

EAFIT University

Impact of Academic Support Strategies to Scholarship Students in Pre-calculus

Research Practise 1: Progress Presentation

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Our problem is to find the impact of the pre-calculus virtual course and the 20 hours of pre-calculus classes on the grade of the scholarship students in the subjects Mathematics 1 and Calculus 1, during these initiatives the students do three evaluations: self-diagnostic evaluation, academical training work in virtual course and follow-up evaluation.



These are the specific goals for this project:

- ▶ Process the data for the self-diagnostic evaluation, follow-up and the subjects notes Mathematics 1 and Calculus 1 for the semester 2015-1 and 2015-2.
- ▶ Find the correlation of data.
- ▶ Make a follow-up report to the three assessment strategies to support academic scholarship students and their possible effect on their academic performance.

Introduction

What is linear regression model?



- ▶ Linear regression model finds an estimate model that described a situation where there is a “ y ” variable that it dependent on some “ x ” variables, this model suppose the relationship between the variables is linear, and “ ϵ ” is the error.

Introduction

What is linear regression model?



- ▶ Linear regression model finds an estimate model that described a situation where there is a “y” variable that it dependent on some “x” variables, this model suppose the relationship between the variables is linear, and “ ϵ ” is the error.
- ▶ This is the model structure:

$$y_i = \beta_1 X_{i1} + \dots + \beta_k X_{ik} + \epsilon_i$$

where $i = 1, 2, \dots, T$ and T is the number of variables values that we have and k is the number of variables “x” that we have.



In this project linear regression model is used in the problem about the impact of virtual pre-calculus course and the 20 hours of contact sessions in the results of scholarship students.

The data processed were:

- ▶ Grade of self diagnostic evaluation.
- ▶ Grade of academical training work in virtual course.
- ▶ Grade of follow-up evaluation.
- ▶ Grade of the subject Mathematics 1 or Calculus 1.
- ▶ Number of students who took the subjects Mathematics 1 or Calculus 1.
- ▶ Number of students who passed the subjects Mathematics 1 or Calculus 1.



The variables used in the linear regression model are:

- ▶ **Grade of the subject Mathematics 1 or Calculus 1:**
Dependent variable " y_i ".
- ▶ **Grade of self diagnostic evaluation:** Independent variable " x_{i1} ".
- ▶ **Grade of academical training work in virtual course:**
Independent variable " x_{i2} ".
- ▶ **Grade of follow-up evaluation:** Independent variable " x_{i3} ".
where $i = 1, 2, \dots, T$, T is the number of students who took Mathematics 1 or Calculus 1 and in this case $k = 3$.

Linear Regression Model

Implementation



To have the linear regression model to our problem, we need to estimate the coefficients β_k , for that we used the following equation because with this I find the estimator of minimum variance (minimum error square).

$$\vec{\beta}_k = (\vec{X}' \vec{X})^{-1} \vec{X}' \vec{y}$$

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$\vec{\epsilon}$ has an uniform distribution with average=0 and variance = $\sigma^2 I_i$.
I can estimate σ^2 with the following equation:

$$\sigma^2 = \frac{\vec{y}' \vec{y} - \vec{\beta}' \vec{X}' \vec{y}}{T-k}$$



How do I know if I have a good estimation?

To know that I searched the determination coefficient R^2 . To find this coefficient I start with the equation $\epsilon = y_{real} - y_{estimate}$ so

$y_{real} = y_{estimate} + \epsilon$. After I find the total sum of squares of each variable.

$$R^2 = 1 - \frac{CES}{CTS} = \frac{\beta' \bar{x}' \bar{y} - T \bar{y}^2}{\bar{y}' \bar{y} - T \bar{y}^2}$$
$$0 \leq R^2 \leq 1$$

where CES =corrected error sum and CTS =corrected total sum.



Population are 488 scholarship students that start the university in the semester 2015-1. 287 students did the self-diagnostic evaluation, with an average grade of 62.4% and 147 students didn't pass the exam.

Self-diagnostic evaluation

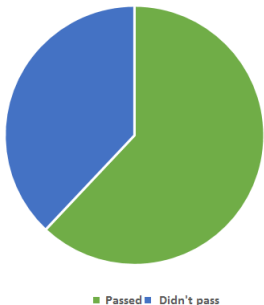


Figure: Students that passed and students that didn't pass self-diagnostic evaluation.



Number of students who did the academical training work in virtual course: 486.

Average grade of students who did the academical training work in virtual course: 68.2% and 140 students didn't pass the exam.

Academical training work in the virtual course

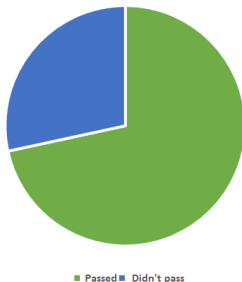


Figure: Students that passed and students that didn't pass academical training work in course.



Number of students who did the follow-up exam: 385.

Average grade of students who did the follow-up evaluation: 79.61%
and 29 students didn't pass the exam.

Follow-up evaluation

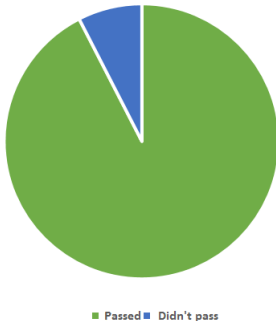


Figure: Students that passed and students that didn't pass follow-up evaluation.



Number of students who took the subject Mathematics 1 or Calculus 1: 257.

Average grade of students who took the subject Mathematics 1 or Calculus 1: 61.42% and 34 students didn't pass the subject.

Grade of Mathematics 1 or Calculus 1

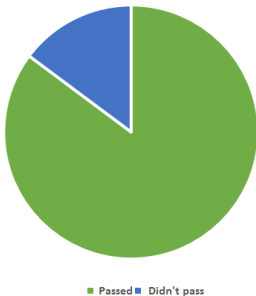


Figure: Students that passed and students that didn't pass Mathematics or Calculus 1.

A decorative graphic consisting of multiple overlapping, flowing lines in shades of light blue and white. The lines curve from the top left towards the bottom right, creating a sense of movement and depth. The background is a soft, light blue gradient.

Thanks for your attention!