# Success of CSULB Students in Introductory Mathematics and Statistics Courses 

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## Success of CSULB Students in Introductory Mathematics and Statistics Courses

1. WHY INTRODUCTORY MATHEMATICS?
2. FIRST MATHEMATICS COURSE AND STUDENT SUCCESS
3. COURSE REDESIGN - IMPROVED PLACEMENT AND TARGETED STUDENT SUPPORT
4. CONCLUSIONS AND RECOMMENDATIONS

## DATA SETS

- IPEDS DATA ON 4Y AND 6Y GRADUATION RATES
- CSUCO DASHBOARD
- CSULB IR TABLEAU - FRESHMAN DATASET
- FALL 2017 FIRST TIME FRESHMAN ADMISSION SCORES, ESM DATA, F'17 MATH GRADES, DEMOGRAPHICS
- FALL 2016 FIRST TIME FRESHMAN ADMISSION SCORES, ESM DATA, F'16 MATH GRADES, RETENTION
- IR CONFIDENTIAL GRADE ANALYSIS REPORTS
- EAB

- Less than half of America's college students ever graduate.
- Seventy percent of students assigned to developmental courses never complete college.

There are two central reasons that students don't complete college, and they typically operate in tandem:

- inadequate preparation $\rightarrow$ non-completion of courses
- difficulty navigating college $\rightarrow$ not taking correct courses


There are two central reasons that students don't complete college (or take longer than necessary), and they typically operate in tandem:

- inadequate preparation $\rightarrow$ non-completion of courses
- difficulty navigating college $\rightarrow$ not taking correct courses

CSULB TOP 100 "NON-PASSING" COURSES

AY 16-17:
100 COURSES
86,882 ENROLLED STUDENTS
9,875 D, F, WU GRADES (11.4\%)

IN THIS GROUP

AY 16-17:
13 COURSES IN MATH
8,001 ENROLLED STUDENTS
1,763 D, F, WU GRADES (22.0\%)

2,462 COURSES
284,090 ENROLLED STUDENTS 19,403 D, F, WU GRADES (6.8\%)

|  | TOTAL\# <br> OF <br> GRADES | UNIV SHARE | D+F+WU <br> GRADES | D+W+WU <br> UNIV SHARE | NON <br> COMPLETION <br> RATE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CSULB | $\mathbf{2 8 4 0 9 0}$ | $100.00 \%$ | 19403 | $\mathbf{1 0 0 . 0 0 \%}$ | $\mathbf{6 . 8 3 \%}$ |
| CLA | 97633 | $34.37 \%$ | 7573 | $39.03 \%$ | $7.76 \%$ |
| CHHS | 52057 | $18.32 \%$ | 1972 | $10.16 \%$ | $3.79 \%$ |
| CNSM | 33780 | $11.89 \%$ | 4501 | $23.20 \%$ | $13.32 \%$ |
| COTA | 32143 | $11.31 \%$ | 1179 | $6.08 \%$ | $3.67 \%$ |
| COE | 28244 | $9.94 \%$ | 1735 | $8.94 \%$ | $6.14 \%$ |
| CBA | 27092 | $9.54 \%$ | 2109 | $10.87 \%$ | $7.78 \%$ |
| CED | 10012 | $3.52 \%$ | 255 | $1.31 \%$ | $2.55 \%$ |
| UNIV | 3129 | $1.10 \%$ | 79 | $0.41 \%$ | $2.52 \%$ |

## MATHEMATICS PATHWAYS



# MATHEMATICS PATHWAYS AND EQUITY 

```
\% URM \(\downarrow\)
MAPB \(\rightarrow\) MATH \(113 \rightarrow\) MATH \(122 \rightarrow\) MATH 123
```

