Evaluating New Academic Supports for AB 705 with Matching

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In Fall 2018, Foothill College fully implemented AB 705 for math.

New academic supports were added:

- Corequisite for Precalculus
- Tutors for Statistics (except online-only sections)

Evaluation question:

Did the new academic supports improve student success?

Precalculus + Corequisite
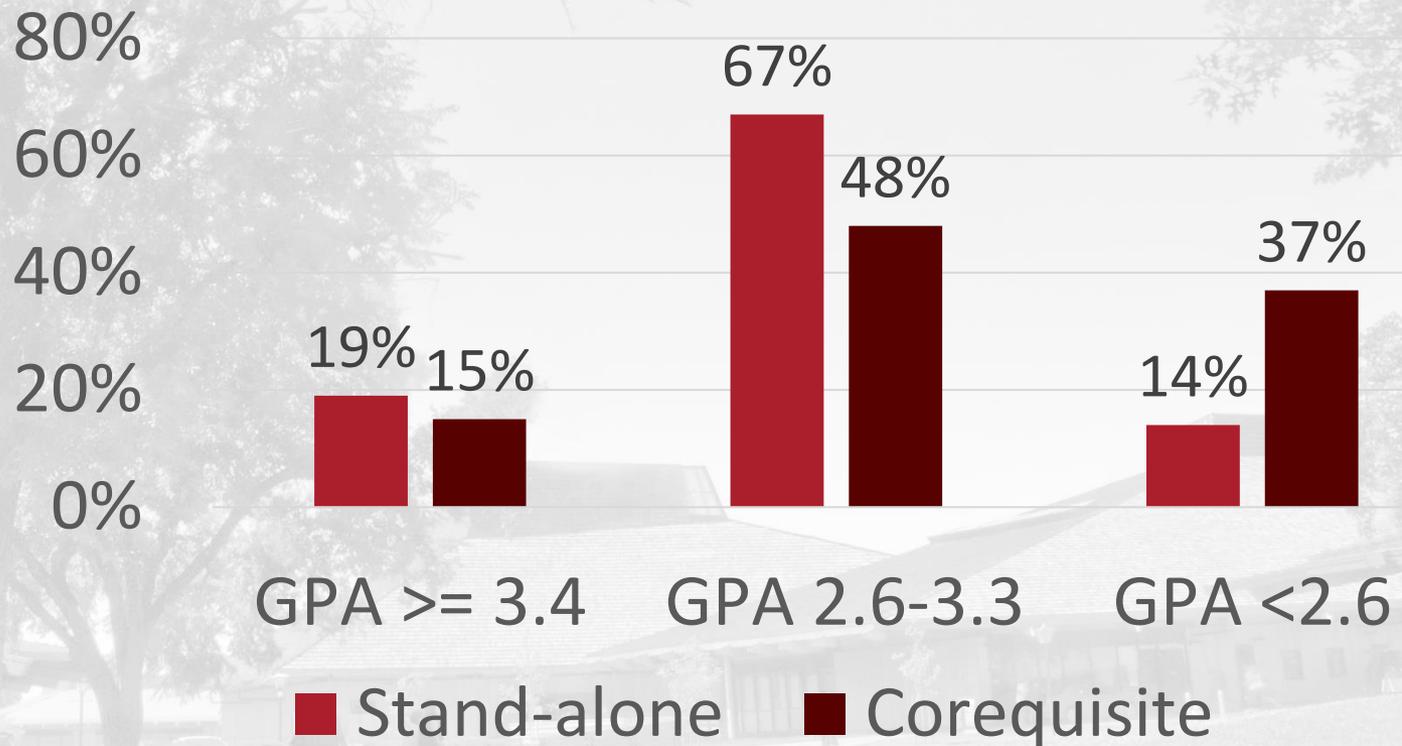
Open enrollment

Stand-alone Precalculus

Enrollment based on: HS GPA, HS coursework, passing prerequisite (algebra), Accuplacer, clearance

Straight comparison of success in corequisite sections to success in stand-alone sections?

HS GPA was higher in stand-alone sections than in corequisite sections:

HS GPA of Students Enrolled in Precalculus: Fall 2018

Bar chart with vertical axis from 0% to 80%:

Category	Stand-alone	Corequisite
GPA >= 3.4	19%	15%
GPA 2.6-3.3	67%	48%
GPA <2.6	14%	37%

Legend: ■ Stand-alone ■ Corequisite

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Problem:

- Difference in HS GPA between groups

- HS GPA is a strong predictor of course success

Approach:

- **Matched** students from corequisite sections with **similar students** from stand-alone sections.

"How would corequisite students have done if they had taken the stand-alone class?"

By matching students:

Control for matched variables, which leads to:

Better causal inferences

Matched on three variables:

- HS GPA

- Ethnicity (White or Asian vs. Not White or Asian)

- Gender (Male vs. Female)

Used exact matching (Mahalanobis Distance), which allows for analyses of these subgroups within the matched data.

Before matching:

	Stand-alone	Corequisite
HS GPA	2.96	2.75
% Female	37%	36%
% White or Asian	47%	29%

After matching:

	Stand-alone	Corequisite
HS GPA	2.78	2.75
% Female	36%	36%
% White or Asian	29%	29%

Logistic regression results:

- The corequisite was a significant predictor of course success (*p*< .01)

Success rates (Fall 2018 matched data):

HS GPA	Stand-alone	Corequisite
GPA >= 3.4	55%	77%
GPA 2.6 – 3.3	36%	64%
GPA < 2.6	41%	47%

What difference did the matching make?

