

Teaching competencies of automotive engineering vocational school teachers in East Kalimantan

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Abstract

This study aimed to examine the factors that classify teacher competencies, based on good and bad educator certificates. The method used in this research is discriminant analysis. This study used a questionnaire survey method. The sample in this study was 54 teachers of the Light Automotive Engineering Vocational High School. The findings of this study revealed several key points: first, there is a significant average difference between competent and non-competent teachers based on the factors evaluated. Second, a discriminant function model was developed from the data, which effectively distinguishes between teacher competencies. Lastly, the model demonstrated a high prediction accuracy, successfully classifying teachers as competent or non-competent with a high degree of reliability. Therefore, this discriminant model can be utilized to assess teacher competency effectively.

Keywords: Automotive teacher competence; competencies; teachers; vocational high schools.

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1. Introduction

Technology and increasingly advanced times in the era of digital transformation and the industrial revolution will replace many existing professions in society with a system or robot for carrying out tasks. The role of a teacher can never be replaced by existing technology (Douse et al., 2019). Facing very dynamic changes, teachers must have an awareness of the importance of learning and improving *skills* capabilities to be able to become educators in this era (Sudira, 2020; Roll & Ifenthaler 2021). Mastery of the main disciplines as a teacher, but not balanced with technological knowledge will create a gap between the dimensions of knowledge in learning in this era (Chua & Jamil, 2012; Khademi-Vidra & Bakos 2024). Changes in the era of the digital revolution, climate change, and increasing knowledge in society will make a shift in the learning paradigm of the theory and practice of a teacher (Majumdar, 2011; Tan et al., 2024; Delcker et al., 2024). The role of the teacher in the existing paradigm shift requires the teacher to be able to master every existing technology so that learning will be able to run according to the demands of the times, a teacher must have competencies related to existing learning for now.

Studies in various developing countries show that several factors contribute to student achievement, the factor that gives the highest contribution is the teacher at 36% (Wagiran, 2013). Teachers have a very significant role compared to other factors in the success of the educational process such as management, study time, and finally the means. It was concluded that teachers have an important role in improving the quality of education because it has a significant impact on the development of student achievement. Teacher competence is an illustration of the teacher's skills or abilities and is expected to become an idea that is a hope for the teaching profession in developing competencies according to the current needs of the teaching profession (Suyitno et al., 2022). Wahyuni et al., (2020) revealed that teacher competency evaluation is an individual analysis to review the quality of teachers in carrying out tasks and determine which competencies should be improved. Evaluation is used to measure the level of competence of existing teachers and assess the strengths and competency gaps possessed by teachers.

The formulation of the competence of vocational education teachers in Europe carried out at *the European Bank for the Development of Modular Curriculum and Educational Technologies* explained that there are eight important things for a vocational teacher in Europe to have, namely: working together, developing the profession, learning desire, creating a learning environment, mastering ICT, foreign language, understand school administration, good personal and have organizational competence (Sakhieva, et al., 2015; Löfgren et al., 2023).

Competent vocational teachers in the 21st century are teachers who are literate in technology and able to master foreign languages. For this reason, the purpose of this research is to examine the factors that classify teacher competence, based on good and poor educator certificates.

1.1. Theoretical framework

1.1.1. Teacher competency

According to Law Number 14 of 2005 concerning Teachers and Lecturers, Article 1 paragraph 10, teacher competency is defined as a combination of knowledge, skills, and behaviors that a teacher must possess, master, and internalize in order to perform their duties. This regulation governs teacher competency in Indonesia. It was also underlined that the Republic of Indonesia's

Government Regulation Number 19 of 2017 about Teachers clarified that these competencies must be implemented and used by educators in the course of their professional responsibilities..

In the Regulation of the Minister of National Education Number 16 of 2007 concerning Academic Qualification Standards and Teacher Competency, the subject of teacher competency is described in detail. A teacher's pedagogical, professional, personal, and social competencies are among the four competencies listed in the regulations.

- 1) Pedagogical competence is the ability of a teacher to manage participant learning
- 2) the professional competence of a teacher is the broad and in-depth ability to master the subject matter being taught.
- 3) Personal competence is the ability of a stable personality, have a noble character, be wise and authoritative, and become a role model for students.
- 4) social competence is the ability to communicate and interact effectively and efficiently with teachers and students, fellow teachers, parents/guardians, and the community

1.1.2. Discriminant analysis

Discriminant analysis is a type of regression in which the dependent variable is categorical or non-metric. Finding characteristics that allow for group differentiation is the aim of discriminant analysis (Ghozali, 2016). The dependence approach, which involves the presence of dependent and independent variables, is a component of discriminant analysis, a multivariate technique. As a result, the data from the independent variable determines the results of some variables. According to Santoso (2002), one unique characteristic is that the independent data must be non-categorical, whereas the dependent variable data must be categorical. Discriminant analysis is used to determine whether the dependent variable differs between groups or categories. Variable differentiation, a linear combination of two or more independent variables, is a component of discriminant analysis that will be used to distinguish between group categories. The relative between-group variance and relative within-group variance can be maximized by assigning weights to each variable. The linear combination for the discrimination function needs to be differentiated in the form:

$$Y = b_0 + b_1 x_1 + b_2 x_2 \dots + b_n x_n \quad (1)$$

Where:

Y = discriminant value (score) and is the dependent variable.

x = the k-th variable (attribute) and is an independent variable.

b = discriminant coefficient/ weight of the k-th variable (attribute).

