Structural Equation Modelling (SEM) In Predicting Student Performance Factors In Mathematics Education Department At Muhammadiyah University of Prof. DR. Hamka

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Structural Equation Modelling (SEM) In Predicting Student Performance Factors In Mathematics Education Department At Muhammadiyah University of Prof. DR. Hamka

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Abstract. The research was conducted at University Muhammadiyah of Prof. Dr. Hamka, Jakarta which involved three years academic level students (2012, 2014, 2015) at mathematics education department that have taken seven compulsory subjects. The students' performance consisted of mid test, final test and GPA meanwhile, the factors which influenced the students' achievement were gender and education background. This research study, there were seven variables which consisted of independent and dependent variables. Structural Equation Modelling was conducted to analyze the final model in predicting influenced factors of GPA. This research study used SmartPLS software to analyze contribution of each variables to the final outcome and dependent variable. The results of the study provide that gender was significantly influence their performance on their GPA. Education background were not directly influence their achievement in GPA but through mid test. The result study showed that final test was influenced by mid test score.

Introduction

McDill, E., 1989, Levin, H., (1986) B.A Chansarkar and A. Mishaeloudis (2001) [1], explained the effects of age, qualification distance from learning place etc. on student performance. The performance of students on the module is not affected by such factors as age, sex and place of residence but is associated with qualification in quantitative subjects. It is also found that those who live near the university perform better than other students. There are often different results by gender, as in Hoxby's K-12 results (2000); Sacerdote (2001) [2] finds that grades are higher when students have unusually academically strong room mates.

Other researchers contend that school characteristics can have a greater effect on student outcomes than would be expected based upon student background (Lee, Bryk, & Smith, 1993) [3]. But while the research in support of this contention does find significant effects for school characteristics, the magnitudes of these effects tend to be modest, far overshadowed by the effects of student background characteristics.

Related to students' performance, there are some factors which influence their performance. One of them is the common issue that the differences between male and female students in their performance in school, particularly in mathematics and science subject. Most people say that male tend to higher performance in the mathematics and science subject rather female. It is supported by

past research that using implicit measures with adults has shown that for women, the stronger the associations of (a) self with female and (b) math with male, the weaker the association of self with math (Nosek, Banaji, & Greenwald, 2002) [4]. The differences between men and women are almost in every line of life like in educational, social, political, and etc. Education background of the students before they enrolled to the university is give impact to students' achievement. Oftentimes, students take their field at University are not linier with their education background.

The other reason of the differences performance of the students is their performance in the previous semester which is showed in their GPA. This research study wants to investigate the influence of gender and education background of the students. The research was conducted in University Muhammadiyah of Prof. Dr. Hamka, Jakarta which involved three years level students (2012, 2014, 2015) that have taken seven compulsory subjects. The students' performance consisted of mid test, final test and GPA meanwhile, the factors which influenced the students' achievement were gender and education background.

2. Method

A sample size of 200 students were taken randomly from different level at University of Muhammadiyah Prof. Dr. Hamka, Jakarta, Indonesia. The students come from different year level (2012, 2014 and 2015) who taken compulsory subjects in Department of Mathematics Education. In this study, there are seven compulsory subjects, Number Theory, Abstract Algebra, Linier Algebra, Algorithm & Programming, Calculus of Differential, Calculus of Integral and Introduction to Basic Mathematics.

This research study, there were seven variables which consisted of independent and dependent variables. There were education background, gender and age as independent variables; mid test, final test, and GPA as dependent variable which is GPA as the final outcome. Education background variable is divided into three types, government school, independent school and religion school. In analyzing, it is created dummy for religion and private school while government school as a baseline. Mid test and Final test score come from seven compulsory mathematics subjects. This research study used SmartPLS software to analyze contribution of each variables to the final outcome and dependent variable. First, the hypothesis model was conducted as shown in Figure 1.