GPA GAP ~ 0.2 IN EACH COURSE OF THE SEQUENCE

EQUITY GAPS IN EACH GRADE CATEGORY

CNSM DATA FELLOWS PRESENTATION MAY 11, 2018

## MATHEMATICS PATHWAYS




COURSE REDESIGN 2012-16

## PRE-BACCALAUREATE MATHEMATICS



## CSULB ENTERING FRESHMAN REMEDIATION NEEDS



## CSULB 6Y GRADUATION RATES



## CSULB $4 Y$ GRADUATION RATES



MATH 113 (COLLEGE ALGEBRA) DFW RATE


## CALCULUS REDESIGN

- ALEKS PPL is highly effective as a placement tool for STEM freshman
- Uniform homework and "benchmark" pre-tests administered through WebAssign and early interventions have improved completion
- Identification of at-risk students and mandatory intervention in the form of 75-minute weekly tutorials for the bottom $30 \%$ based on exam scores ( 4 midterm exams) taught by TAs or undergraduate students
- Freshman in calculus have high CSULB and STEM retention regardless of the grade

45\%


## MATHEMATICS PATHWAYS




COURSE REDESIGN 2012-16

## CSU FRESHMAN ADMISSIONS

CSU recommended placement for GE mathematics/quantitative reasoning courses based on multiple measures of academic proficiency (MMAP).

C S U L B EARLY START 2018 (5 weeks/1 unit with ALEKS PPL support)


# CSULB EARLY START 

JEN-MEI CHANG<br>ASSOCIATE PROFESSOR MATHEMATICS \& STATISTICS



## History of ESM at CSULB

- In June 2010, Executive Order 1048 established the Early Start Program (ESP).
- Students were required to have achieved proficiency in English and/or Mathematics on or before the end of their first year of enrollment at a CSU campus, as directed by Executive Order 665.
- Early Start Mathematics Program (ESM) at CSULB was implemented in the summer of 2012.
- 1-unit and 3-unit ESM classes were offered during 2012-2016, both lecturebased.
$>1$-unit: meets 3 hr/day for 1 week
$>3$-uint: meets 3 hr/day for 4 weeks


## 2017 Early Start Mathematics Program at CSULB

## 3-unit <br> (ESM 3, 21, 33)

1-unit
(ESM 1, 11)


## 1-unit ESM with ALEKS PPL in 2017

## Course Outcomes

CR: advance to the next level

- 30-45: beginning algebra $\rightarrow$ intermediate algebra
- 46 or higher intermediate algebra $\rightarrow$ GE math
(e.g., CR in ESM 11 advances to MATH 113 equivalents in fall)

RP: satisfied the CSU ESM requirement, but do not advance to the next level
(e.g., RP in ESM 11 means taking MAPB 11 in fall)

NC: did not complete CSU ESM requirement, fall

|  | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Week 1 | 7/10 | $7 / 11$ | $7 / 12$ | 7/13 | $7 / 14$ | 7/15 | 7/16 |
|  | Take the initial proctored assessment Work in ALEKS for a minimum of 5 hours between class meetings. Visit the tutoring center for additional support |  |  |  |  |  |  |
| Week 2 | $7 / 17$ | $7 / 18$ | $7 / 19$ | 7/20 | 7/21 | $7 / 22$ | 7/23 |
|  | Continue working in ALEKS; take <br> unproctored assessment for practice <br> Visit the tutoring center for additional support <br> Work in ALEKS for a minimum of 5 hours between class meetings. |  |  |  |  |  |  |
| Week 3 | 7/24 | $7 / 25$ | 7/26 | 7/27 | $7 / 28$ | 7129 | 7/30 |
|  | Continue working in ALEKS; take <br> unproctored assessment for practice <br> Visit the tutoring center for additional support |  |  |  |  |  |  |
| Week 4 | 7/31 | 8/1 | 8/2 | 8/3 | 8/4 | 8/5 | 8/6 |
|  | Take the final proctored assessment |  |  |  |  |  |  | admission is jeopardized

Historic Failure Rate


On target to "lose" 98.5\% or 318 students in 2017 while, in fact, 115 were lost. The new format w/PPL saved 203 students at least one semester of dev math at CSULB.



