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ANALYSIS OF THE RELATIONSHIP BETWEEN LECTURERS' TEACHING METHOD FOR QUANTITATIVE COURSES AND STUDENTS' LEARNING MOTIVATION (Case Study: Industrial Engineering Department, Maranatha Christian University, Bandung-Indonesia)

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ABSTRACT

To improve the competitiveness of graduates in the workforce, one of the efforts to be made by the educational institution is to increase achievement (GPA) of graduates and accelerate the study period. Student motivation to learn during his education plays an important role in the success of achieving maximum accomplishment. This research conducted a study on the relationship between students' learning motivation and lecturer teaching method for quantitative courses. Data processing using Canonical Correlation Analysis and Regression Analysis to determine the factors of teaching methods that significantly influence students' learning motivation.

Generated from this study will be proposed how lecturers of quantitative courses should teach to increase student learning motivation for achieving highest accomplishment.

Keywords : motivation, teaching methods, Canonical Correlation Analysis, Regression Analysis

1. INTRODUCTION

1.1 Preliminary

The study program as part of the college has a responsibility to equip their students with science to prepare them for work in the community at the time. College graduates in general will plunge into the world of work, so that the course needs to ensure that its graduates have a fairly high competitiveness.

As a study program that combines social sciences and exact sciences, the courses taught in the industrial engineering department are dividing into qualitative and quantitative. Industrial Engineering Department of Maranatha Christian University (IED - MCU) observed that the graduation rate of students for the quantitative courses lower than qualitative courses, in addition to the proportion of students with the good score(A or B + or B) for the course quantitative also lower than qualitative courses . In connection with these problems, the research will focus on quantitative courses.

Student' graduation rates and student' scores greatly influenced by the students' learning motivation. Many internal and external factors which can affect students' learning motivation is socially, learning environment, family support, teaching method, lecture facilities, department support, and others.

This study focused on variables that can be controlled by IE-MCU, which is the way lecturer taught quantitative courses and its relation to student learning motivation.

1.2 Research Objectives

The purpose of this study as follows:

1 Knowing the strength of the relationship between lecturers' teaching method for quantitative courses with students' learning motivation.
2 Identifying variables of lecturers' teaching method for quantitative courses that have a strong relationship with students' learning motivation.
3 Identifying variables lecturers' teaching method for quantitative courses that were significantly related to student learning motivation.
4 Provide suggestions on how lecturers' method for quantitative courses, to increase student motivation to learn,

increase students' scores and graduation rates for quantitative courses.

2. THEORETICAL BACKGROUND

2.1 Motivation

According Klausemeier (1971), motivation has characteristics as follows: (Prayitno, 63-86)

- Students work on assignments given by lecturers.
- Students are responsible for the success of the study.
- Students have the self-control
- Students have the value system of good behavior

2.2 Phase of Teaching Quantitative Courses

Phase of teaching for quantitative subjects is also called Direct Instruction Model, which is a teaching approach that can assist students in learning basic skills and obtain information that can be taught step by step.

The fundamental thought of the direct teaching model is that students learn by observing selectively, remembering and imitating the behavior of the teacher, so imparting knowledge that is too complex should be avoided.

Direct teaching model has five (Arends, 304), which are:

1. Lecturers clarify and define the course objectives.
2. Lecturers demonstrate knowledge or skills acquired from the course.
3. Lecturers engage students in demonstration (practice) with guidance.
4. Lecturers provide advanced tasks and testing student understanding.
5. Lecturers check student understanding of related subjects and provide feedback.

2.3 Canonical Correlation Analysis (Supplement, 4-26)

Canonical correlation analysis is a useful and powerful technique for exploring the relationships among multiple independent and multiple dependent variables, particularly when the researcher has little a priori knowledge about relationship among the sets of variables.

Canonical correlation does not imply that independent and dependent variables share a causal relationship. Instead, it simply refers to how the two sets of multiple variables correlate. Canonical correlations develop a canonical function that maximizes the canonical correlation coefficient between the two canonical variates.

