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Peter A. Gustafson
Western Michigan University, peter.gustafson@wmich.edu

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Does the Past Predict the Future? A Retrospective Statistical Analysis of Lower Level Grades and Program Outcomes at Graduation

Peter A. Gustafson PhD, Associate Professor

Background

Context: Mechanical and Aerospace Engineering is the largest department in the college of engineering and the second largest at WMU. It teaches several service courses used throughout the college of engineering programs.

Metrics and Gap in Knowledge: Failure rates in service courses have historically been high (28% of the 7376 attempts received below C since 2012). They are a significant barrier to advancement. `The impact of these courses on performance in higher level courses has not been conclusively established.`

Method

Assumption: Overall GPA at graduation is an indicator of performance in engineering education.

Hypothesis: Performance in early engineering courses predicts overall performance and program outcome.

Approach: A retrospective statistical analysis was completed. Data was harvested from COGNOS for MAE graduates between 2012-2017. Regression established the correlation between low level engineering courses and several measures of student success at graduation.

Selected Results

Overall: A few grades in selected low level courses are `an excellent predictor of overall GPA`.

Well Correlated Courses: Dynamics, Intro to Mechanical, Tech Communication (Writing), and Physics E&M are strong predictors of overall performance

Uncorrelated: Some courses are uncorrelated. Student performance in these courses is inconsistent with their overall performance in others courses. This is unexpected and requires additional investigation.

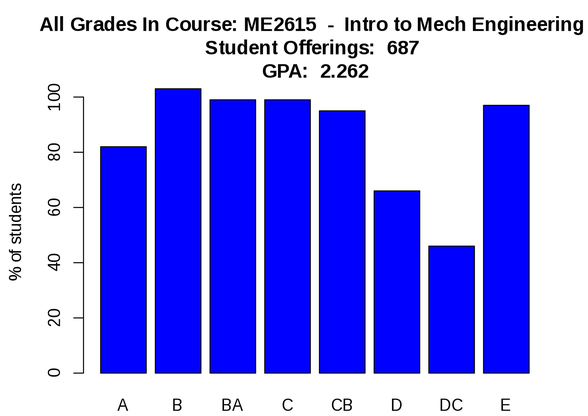
Discussion

Retention: Identification of the "key" courses may be useful for `early intervention which may improve student success rates`.

Research: Potentially implement `automatic admission` into accelerated MS programs at conclusion of sophomore year. This may `improve retention of top students and research output`.

Quality: Some courses have no correlation with overall GPA – this may indicate lack of long term learning. This is an opportunity to `improve program quality`.

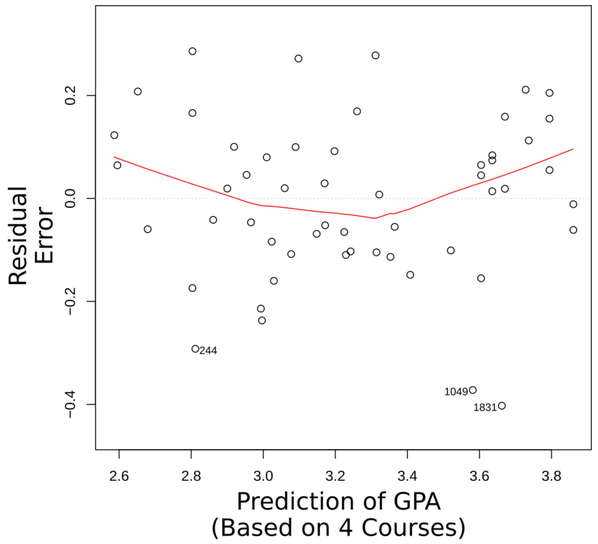
Example Grade Distribution:



Example Regression: Four Courses:

	Dependent variable:
	GPA
ME2615	0.188^{***} (0.036)
ME2580	0.246^{***} (0.041)
PHYS2070	0.148^{***} (0.039)
IEE1020	0.176^{***} (0.037)
Constant	0.836^{***} (0.152)
Observations	50
R^2	0.863
Adjusted R^2	0.850
Residual Std. Error	0.157 (df = 45)
F Statistic	70.682^{***} (df = 4; 45)
Note:	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Accurate Prediction: Four Courses:



Limitations:

Correlation does not imply causation.

Despite a sample of ~600 graduates, transfer credits, course selection, and curricular changes limit the number included in each regression.

Contact Information:
peter.gustafson@wmich.edu

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