## Improving academic success

ESM is the key, data analysis is the vehicle


[^0]PPL Itans In toc order

## 2018 Early Start Mathematics Program at CSULB

|  |  | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Week 1 | 6/25 | 6/26 | $6 / 27$ | $6 / 28$ | 6/29 | 6.30 | 7/1 |
| Recommend | $\begin{gathered} 9: 00 \\ -\quad \\ 12: 00 \end{gathered}$ | 1. Go over syllabus with lead ins tructor <br> 2. Create ALEKS logins <br> 3. Take the ALEKS tour <br> 4. Take the initial proctored assessment (1) and work in ALEKS for 20 minutes <br> 5. Go over students' responsibilities/homework | LEARN in ALEKS a minimum of 20 topics AND for a minimum of 5 hours before the next class meeting |  |  |  |  |  |
| destination | Week2 | 7/2 | 73 | $7 / 4$ | $7 / 5$ | 76 | $7 / 7$ | 718 |
|  | 9:00-9:05 | Meet in lab to receive break-out (BO) schedule | LEARN in ALEKS a minium of 20 topics AND for a minimum of 5 hours AND take an unproctored assessment (2) before the nextclass meeting |  |  |  |  |  |
|  | 9:05-9:50 | Attend BO 1 |  |  |  |  |  |  |
| students to | 9:55-10:40 | Attend BO 2 |  |  |  |  |  |  |
|  | 10:45-11:30 | Attend BO 3 |  |  |  |  |  |  |
|  | 11:30-12:00 | Mork in ALEKS |  |  |  |  |  |  |
|  | Week 3 | 7/9 | 7/10 | 7/11 | 7/12 | 7/13 | 7/14 | 7/15 |
|  | 9:00-9:05 | Meet in lab to receive break-out (BO) schedule | LEARN in ALEKS a minium of 20 topics AND for a minimum of 5 hours AND take an unproctored assessment (3) before the next class meeting |  |  |  |  |  |
|  | 9:05-9:50 | Attend BO 1 |  |  |  |  |  |  |
|  | 9:55-10:40 | Attend BO 2 |  |  |  |  |  |  |
| ensure a | 10:45-11:30 | Attend BO 3 |  |  |  |  |  |  |
|  | 11:30-12:00 | Work in ALEKS |  |  |  |  |  |  |
|  | Week 4 | 7/16 | 7/17 | 7/18 | 7/19 | $7 / 20$ | 721 | $7 / 22$ |
| placement | 9:00-9:05 | Meet in lab to receive break-out (BO) schedule | LEARN in ALEKS a minium of 20 topics AND for a minimum of 5 hours before the next class meeting |  |  |  |  |  |
|  | 9:05-9:50 | Attend BO 1 |  |  |  |  |  |  |
|  | 9:55-10:40 | Attend BO 2 |  |  |  |  |  |  |
|  | 10:45-11:30 | Attend BO 3 |  |  |  |  |  |  |
|  | 11:30-12:00 | Work in ALEKS |  |  |  |  |  |  |
|  | Week5 | 7/23 | 7/24 | 7125 | $7 / 26$ | $7 / 27$ | 7128 | $7 / 29$ |
|  | 9:00-10:00 | Logistics and last minute ALEKS catch-up |  |  |  |  |  |  |
|  | $\begin{gathered} 10: 05 \\ -\quad \\ 12: 00 \end{gathered}$ | 1. Take the final proctored assessment (4) <br> 2. Discuss math placement outcome with individual students |  |  |  |  |  |  |

## CSULB ENTERING FRESHMAN REMEDIATION NEEDS



## MATH REMEDIATION AND MAJOR-SWITCHING PATTERNS

CONSIDER 2009, 2010, AND 2011 COHORTS OF FRESHMAN (JOINTLY) HOW MANY STUDENTS GRADUATED IN 6 YEARS IN EACH COLLEGE (TOTAL FROM 3 COHORTS)?

|  | BY ENTRY <br> COLLEGE | BY <br> GRADUA <br> TION <br> COLLEGE | NET DIFF |
| :---: | :---: | :---: | :---: |
| CBA | 756 | 1010 | 254 |
| CED | 199 | 206 | 7 |
| COE | 848 | 757 | -91 |
| CHHS | 1544 | 1808 | 264 |
| CLA | 1289 | 2635 | 1346 |
| CNSM | 1036 | 546 | -490 |
| COTA | 900 | 828 | -72 |
| UNDCL | 1218 | 0 | -1218 |
|  |  |  |  |
|  | 7790 | 7790 |  |