General form of canonical analysis formulation is:

$$Y_1+Y_2+Y_3 + \ldots +Y_n = X_1+X_2+X_3+ \ldots +X_n \quad (1)$$

Results obtained from a canonical analysis should suggest answers to questions concerning the number of ways in which the two sets of multiple variables are related, the strengths of the relationship and the nature of the relationship defined. The researcher then can select those variables (independent and dependent) that appear to be significantly related and run subsequent canonical correlations with the more significant variables remaining or perform individual regressions with these variables.

2.4 Linear Regression Analysis (Hair, 169-267

Regression analysis can be used to analyze relationship between a single dependent variable and independent variables. The objective is to use the independent variables whose values are known to predict the single dependent value.

General form of linear regression analysis formulation is:

$$Y = X_1+X_2+X_3+ \ldots +X_n \quad (2)$$

The regression variate must be interpreted by evaluating the estimated regression coefficients for their explanation of the dependent variable. The estimated regression coefficients represent both the type of relationship (positive or negative) and the strength of the relationship between independent and dependent variables in the regression variate. Independent variables with larger regression coefficients make a greater contribution to the predicted value.

For explanatory purposes, the regression coefficients become indicators of the relative impact and importance of the independent variables in their relationship with the dependent variables.

3. RESEARCH METHOD

3.1 Identification of Research Variables

This research is involving the independent variables and the dependent variable, which are:

- Dependent variable: students' learning motivation (Motivation Variable)
- Independent Variable: Lecturers' Teaching Method for Quantitative Courses.

Variables of Motivation and Lecturers' Teaching Method for Quantitative Courses derived from Hikmah Sianturi research (2013).

Motivation variables were developed from Klausemeier theory:

Motiv1 : Students work on assignments given by lecturers
Motiv2 : Students are responsible for the success of the study
Motiv3 : Students have the self-control
Motiv4 : Students have the value system of good behavior

Answer choices that are used to assess the Motivation Variable are:
1= Never
2 = Almost Never
3 = Sometimes
4 = Often
5 = Always

Lecturers' Teaching Method for Quantitative Courses developed from theory Richard Arrends:

Kuanti1 : Lecturer clarify and define the course objectives
Kuanti2 : Lecturers demonstrate the knowledge and skills acquired from the course.
Kuanti3 : Lecturer engage students in a demonstration (practice) with guidance.
Kuanti4 : Lecturers provide advanced tasks and testing student understanding.
Kuanti5 : Lecturer check student understanding of related subjects and provide feedback.

Answer choices that are used to assess Variable Lecturers' Teaching Method for Quantitative Courses is the percentage of lecturers who have appropriate teaching method, namely:
1 = 0-20%
2 = 21%-40%
3 = 41%-60%
4 = 61%-80%
5 = 81%-100%

3.2 Sample

Research carried out on 80 active students in the class of 2011 Industrial Engineering Department Maranatha Christian University Bandung. From 80 questionnaires distributed, only 62 questionnaires were returned and filled in correctly.

3.3 Canonical Correlation Analysis Method (Hair, 4-32)

Once the variables have been confirmed for accuracy with the classical assumption test, namely linearity, normality, homoscedasticity and multicollinearity, next step is to derive one or more canonical functions. Each function consists of a pair of variates (independent and dependent variables). The first function has the highest intercorrelation between the variates.

Criteria to decide which canonical functions should be interpreted:

- Level of statistical significance of the function, generally considered to be the minimum acceptable for interpretation is the 0.05 level, with F-statistics based on Rao's approximation.

  In addition to separate tests of each canonical function, we can use Wilks' lambda, Hotelling's trace, Pillai's trace and Roy's gcr.
- Magnitude of the canonical correlation. The size of the canonical correlations can use for practical significance. The decision usually based on the contribution of the findings to better understanding of the research problem being studied. Usually minimum acceptable for canonical correlation is 0.5. (Santoso, 270)
- Redundancy Index (RI). This index provides a summary measure of the ability of a set of independent variables to explain variation in the dependent variables (analogous to multiple regressions' R^2). The researcher must judge each canonical functions based on theoretical and practical significance to the research problem being investigated to determine whether the RI is sufficient to justify interpretation.