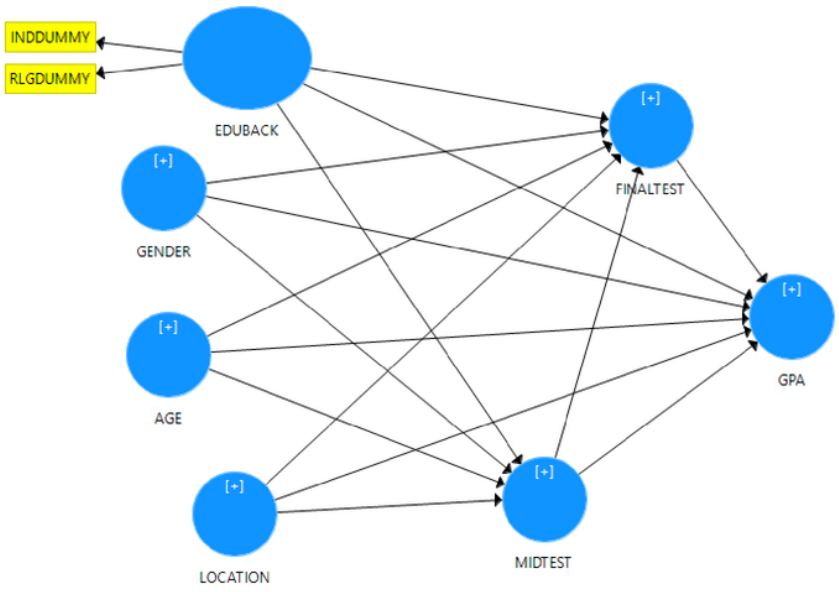

Figure 1. The Hypothesized Model of factors impacting the final outcome, GPA

Secondly, using SmartPLS, we run the analysis of the hypothesized model to confirm which variables are significant by checking p value, p value must be less than .05. The statistical significance of individual parameter estimates for the paths in the model, which are values computed by dividing the parameter estimates by their respective standard errors. This is referred to as a *t* or *z* value, and is typically compared to a tabled *t* or *z* value of 1.96 at the .05 level of significance (Schumaker, Randall E&Lomax, Richard G., 2016) [5].

3. Result and Discussion

Structural Equation Modelling was conducted to analyze the final model in predicting influenced factors of GPA at University Muhammadiyah of Prof. Dr. Hamka, Jakarta, Indonesia. Using SmartPls 3 software, the result can be seen in Table 1.

Table 1 p value of hypothesis model

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Education Background -> Final Test	-0.076	-0.08	0.059	1.281	0.201
Education Background -> GPA	-0.04	-0.037	0.047	0.854	0.394
Education Background -> Mid Test	-0.156	-0.159	0.069	2.271	0.024
Final Test -> GPA	0.427	0.43	0.055	7.826	0
Gender -> Final Test	-0.011	-0.007	0.054	0.198	0.843

Gender -> GPA	-0.271	-0.272	0.057	4.721	0
Gender -> Mid Test	-0.073	-0.068	0.066	1.094	0.275
Mid Test -> Final Test	0.635	0.637	0.044	14.557	0
Mid Test -> GPA	0.356	0.353	0.056	6.317	0

Table 1 shows that there are three paths which have significant for p value (<.05). Final test to GPA, Gender to GPA, Mid test to Final test and Mid test to GPA. The interpretation of the path coefficients shown in Table 2.

Table 2. Values of the path coefficients of the hypothesis model

Causal Relations	Path Coefficients
Education Background -> Final Test	1.399
Education Background -> GPA	0.990
Education Background -> Mid Test	2.349
Final Test -> GPA	7.101
Gender -> Final Test	0.513
Gender -> GPA	5.105
Gender -> Mid Test	1.511
Mid Test -> Final Test	14.574
Mid Test -> GPA	6.314

Table 2 shows that the highest path coefficient is path from mid test to final test. It indicates that the highest contribution (14.574) to Final test score is from Mid test. Path coefficient from gender to final test is the smallest (0.513) that can be interpreted gender does not give significant contribution to final test score. It can be concluded that there is no difference performance between male and female student in Final Test.