THERE ARE 7 POSSIBLE "GRADUATION COLLEGES": CBA, CED, COE, CHHS, CLA, CNSM, COTA

THERE ARE 8 POSSIBLE "FRESHMAN ENTRY COLLEGES": CBA, CED, COE, CHHS, CLA, CNSM, COTA, UNDCL

THERE ARE 8 POSSIBLE "FRESHMAN ENTRY COLLEGES": CBA, CED, COE, CHHS, CLA, CNSM, COTA, UNDCL

## WHICH "ENTRY COLLEGE - GRADUATION COLLEGE" COMBINATIONS PRODUCE MOST GRADUATES?

WHICH "ENTRY COLLEGE - GRADUATION COLLEGE" COMBINATIONS PRODUCE MOST GRADUATES?

| Graduation College | Entry College | NO REMED | ONLY ENGLISH | 1 MATH <br> AND 1 <br> ENGL | ONLY 1 MATH | 2 MATH <br> AND 1 <br> ENGL | 2 MATH ONLY | TOTAL |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CLA | CLA | 587 | 97 | 47 | 83 | 123 | 75 | 1012 |
| CHHS | CHHS | 511 | 202 | 59 | 52 | 115 | 29 | 968 |
| COTA | COTA | 432 | 84 | 21 | 37 | 42 | 22 | 638 |
| COE | COE | 397 | 159 | 15 | 3 | 15 |  | 589 |
| CLA | UNDCL | 215 | 96 | 54 | 36 | 86 | 26 | 513 |
| CBA | CBA | 266 | 151 | 25 | 13 | 16 | 5 | 476 |
| CLA | CHHS | 145 | 76 | 47 | 28 | 76 | 21 | 393 |
| CNSM | CNSM | 301 | 62 | 8 | 6 | 4 | 2 | 383 |
| CLA | CNSM | 157 | 51 | 32 | 16 | 37 | 4 | 297 |
| CHHS | UNDCL | 112 | 80 | 35 | 11 | 50 | 7 | 295 |
| CBA | UNDCL | 94 | 67 | 14 | 7 | 10 | 4 | 196 |
| CHHS | CNSM | 96 | 55 | 20 | 6 | 13 | 6 | 196 |
| CLA | CBA | 62 | 30 | 13 | 7 | 28 | 5 | 145 |
| CHHS | CLA | 61 | 18 | 11 | 5 | 37 | 5 | 137 |
| CLA | COTA | 79 | 18 | 12 | 8 | 15 | 5 | 137 |
| CED | CED | 70 | 22 | 8 | 9 | 20 | 3 | 132 |
| CLA | COE | 56 | 20 | 6 | 4 | 9 | 2 | 97 |
| CHHS | CBA | 29 | 23 | 14 | 3 | 18 | 3 | 90 |
| CBA | CNSM | 46 | 20 | 7 | 4 | 4 | 3 | 84 |
| CBA | CHHS | 42 | 26 | 5 | 4 | 2 | 1 | 80 |

WHICH "ENTRY COLLEGE - GRADUATION COLLEGE" COMBINATIONS PRODUCE MOST GRADUATES WHO STARTED IN MATH REMEDIATION?