If those three criteria are acceptable, the researchers need to make interpretations of the results:

- Canonical Weights (standardized coefficients). The interpreting involves examining the sign and magnitude of the canonical weight. Variables with relatively larger weight contribute more to the variates, and vice versa. Variables whose weights have opposite signs exhibit an inverse relationship with each other, variables with same sign exhibit a direct relationship.
- Canonical loadings (structure correlations). Canonical loadings measure the simple linear correlation between an original variable in the dependent or independent set and the set's canonical variate. The larger the coefficient, the more important it is in deriving the canonical variate.

3.4 Linear Regression Analysis

Results of Canonical Correlation processing are continued with the analysis of the relationship between independent variables that significantly affect dependent variable.

By Linear Regression Analysis, independent variables that significantly affect dependent variables found.

3.5 Analysis and Proposal

Proposals given from the value of the canonical weights and canonical loadings of the independent variables. Proposals also based on the dependent and independent variables which are significantly related. Thus, the resulting proposal is a proposal about the way Lecturers' Teaching Method for Quantitative Courses, so the students' learning motivation can be increased.

4. RESULT AND DISCUSSION

Before processed using the method of Canonical Correlation Analysis, the data used must meet the test of this assumption has been confirmed for multivariate methods, namely linearity, normality, homoscedasticity and multicollinearity. The results of testing this assumption is variable Kuanti5 not processed further because it does not meet the assumption of normality.

4.1 Canonical Correlation Analysis

Variables are further processed by Canonical Correlation Analysis is:

- Dependent Variable: Motiv1, Motiv2, Motiv3 and Motiv4
- Independent Variables: Kuanti1, Kuanti2, Kuanti3 and Kuanti4.

To determine Canonical Function selected, used three criteria, namely:

- Level of statistical significance of the function, can be seen in Table 1. *Measures of Overall Model Fit for Canonical Correlation Analysis*. Function that can be used for further analysis is the Function with a probability value of the F-Statistics > 0.05. There are two functions that can be processed further, which are Function 1 and Function 2, which have significant relationship with the dependent and independent variables were examined.

  Additional tests performed using a significance value of Pillais trace, Hotelling's trace, Wilks' lambda, and Roy gcr, can be seen in *Table 2 Multivariate Test of Significance*. All method is based on the value of a probability value of < 0.05 so Canonical Correlation suitable method for this study.
- Magnitude of the canonical correlation. Table 3 and 4 show that the Canonical Correlation for First Function = √0.25595 = 0.50592 and Canonical Correlation for the Second Function = √0.20564 = 0.45348. For practical significance, usually the minimum acceptable for the canonical correlation is 0.5, so based on these criteria only Function 1 is selected.
- Redundancy Index (RI). RI values also can be seen in *Table 3* and *4 Calculation of the Redundancy Indices for the First* and *Second Canonical Function*. RI for Independent Variables in the Second Canonical Function is very low, indicating that the poor ability of a set of independent variables to explain variation in the dependent

variables. Based on the RI criteria, only Function 1 is selected.

From the three criteria used in determining the appropriate Canonical Function, Function 1 was selected as the best function so that for subsequent analyzes used only Function 1.

The results of that processing can be seen in *Table 5 Canonical Weights and loadings for the First Canonical Function*:

- Motiv2 and Kuanti2 contribute most to the variates because The Canonical Weights for the two variables are the largest. Motiv1 and Motiv3 have opposite sign, so the two dependent variables exhibit an inverse relationship with the other variables. However, the weights of Motiv1 and Motiv3 are small enough so that the effect of inverse relationship is not strong.
  Kuanti1, Kuanti2, Kuanti3 and Kuanti4 have the same sign, exhibit a direct relationship, which means the higher percentage of lecturers who have appropriate teaching method, will increase the students' learning motivation.
- All independent variables have a high correlation to the canonical variate, indicated by Canonical loading > 0.5, but the highest correlation owned by Kuanti2. The highest correlation of the dependent variable owned by Motiv2. The higher correlation means that the more important variable in shaping the canonical variate.

