

**A STATISTICAL MODEL TO IDENTIFY THE
INFLUENCE OF MATHEMATICS ON STUDENTS'
PERFORMANCE IN ENGINEERING PROGRAMS**

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Degree of Master of Philosophy

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Dissertation submitted in partial fulfillment of the requirements for the Degree of
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DECLARATION

“I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.”

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ABSTRACT

Mathematics plays a major role in higher education as it is particularly essential to develop the analytical thinking of students in a wide range of disciplines, especially, in engineering sciences. Therefore, exploring the student academic performance has been a crucial aspect of the educational research recently. In this study, the impact of mathematics in Level 1 and Level 2 on student engineering performance in Level 2 was investigated for seven engineering disciplines at the Faculty of Engineering, University of Moratuwa, Sri Lanka under two scenarios: (i) effect of mathematics in Level 1 and Level 2 simultaneously and (ii) effect of mathematics in Level 1 and Level 2 separately by using unadjusted and adjusted Canonical Correlation Analysis (CCA). A theoretical model underlying relationship between two measurements, mathematics performance and engineering performance was developed based on literature review. The Structural Equation Modeling based on Partial Least Squares (PLS-SEM) technique was used to validate the conceptual model and proposed an index to measure the mathematical influence on student engineering performance. The first canonical variate of engineering was found to be the best proxy indicator for the engineering performance. The impact of mathematics in semester 2 is significantly higher compared with the impact of mathematics in semester 1 on engineering performance in Level 2. The mathematics in Level 1 and Level 2 jointly influenced on the engineering performance in Level 2 irrespective of the engineering disciplines and the level of impact of mathematics varies among engineering disciplines. The individual effect of mathematics in Level 2 is significantly higher compared to the individual effect of mathematics in Level 1 on engineering performance in Level 2. The mathematics in Level 1 is still important in affecting students' engineering performance in Level 2 as there is a significant effect indirectly. The results obtained in this study can be utilized in curriculum development in mathematics modules.

Keywords: canonical correlation analysis; engineering mathematics; structural equation modeling; student academic performance

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LIST OF ABBREVIATIONS

Abbreviation	Description
ANOVA	Analysis of Variance
AVE	Average Variance Extracted
CCA	Canonical Correlation Analysis
CE	Civil Engineering
CH	Chemical and Process Engineering
CR	Composite Reliability
CS	Computer Science and Engineering
EE	Electrical Engineering
EN	Electronic and Telecommunication Engineering
ENG	Engineering
GPA	Grade Point Average
MAT	Mathematics
ME	Mechanical Engineering
MT	Material Science and Engineering
OLS	Ordinary Least Squares
PLS	Partial Least Squares
S1	First Semester
S2	Second Semester
S3	Third Semester
S4	Fourth Semester
SE	Standard Error
SEM	Structural Equation Modeling
VIF	Variance Inflation Factor