| Graduation College | Entry College | NO REMED | ONLY ENGLISH | 1 MATH <br> AND 1 <br> ENGL | ONLY 1 MATH | 2 MATH <br> AND 1 <br> ENGL | 2 MATH ONLY | TOTAL | 1 OR 2 REMEDIAL MATH | $2$ <br> REMEDIAL <br> MATH |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CLA | CLA | 587 | 97 | 47 | 83 | 123 | 75 | 1012 | 328 | 198 |
| CHHS | CHHS | 511 | 202 | 59 | 52 | 115 | 29 | 968 | 255 | 144 |
| CLA | UNDCL | 215 | 96 | 54 | 36 | 86 | 26 | 513 | 202 | 112 |
| CLA | CHHS | 145 | 76 | 47 | 28 | 76 | 21 | 393 | 172 | 97 |
| COTA | COTA | 432 | 84 | 21 | 37 | 42 | 22 | 638 | 122 | 64 |
| CHHS | UNDCL | 112 | 80 | 35 | 11 | 50 | 7 | 295 | 103 | 57 |
| CLA | CNSM | 157 | 51 | 32 | 16 | 37 | 4 | 297 | 89 | 41 |
| CBA | CBA | 266 | 151 | 25 | 13 | 16 | 5 | 476 | 59 | 21 |
| CHHS | CLA | 61 | 18 | 11 | 5 | 37 | 5 | 137 | 58 | 42 |
| CLA | CBA | 62 | 30 | 13 | 7 | 28 | 5 | 145 | 53 | 33 |
| CHHS | CNSM | 96 | 55 | 20 | 6 | 13 | 6 | 196 | 45 | 19 |
| CED | CED | 70 | 22 | 8 | 9 | 20 | 3 | 132 | 40 | 23 |
| CLA | COTA | 79 | 18 | 12 | 8 | 15 | 5 | 137 | 40 | 20 |
| CHHS | CBA | 29 | 23 | 14 | 3 | 18 | 3 | 90 | 38 | 21 |

## WHICH "ENTRY COLLEGE - GRADUATION COLLEGE" COMBINATIONS PRODUCE LEAST GRADUATES WHO STARTED IN MATH REMEDIATION?

| Graduation College | Entry College | NO REMED | ONLY ENGLISH | 1 MATH <br> AND 1 <br> ENGL | ONLY 1 <br> MATH | 2 MATH <br> AND 1 <br> ENGL | $\begin{aligned} & 2 \text { MATH } \\ & \text { ONLY } \end{aligned}$ | TOTAL | 1OR 2 <br> REMEDIAL <br> MATH | 2 <br> REMEDIAL MATH | 1 OR 2 <br> REMEDIA <br> L MATH <br> \% | 2 <br> REMEDIAL MATH \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| COE | CNSM | 35 | 7 |  |  |  |  | 42 | 0 | 0 | 0.00\% | 0.00\% |
| CNSM | CLA | 14 | 4 |  |  |  |  | 18 | 0 | 0 | 0.00\% | 0.00\% |
| COE | CLA | 10 | 3 |  | 0 |  |  | 13 | 0 | 0 | 0.00\% | 0.00\% |
| CNSM | COTA | 9 | 2 |  |  |  |  | 11 | 0 | 0 | 0.00\% | 0.00\% |
| COE | CHHS | 5 | 5 | 0 |  |  |  | 10 | 0 | 0 | 0.00\% | 0.00\% |
| CNSM | CBA | 5 | 3 |  |  |  |  | 8 | 0 | 0 | 0.00\% | 0.00\% |
| CED | CBA |  | 3 |  |  |  |  | 3 | 0 | 0 | 0.00\% | 0.00\% |
| CNSM | CED | 1 |  |  |  |  |  | 1 | 0 | 0 | 0.00\% | 0.00\% |
| CNSM | COE | 18 | 5 | 1 |  |  |  | 24 | 1 | 0 | 4.17\% | 0.00\% |
| CNSM | CNSM | 301 | 62 | 8 | 6 | 4 | 2 | 383 | 20 | 6 | 5.22\% | 1.57\% |
| COE | COE | 397 | 159 | 15 | 3 | 15 |  | 589 | 33 | 15 | 5.60\% | 2.55\% |
| COTA | CBA | 8 | 4 |  |  | 1 |  | 13 | 1 | 1 | 7.69\% | 7.69\% |
| CNSM | CHHS | 33 | 12 | 4 |  | 1 |  | 50 | 5 | 1 | 10.00\% | 2.00\% |
| COE | UNDCL | 45 | 17 | 5 | 0 | 2 |  | 69 | 7 | 2 | 10.14\% | 2.90\% |
| CBA | CLA | 39 | 16 | 3 | 2 | 2 |  | 62 | 7 | 2 | 11.29\% | 3.23\% |
| CBA | CBA | 266 | 151 | 25 | 13 | 16 | 5 | 476 | 59 | 21 | 12.39\% | 4.41\% |
| COE | CBA | 12 | 6 | 2 |  | 1 |  | 21 | 3 | 1 | 14.29\% | 4.76\% |
| CED | CNSM | 9 | 3 | 1 |  |  | 1 | 14 | 2 | 1 | 14.29\% | 7.14\% |
| CBA | CHHS | 42 | 26 | 5 | 4 | 2 | 1 | 80 | 12 | 3 | 15.00\% | 3.75\% |