Canonical analysis formulation based on canonical loading in Table 5:

0.54929Kuanti1 + 0.95907Kuanti2+ 0.69303Kuanti3 + 0.55734Kuanti4
= 0.12751Motiv1 + 0.63482Motiv2 – 0.05696Motiv3 + 0.29543Motiv4

Based on the results of the Canonical Correlation Analysis Lecturers' Teaching Method for Quantitative Courses and Motivation can be seen in Picture 1.

4.2 Linear Regression Analysis

Results of Canonical Correlation processing are continued with the analysis of the relationship between independent variables that significantly affect dependent variable.

Table 6 Univariate Test for Dependent Variables showed that significantly influence was Motiv2, indicated by the significant value of F statistics > 0.05. Because there is only one dependent variable is significant, then the subsequent data processing using simple linear regression.

Table 7 Regression Analysis for Dependent Variable: Motiv2 used to find independent variables that significantly affect the Motiv2. By using the limit 0.05 for the significant value, it was found that the independent variables that significantly affect Motiv2 are Kuanti4.

So, the linear regression analysis formulation based on B value in Table 7:

Motiv2 = 0.272108Kuanti4

4.3 Proposed Strategy

Based on the results of Canonical Correlation Analysis, to improve student learning motivation suggested that:

- Lecturers give students a deeper understanding about the importance of responsibility to success in their study (Motiv2). As a teenager, student often not fully aware of their responsibilities.
- Lecturers of quantitative courses advised to be more actively demonstrating knowledge and skills acquired from the course, i.e. demonstrate the soft ware's application during class and providing examples of the formula used for the calculation. Thus students can make observations and then imitate the practice conducted by a lecturer (Kuanti2). Kuanti2 is a very important variable, shown by the high value of Canonical Canonical Weight and Canonical Loading.
- Lecturers reminded to regularly check students' understanding of related subjects (e.g. through assignments, quizzes, exams) and then provide feedback immediately to discuss assignments, quizzes or exams given (Kuanti4). Thus, students can immediately identify the weaknesses of their knowledge related subjects, and students' understanding can be deepened. This is a direct effect on students' motivation to be responsible for the success of the study (Motiv2).

5. CONCLUSION

The conclusions obtained from this study are:

- The result of the assumption of multivariate testing, it found that the independent variables Kuanti5 do not meet the assumptions of normality, so this variable cannot be processed further.
- Based on the criteria for the determination of Canonical Function 3, obtained only one function is selected, namely Function 1.
  Canonical weight independent variables showed that the higher percentage of lecturers, who have appropriate teaching method, will increase the students' learning motivation.
- The most important variable in shaping the canonical variate is Kuanti2 and Motiv2.
- Dependent variable that significantly influence canonical variate is Motiv2, and Motiv2 significantly affected by Kuanti4
- Proposed in IED - MCU for :
  - Provide insight to students about the importance of responsibility to success in their study
  - Encourage lecturers to more actively demonstrate practice to the students such as the application of software and providing examples of the formula used for the calculation.
  - Emphasis on the lecturers to routinely check for student understanding of related subjects and then provide immediate feedback, for example by discussing the assignments, quizzes and exam questions given.

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Table 1 Measures of Overall Model Fit for Canonical Correlation Analysis

Canonical Function	Canonical Correlation	Canonical R^2	F Statistics	Probability
1	0.50592	0.25595	2.44573	0.002
2	0.45347	0.20564	2.31964	0.019
3	0.28343	0.08033	1.76342	0.141
4	0.19412	0.03768	2.23203	0.141

Table 2 Multivariate Test of Significance

Statistics	Value	Approximate F Statistics	Probability
Pillais trace	0.57960	2.41473	0.002
Hotellings trace	0.72938	2.39326	0.003
Wilks' lambda	0.52308	2.44573	0.002
Roy's gcr	0.25595		