The result of hypothesis model analysis gives information that some variables are not significant for p value (<.05). Therefore, the variables which is not significant was deleted and run the analysis to confirm whether the rest of significant variables are still give significant value or not. The result of the second analysis is shown in Table 3.

Table 3 *p* value of second analysis

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Education Background -> Mid Test	-0.151	-0.162	0.066	2.276	0.023
Final Test-> GPA	0.432	0.432	0.056	7.754	0
Gender-> GPA	-0.268	-0.266	0.053	5.075	0
Mid Test -> Final Test	0.647	0.644	0.042	15.227	0
Mid Test -> GPA	0.359	0.361	0.058	6.212	0

Table 3 indicates that those path of variables are significant for p value which means that those model should be exist. The interpretation of the path coefficients for second analysis is shown in Table 4.

Table 4. Values of the path coefficients of the second analysis

Causal Relations	Path Coefficients
Education Background -> Mid Test	2.271
Final Test -> GPA	7.826
Gender -> GPA	4.721
Mid Test -> Final Test	14.557
Mid Test -> GPA	6.317

Table 4 illustrates that the highest value of path coefficient is still Mid test to Final test (14.557) which means that Final test is the most influenced by Final test score. The final model of this study is shown in Figure 2 and Table 5 shows the direct and indirect effect of the final outcome, GPA.

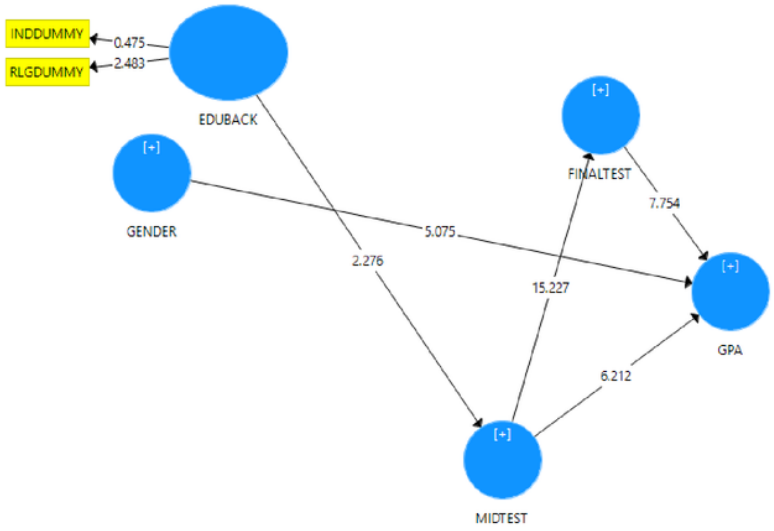

Figure 2. The Final Model of factors impacting the final outcome, GPA

Table 5 Direct, Indirect and Total effect of the variables

Outcome	Predictor(s)	Direct Effect	Indirect Effect	Total Effect
GPA	Gender	5.075		5.075
GPA	Final Test	7.754		7.754
GPA	Education Backgorund		14.139	282.866
	Mid Test	6.212		
	Final Test			
GPA	Education Background		268.727	

4. Conclusion

This research study investigated the factors that influence students' performance in mathematics department at University Muhammadiyah of Prof.Dr.Hamka, Jakarta. The results of the study provide that gender was significantly influence their performance on their GPA. Education background were not directly influence their achievement in GPA but through mid test. The result study showed that final test was influenced by mid test score. Finally, the policy makers and educationalists can find the benefit from this result study in developing their plans and strategies. Particularly for mathematics lecturers, they can evaluate and improve the strategies in teaching which can improve the students' performance at University.

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