## 2009-11 FTF WHO STARTED IN REMEDIAL MATHEMATICS AND GRADUATED IN 6 YEARS BASED ON THE COLLEGE OF ORIGIN

|  | \# OF REMEDIAL FTF <br> WHO GRADUATED | \# OF REMEDIAL FTF <br> WHO SWITCHED |
| :--- | :---: | :---: |
| CNSM | 20 | 157 |
| COE | 33 | 57 |
| CBA | 59 | 95 |
| CED | 40 | 32 |
| CHHS | 255 | 202 |
| CLA | 328 | 74 |

## 2013 FIRST TIME FRESHMAN WHO GRADUATED IN 4 YEARS (BY COLLEGE OF GRADUATION)

|  | Null | CBA | CED | COE | CHHS | CLA | CNSM | COTA | TOTAL GRADUATED | FTF COHORT | 4Y RATE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| NO REMEDIATION NEEDED | 111 | 69 | 12 | 91 | 192 | 281 | 38 | 93 | 887 | 3054 | 29.04\% |
| ONE MATH AND ONE ENGLISH REMEDIATION NEEDED | 8 | 5 | 0 | 3 | 2 | 6 | 0 | 0 | 24 | 191 | 12.57\% |
| ONLY ENGLISH REMEDIATION CLASS NEEDED | 21 | 22 | 1 | 17 | 11 | 24 | 1 | 5 | 102 | 550 | 18.55\% |
| ONLY ONE MATH REMEDIATION CLASS NEEDED | 11 | 3 | 0 | 0 | 5 | 25 | 0 | 5 | 49 | 228 | 21.49\% |
| TWO MATH AND ONE ENGLISH REMEDIATION NEEDED | 8 | 7 | 1 | 12 | 5 | 5 | 0 | 3 | 41 | 241 | 17.01\% |
| TWO MATH REMEDIATION CLASSES NEEDED | 4 | 0 | 0 | 0 | 1 | 4 | 0 | 3 | 12 | 79 | 15.19\% |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | TOTAL | 1115 | 4343 | 25.67\% |
|  |  |  |  |  |  | MATH REM TOTAL |  |  | 126 | 739 | 17.05\% |

## CSU FRESHMAN ADMISSIONS

CSU recommended placement for GE mathematics/quantitative reasoning courses based on multiple measures of academic proficiency (MMAP).

C S U L B EARLY START 2018 (5 weeks/1 unit with ALEKS PPL support)


# Can we predict whether a student can pass Math113 in the first fall semester using high school GPA and math SAT? 

TIANNI ZHOU
ASSOCIATE PROFESSOR MATHEMATICS \& STATISTICS


## FALL 2017 FRESHMAN IN CACLULUS PATHWAY




High School GPA

FALL 2017 FRESHMAN IN ALGEBRA


## Logistic Regression Model <br> $>$ Bina ry outc ome is common in research:

- Pass/fail
- Graduate in 4 years (Yes/No)
- Dead / Alive
- Hospitalisation (Yes/ No)
- Met target e.g. total cholesterol $<5.0 \mathrm{mmol} / \mathrm{I}$ (Yes/ No)
$>$ Outcome Variable Y, takes on a value of either 1 or 0
$\rightarrow$ We predict the probability of an outc ome occuring

$$
p: \quad P(Y=1)
$$

> Use explanatory variablesto predict the probability of an outcome

- Example: use high school GPA and math SATscores to predict the probability of students passing Math 113 (Pre-calc ulus Algebra)
- Logistic model is used to estimate the probability of a binary response based on one or more explanatory (or independent) variables.