Table 3 Calculation of the Redundancy Indices for the First Canonical Function

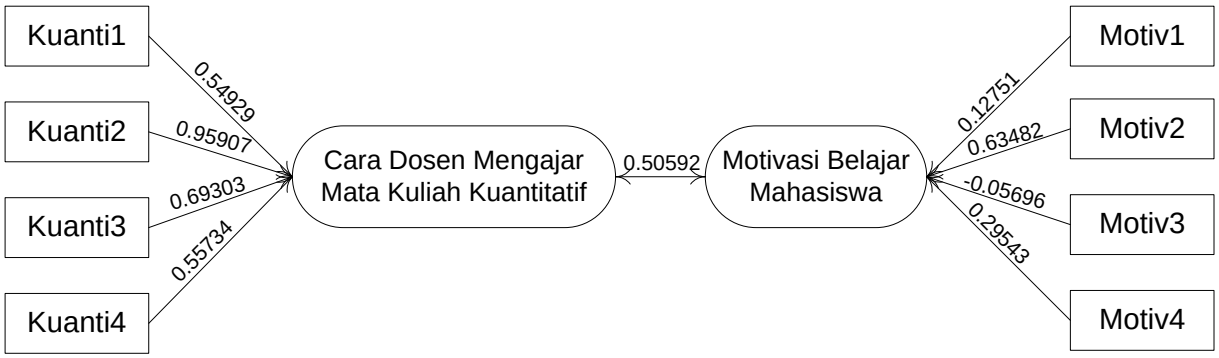
Variate/Variables	Canonical Loading	Canonical Loading Squared	Average Loading Squared	Canonical R^2	Redundancy Index
Dependent Variables					
Motiv1	0.12751	0.016259			
Motiv2	0.63482	0.402996			
Motiv3	-0.05696	0.003244			
Motiv4	0.29543	0.087279			
Dependent Variate		0.509779	0.127445	0.25595	0.032619
Independent Variables					
Kuanti1	0.54929	0.301720			
Kuanti2	0.95907	0.919815			
Kuanti3	0.69303	0.480291			
Kuanti4	0.55734	0.310628			
Independent Variate		2.012453	0.503113	0.25595	0.128772

Table 4 Calculation of the Redundancy Indices for the Second Canonical Function

Variate/Variables	Canonical Loading	Canonical Loading Squared	Average Loading Squared	Canonical R^2	Redundancy Index
Dependent Variables					
Motiv1	0.46308	0.21444309			
Motiv2	0.52512	0.27575101			
Motiv3	0.2309	0.05331481			
Motiv4	-0.50285	0.25285812			
Dependent Variate		0.79636703	0.1990918	0.20564	0.04094123
Independent Variables					
Kuanti1	-0.02288	0.00052349			
Kuanti2	0.08707	0.00758118			
Kuanti3	-0.48345	0.2337239			
Kuanti4	0.30051	0.09030626			
Independent Variate		0.33213484	0.0830337	0.20564	0.01707505

Table 5 Canonical Weights and Loadings for the First Canonical Function

	Canonical Weights	Canonical Loadings
Independent Variables		
Kuanti1	0.17790	0.54929
Kuanti2	0.75469	0.95907
Kuanti3	0.18419	0.69303
Kuanti4	0.09120	0.55734
Dependent Variables		
Motiv1	-0.42854	0.12751
Motiv2	1.32425	0.63482
Motiv3	-0.99078	-0.05696
Motiv4	0.53330	0.29543



Picture1 Canonical Relationship between
Lecturer Teaching Method for Quantitative Courses and Students' Learning Motivation

Table 6 Univariate Test for Dependent Variables

Variables	F Statistics	Sig. of F
Motiv1	1.76197	0.149
Motiv2	3.07283	0.023
Motiv3	0.84116	0.505
Motiv4	1.88519	0.125

Table 7 Regression Analysis for Dependent Variable: Motiv2

Independent Variables	B	t-value	Sig. of t
Kuanti1	0.029448	0.48750	0.628
Kuanti2	0.163679	1.55712	0.125
Kuanti3	-0.150697	-1.25815	0.213
Kuanti4	0.272108	2.40688	0.019