Matched data (Precalculus):

HS GPA	Stand-alone	Corequisite
GPA >= 3.4	55%	77%
GPA 2.6 – 3.3	36%	64%
GPA < 2.6	41%	47%

Unmatched data (Precalculus):

HS GPA	Stand-alone	Corequisite
GPA >= 3.4	55%	77%
GPA 2.6 – 3.3	46%	65%
GPA < 2.6	40%	45%

What difference did the matching make for Statistics?

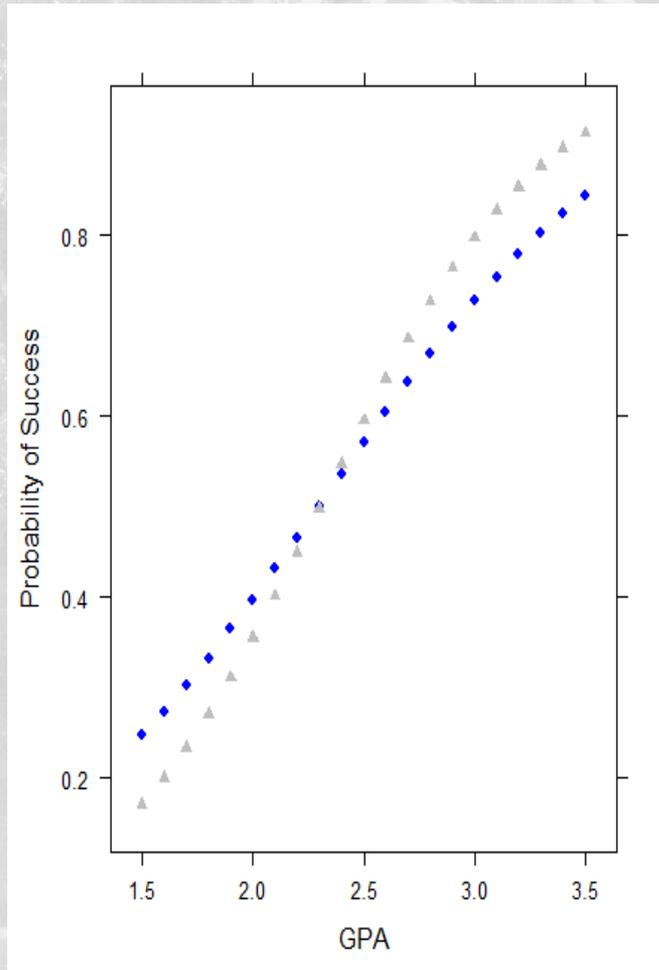(Same procedure, but did not match on gender)

Matched data (Statistics):

HS GPA	No tutors	Tutors
GPA >= 3.0	72%	79%
GPA 2.3 – 2.9	44%	48%
GPA < 2.3	44%	34%

Unmatched data (Statistics):

HS GPA	No tutors	Tutors
GPA >= 3.0	69%	78%
GPA 2.3 – 2.9	50%	48%
GPA < 2.3	29%	33%

Data excludes online-only sections

Math 10 predicted probability of success, regression of unmatched data
(Tutors: grey; No tutors: blue)

White or Asian

Not White or Asian
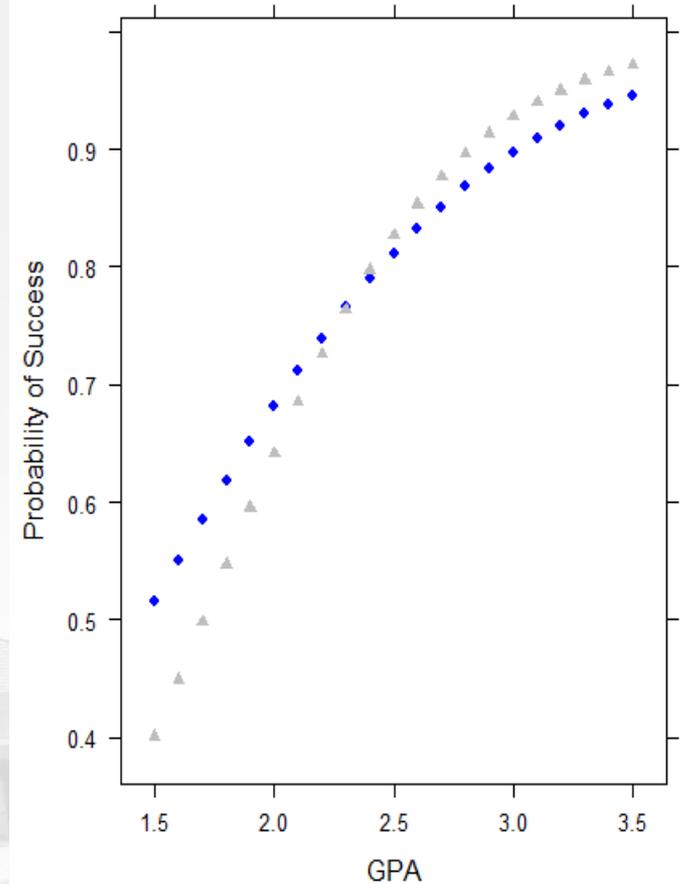
Advantages to matching:

- Simultaneously control for multiple variables.

- Can disaggregate by matched variables.

- Concept of matching is easy to understand; makes intuitive sense.

Caveats to matching:

- Does **NOT** include all students. Compares outcomes for the treatment group against outcomes for **similar students** in the control group.

- "Similar" is defined by the variables used during matching.

- Students cannot have missing data on any of the variables used for matching.

- May be difficult to find good matches with a large number of matching variables.

Matching software:

MatchIt package in R

Daniel E. Ho, Kosuke Imai, Gary King, Elizabeth A. Stuart (2011). MatchIt: Nonparametric Preprocessing for Parametric Causal Inference. Journal of Statistical Software, Vol. 42, No. 8, pp 1-28.

https://gking.harvard.edu/matchit