because each student has different skills or abilities.

The instrument testing phase is carried out with a validity test to measure the quality of the instrument and whether it accurately measures the characteristics of the target variable. The validity test was based on data from theoretical competency test results on practice using the posttest in class XII students of SMK Negeri 2 Manado. Item analysis was performed by calculating the correlation between the scores of the instrument items and the total score. Validity testing uses the help of the Microsoft Excel program, where from 20 item items, 16 valid questions are obtained (r count > r table). Therefore, these 4 questions are no longer used.

After that, a reliability test is carried out to measure the accuracy and consistency of a measuring instrument so that the results can be trusted. Testing the reliability of the items was measured using the beginning-end splitting technique and analyzed using the Spearman-Brown formula. The reliability coefficient value obtained was 0.55. Thus, it was concluded that the items used were classified as reliable with a moderate reliability coefficient. The classification of the reliability coefficients of the questions can be seen in Table 3.

From the calculation of the normality test with $\alpha = 0.05$ for class TITL 1, L count = 0.118 L table = 0.259. So it is obtained that L count < L table, then the data on student test scores are normally distributed. From the results of the student posttest, homogeneity testing was carried out with the test results in Table 5.

From the data in Table 5, it is obtained that F count = 1.317 <Ftable = 1.914, which means that there is no significant difference between the results of the theoretical competency test and the results of the practical competency test or, in other words, the effect of theory on practice is homogeneous.

**Table 5**. Homogeneity Test Results

| Variable | $\alpha$ | $dk_1$ | $dk_2$ | F count | F table | Description |
|---|---|---|---|---|---|---|
| Learning outcomes | 0.05 | 27 | 29 | 1.317 | 1.914 | Homogeneous |

### *Hypothesis Test Results*

Test the hypothesis in this study using the t-test with the following hypothesis formulation:

Ho: $\mu 1 = \mu 2$

H1: $\mu 1 \neq \mu 2$

$\mu 1$ : Average student learning outcomes taught using theory

$\mu 2$ : The average student learning outcomes are assessed from practical competence

**Table 6**. Results of Hypothesis Testing Data on Student Learning Outcomes

| Competence test | Average | SD | S gab | t count | t table | Conclusion |
|---|---|---|---|---|---|---|
| Theory | 84.81 | 6.57 | 6.15 | 5.16 | 2.02 | Reject $H_O$ |
| Practice | 76.03 | 5.72 | | | | |

Table 6 shows that the value of t count = 5.16 is greater than t table = 2.02 at a significant level (α) = 0.05. Based on the hypothesis testing criteria, accept Ho if t count < t table and reject Ho if t count > t table. Because the data analyzed obtained t count > t table, the research hypothesis is to reject Ho. So it can be concluded that there are differences in the results of the theoretical competency test against the practical competency test in electric motor subjects.

The independent variable in this study is the result of the theoretical competency test. In contrast, the dependent variable results from the practical competency test for class XII TITL students of SMK Negeri 2 Manado. The biserial correlation coefficient is used to determine the effect of the practical competency test results on the students' practical competency test results.

Based on the data obtained, the magnitude of $\bar{Y}1 = 84.81$ ; $\bar{Y}2 = 76.03$; Sy = 6.15; p = 0.82; q = 0.17 and u = 0.3989. Furthermore, the magnitude of the biserial correlation coefficient of student learning outcomes (rb) = 0.45 is obtained. Following the guidelines for providing an interpretation of the correlation coefficient (Sugiyono, 2015), the results of the competency test of the theory of electric motors have a moderate effect on the results of practice.

Based on the calculation results, the biserial correlation coefficient obtained from the competence test results (rb) is 0.45 and included in the medium category, so the coefficient of determination (KD) is 20.25%. So, the magnitude of the effect of the results of the theoretical competency test on student learning outcomes in the electric motorbike subject on the practical competency test is 20.25%.

### *Discussions*

This study aims to determine the effect of the theory of vocational competency test on the results of the competency test of vocational practice in the electric motor installation subject for TITL Students of SMK Negeri 2 Manado. This experimental research is divided into two classes, and the two classes will be tested on theoretical competence against practical competence. The population in this study was the entire class XII TITL SMK Negeri 2 Manado, where the sample was taken using a simple random sampling technique.

In this study, two classes were taken as samples, namely class XII 1 and 2. This research activity was carried out in November 2021, where the lesson hours used to deliver material on the Electric Motor Installation subject were only four hours per week.

Each class is given two hours to explain the theory that will be used for practice. In the first week, the researcher only gave theoretical material to carry out practice the next week. After the next week, the researcher prepared the tools in the electric motor installation laboratory to carry out the practice; the practice results determined that the student's theoretical competence greatly impacted the results of the practical competency test. Researchers also gave questions to students about electric motor subjects.

Based on observations for the 2019/2020 academic year, the classical completeness of students at SMK Negeri 2 Manado is still below the KKM, namely 75, then in the 2020/2021 school year, based on the results of research in the two classes, there was an increase in the average learning outcome to 76.03, this was due to In the learning process, many students are active or often ask and answer questions.

Students were given a post-test to find out the results of students' cognitive learning at the last meeting. The value of this post-test is used to test the hypothesis. Before testing the hypothesis, a normality test and a similarity test of the two variances of the post-test value data were first carried out in the two classes.

The results of the calculation of the normality test can be concluded that the data of the two classes are normally distributed so that the next test average uses parametric statistics. Based on data analysis, the results are that theoretical competency tests have a positive effect on practical competency tests on student learning outcomes, as evidenced by the coefficient of determination test and post-test data. The average cognitive learning outcomes of theoretical competence are known to be higher than the results of practical competence.

The right-hand difference t-test was performed to determine if the theoretical competency exam results were greater than the practical competency test results. Based on the results of this study, data was obtained that the results of the theoretical competency test were higher than the results of the practical competency test, with the acquisition of an average score post-test learning outcomes of theoretical competence, namely 84.81 with a maximum score of 95 and a minimum score of 70 compared to the average acquisition of practical

competence, namely 76.03 with a maximum score of 90 and a minimum score of 65 so that the results of the theoretical competency test have a large influence on practice with learning outcomes students namely 20.25% by using the test of the coefficient of determination.

This is because learning from theory to practice is effective for students because theory greatly influences students' competency in practice (C. Mamahit et al., 2023). Appreciation to students for the success that will be achieved in learning will make students more motivated in learning abilities.

## IV. CONCLUSION

Based on the results of the research that has been done, there is a difference in the average student learning outcomes regarding the results of the vocational theory competency test against the vocational practice competency test results. The hypothesis test t count = 5.16 > t table = 2.02 with an average competency test of learning outcomes score of 84.81 and practical competence is 76.03 demonstrates this. The magnitude of the influence of theory on vocational practice for class XII students of SMK Negeri 2 Manado is 20.25%, as evidenced by the coefficient of determination test.

In learning, students should be actively involved to feel more valued and cared for, increasing good learning behavior. The teacher must actively provide questions and answers to students. Researchers need further research regarding the results of theoretical competency tests on practical competency test results so that learning of electric motorbikes in schools can develop and other factors that influence learning outcomes in Electric Power Installation Engineering in the Electric Motors subject can be identified.

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