How do we formulate relationship between probability of an outcome and explanatory variables?


$$
(-\infty, \infty)
$$

Odds of the ith student pass Math 113

Solve for $p_{i}$, we have

$$
p_{i}=\frac{e^{\left(\beta_{0}+\beta_{1} * G P A_{i}+\beta_{2} * S A T_{i}\right)}}{1+e^{\left(\beta_{0}+\beta_{1} * G P A_{i}+\beta_{2} * S A T_{i}\right)}}
$$

The estimated logistic regression model based on Fall 2016 data is

$$
\operatorname{logit}\left(\widehat{p_{i}}\right)=-10.544+2.08 * G P A_{i}+0.0077 * S A T_{i}
$$

OR

$$
\widehat{p}_{i}=\frac{e^{\left(-10.544+2.08 * G P A_{i}+0.0077 * S A T_{i}\right)}}{1+e^{\left(-10.544+2.08 * G P A_{i}+0.0077 * S A T_{i}\right)}}
$$

-Build the model based on Fall 2016 data
-Apply the model to a new data set, Fall 2017 data
-Make prediction of each student who took the class in Fall 2017

## Case Summaries

| High GPA | Math SAT | Pass Math 113 in Fall <br> 2017 (actual Outcome) | Predicted Probability of <br> pass Math 113 in Fall <br> 2017 | Predicted <br> Outcome |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{1}$ | 3.30 | 560 | Fail | Pass |  |
| $\mathbf{2}$ | 3.12 | 590 | Pass | Pass |  |
| $\mathbf{3}$ | 3.55 | 630 | Pass | 0.656 | Dangerously <br> misclassified |
| $\mathbf{4}$ | 2.84 | 540 | Pass | 0.622 | Pass |
| $\mathbf{5}$ | 4.03 | 570 | Pass | 0.385 | Fail |

$>$ Sensitivity: measures the proportion of positives that are correctly identified as such
$>$ Specificity: measures the proportion of negatives that are correctly identified as such
actual
outcome

|  | Cut-point=0.65 | fail | pass |
| :--- | :--- | :--- | :--- |
| predicted | fail | 117 | 96 |
| outcome | pass | 72 | 307 |

$>$ Sensitivity (true positives) : 307/(96+307) $=0.762$
$>$ Specificity (true negatives) : 117/(117+72)=0.619
$>1$-sensitivity (false negatives): $96 /(96+307)=0.238$
$>1$-specificity(false positive): 72/(117+72)=0.381


Predicted probability of passing Math 113 as a function of math SAT and different categories of high school GPA


FALL 2016 FRESHMAN IN MAPB 11 - COLLEGE RETENTION AS OF MARCH 2018

|  | FALL 2016 COLLEGE |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| S'18 COLLEGE | UNDCL | CBA | COE | CNSM |
| CBA | 7 | 50 | 0 | 3 |
| CED | 3 | 2 | 0 | 0 |
| COE | 0 | 0 | 2 | 0 |
| CHHS | 19 | 5 | 1 | 8 |
| CNSM | 2 | 1 | 0 | 9 |
| CLA | 13 | 5 | 1 | 3 |
| COTA | 2 | 1 | 1 | 1 |
| UNDCL | 49 | 2 | 6 | 3 |
| NOT RETAINED | 33 | 31 | 8 | 18 |
|  |  |  |  |  |
| TOTAL | 128 | 97 | 19 | 45 |
| CSULB RET | $74.22 \%$ | $68.04 \%$ | $57.89 \%$ | $60.00 \%$ |