1.2. Purpose of the study

The purpose of discriminant analysis is to find out whether there are clear differences between groups or categories in the dependent variable. The purpose of this study is to examine the factors that classify the competence of 21st-century vocational teachers who are literate in technology and master foreign languages, based on good and less educator certificates.

2. METHODS AND MATERIALS

2.1. Participants

There is no determination of the ideal number of samples in Discriminant Analysis. Data analysis was performed using the Rstudio program. The sampling technique used is the purposive sampling technique. In this study, the sample was a teacher at an Automotive Engineering Vocational High School (SMK) in East Kalimantan. The following details the number of teachers who were sampled in this study:

Table 1
Data distribution

Area	Population	Sample
Samarinda	28	24
Really	8	7
Bontang	9	5
Balikpapan	13	10
Kutai Kartanegara	12	8
Total	70	54

2.2. Data collection tool

A questionnaire survey method was used in this study to collect data from participants. This methodology facilitated the methodical gathering of data on a number of topics pertaining to the research issue, such as teacher competencies, instructional strategies, and variables impacting arithmetic student accomplishment.

2.3. Data analysis

In discriminant analysis in general, the steps of the analysis process are conducting the multivariate normal test, covariance matrix similarity test, average vector similarity test, formation of discriminant function, significance test of the formed discriminant function, a test of the strength of discriminant function relationship and assessing discriminant validity.

3. RESULTS

3.1. Similarity test of variance-covariance

Matrix Calculations and data processing using the Rstudio program, the result is that the $p\text{-value} > \hat{y}$ value, so the data is homoscedasticity.

3.2. Significance test

Calculations and data processing using the Rstudio program, the results are as follows shown in table 2. The significance test is below.

Table 2
Significance test

Test Function (s)	Chi-Square	df	sig
1	22,22	1	0,000

3.3. Discriminant function

Calculations and data processing using the Rstudio program, the results are as follows shown in Table 3. Discriminant function below.

Table 3

Discriminant function below

	Function I
TIK	-0.3126729
Foreign language	-1.1181504
Length of work	-0.1189016

3.4. Classification

Calculations and data processing using the Rstudio program, the results are as follows shown in table 4 Classification Function Coefficient below.

Table 4

Classification Function Coefficient

	good	less
competen	0.8889	0.0185
no	0.0371	0.0556

3.5. Discriminant Validity Assessment

After the formation and classification are done, then it will be seen how big the results of the classification are correct, as shown in Table 5. Classification results are below.

Table 5

Classification results

		Predicted Group Membership		
competence		good	less	Total
Count	good	48	1	49
	less	2	3	5
`%	good	88,89%	1,84%	90,74%
	less	3,71%	5,56%	9,26%

4. DISCUSSION

Table 2. The Significance Test above, by looking at the results of a significant value of less than 0.05 (sig. <0.05), meaning that the variables studied can be used to identify differences between categories, it can be concluded that the variables studied have differences between groups.

Based on Table 3 above, the discriminant function is obtained as follows:

$$Y = -0.118 - 0.3126 X_1 - 1.118 X_2 \quad (2)$$

From Table 4 above, the discriminant function of Fisher where the distribution is based on the code groups is explained as follows:

For Teacher Competency in the LESS category:

$$LESS = 0.0185 X_1 + 0.0556 X_2$$

For Teacher Competency in the GOOD category:

$$\text{GOOD} = 0.8889 X1 + 0.0371 X2$$

So, by looking for the difference between Teacher Competency in the LESS and GOOD categories, we get the following:

$$Y = -0.8704 X1 + 0.0185 X2 \quad (3)$$

Table 5 above shows that in the initial data, 48 teachers belonged to the good category. While the teachers who initially entered into the less category will be as many as 3 people. The predictive accuracy of the discriminant model of 94% is classified correctly, so the accuracy of this model is considered high. Because the accuracy value is more than 50%. So, this discriminant model can be used to classify teachers who are competent or not.

5. CONCLUSION

The following is the conclusion obtained in this study, that there is a significant difference between teachers who have GOOD and LESS competence. This is evidenced in table 2. Significance Test. From the table, the value of Sig. 0.000 < 0.05, which means that there is an average difference between teachers who are competent and not based on the factors used.

The discriminant function model is formed based on the results of data processing in the study this, is: $Y = -0.118 - 0.3126 X1 - 1.118 X2$ The predictive accuracy of the discriminant model of 94% is classified correctly, so the accuracy of this model is considered high. Because the accuracy value is more than 50%. So, this discriminant model can be used to classify teachers who are competent or not.

Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval: The study adheres to the ethical guidelines for conducting research.

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