## FALL 2016 CNSM FRESHMAN IN MATH 113 AND CALCULUS - COLLEGE RETENTION AS OF MARCH 2018

|  | FALL 2016 MATH 113 GRADE |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| S'18 COLLEGE | A | B | C | D-W |
| CBA | 1 | 2 | 2 | 0 |
| CED | 0 | 1 | 4 | 1 |
| COE | 1 | 1 | 2 | 0 |
| CHHS | 3 | 11 | 8 | 3 |
| CLA | 0 | 4 | 3 | 5 |
| CNSM | 17 | 26 | 16 | 3 |
| COTA | 0 | 1 | 3 | 0 |
| UNDCL | $\mathbf{1}$ | 5 | 3 | 2 |
| NOT RETAINED | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{7}$ | $\mathbf{2 2}$ |


|  | FALL 2016 MATH CALCULUS GRADE |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| S'18 COLLEGE | A | B | C | D-W |
| CBA | 1 | 4 | 2 | 0 |
| CED | 0 | 0 | 0 | 1 |
| COE | 7 | 2 | 4 | 1 |
| CHHS | 5 | 9 | 4 | 6 |
| CLA | 2 | 3 | 1 | 1 |
| CNSM | 42 | 30 | 29 | 10 |
| COTA | 0 | 1 | 0 | 1 |
| UNDCL | 0 | 1 | 3 | 1 |
| NOT RETAINED | $\mathbf{1}$ | 3 | $\mathbf{2}$ | 5 |


| TOTAL | 24 | 53 | 48 | 36 |
| :---: | :---: | :---: | :---: | :---: |
| CSULB RET | $95.83 \%$ | $96.23 \%$ | $85.42 \%$ | $38.89 \%$ |
| CNSM RET | $70.83 \%$ | $49.06 \%$ | $33.33 \%$ | $8.33 \%$ |


|  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| TOTAL | 58 | 53 | 45 | 26 |
| CSULB RET | $98.28 \%$ | $94.34 \%$ | $95.56 \%$ | $80.77 \%$ |
| CNSM RET | $72.41 \%$ | $56.60 \%$ | $64.44 \%$ | $38.46 \%$ |

## SUMMARY AND RECOMMENDATIONS



COURSE REDESIGN 2012-16

- EARLY START COMBINED WITH ADAPTIVE LEARNING IS VERY EFFECTIVE IN IMPROVING STUDENTS' PREPARATION AND PLACEMENT
- STUDENTS WHO START MATH SEQUENCE IN MAPB (PARTICULALRY STEM MAJORS) ARE AT INCREASED RISK FOR ATTRITION OR GRADUATING LATE
- FIRST MATH FRESHMAN COURSE PREDICTS MAJOR-SWITCHING PATTERNS (MAPB VS 113 VS CALCULUS)
- HS GPA AND SAT COMBINATION CORRELATES WITH FRESHMAN SUCCESS IN ALGEBRA
- ALEKS PPL PLACEMENT AND TARGETED SUPPORT IMPROVE STUDENT SUCCESS IN CALCULUS


## ACKNOWLEDGEMENTS

| GE B2 REDESIGN COMMITTEE |  |  |  |
| :--- | :--- | :--- | :--- |
| Name | Department | Title | Role |
| Annabelle Cariaga | EOP - Retention | Associate Director | EOP Liaison |
| Carlos Ayon | College Assistance <br> Migrant Program | Recruiter | CAMP Liaison |
| Dr. Babette Benken | Math \& Stat | Professor | LBCP Liaison/TA TRAINING |
| Dr. Bill Pedersen | Psychology | Professor | PSY 110 |
| Dr. David Sanfilippo | Disabled Students <br> Services | Director | DSS Liaison |
| Dr. Florence Newberger | Math \& Stat | Professor | Algebra/Business Calc |
| Dr. Isabella Lanza | Human Dev | Assistant Professor | HDEV 190 |
| Dr. Jen-Mei Chang | Math \& Stat | Associate Professor | QR Course |
| Dr. Josh Chesler | Math \& Stat | Associate Professor | MTED 110 / QR Course |
| Dr. Kagba Suaray | Math \& Stat | Professor | STAT 108 |
| Dr. Kris Slowinski | CNSM | Associate Dean | COORDINATION/COMMUNICATION |
| Dr. Nancy Martin | Sociology | Assistant Professor | SOC 170 |
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[^0]:    LONG BEACH SATVEESSTy

