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# Quantitative Leap! Webinar 3: High School Math Course-Taking and College Readiness

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With Support from the College Futures & James Irvine Foundations



# The Quantitative Leap Series

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- Webinar 1 – A Gateway to College: Rethinking Postsecondary Mathematics
- Webinar 2 – Improving the Targeting of Treatment: Emerging Research on Postsecondary Math Placement Policies

TODAY: High School Math Course-Taking and College Readiness



# Background

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- Impact of rigorous coursework – well-documented
- Effects of requiring more rigor – under debate
- Profound implications for policies:
  - High school graduation
  - College admissions
  - College readiness (and how it is measured)



# STATUS QUO: Policies

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## High school graduation:

- 18 states require 4 years of math
- 24 states require 3 years of math
- 5 states require 2 years of math (e.g. California)

## California

High school graduation: 2 years of math (incl. Algebra 1)

UC/CSU admission: 3 years of math (incl. Algebra 2)



# STATUS QUO: Patterns in California

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Key Measures:

Four years of mathematics? Completion of Algebra 2?

UC applicants	93% took four years of math
CSU freshmen	70% took four years of math
CCC students	54% completed Algebra 2
CA high school graduates	70% took math in senior year 44% completed Algebra 2



# Today's Presenters

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Pamela Burdman  
Fellow, The Opportunity Institute



Louise Jaffe  
Trustee, Santa Monica College



Sonya Sedivy  
Associate Scientist,  
University of Wisconsin-Madison



David Barsky  
Associate Professor of Mathematics,  
California State University-San Marcos



Julian Betts  
Professor of Economics,  
University of California-San Diego

*Send us your questions during the presentation!*

# The Effect of Senior Year on College Placement

Sonya Sedivy, Associate Scientist, University of Wisconsin Center for Placement Testing



# Purpose of the Study

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Investigate high school preparedness and placement into college mathematics courses.

1. Do students who complete math during their senior year of high school score higher on the UW System math placement test than students who do not take math their senior year of high school?
2. If there is an observed difference in average math placement test scores for these two groups, does the difference in scores result in different placement levels?
3. Do math skills regress for students who did not take math during their senior year of high school?



# UW System Math Placement Test

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- 85 multiple choice items
  - 75 scored, 10 pilot
- Three sections:
  - Basic Math Skills (MBSC)
  - Algebra (ALG)
  - Trigonometry (TRG)
- Scores range from 150-850
- Highly reliable
  - Reliabilities for the three sections range from .85 to .90s



# Math Background Survey

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- Did you take math during your junior year of high school?
- Did you take math during your senior year of high school?
- Identify which math courses you took during junior and senior year.



# Data

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- Three years of data
- Only students who
  - were 17 to 19.5 years old when they took their placement test and
  - completed the math background survey
- Resulting sample size = 49,347



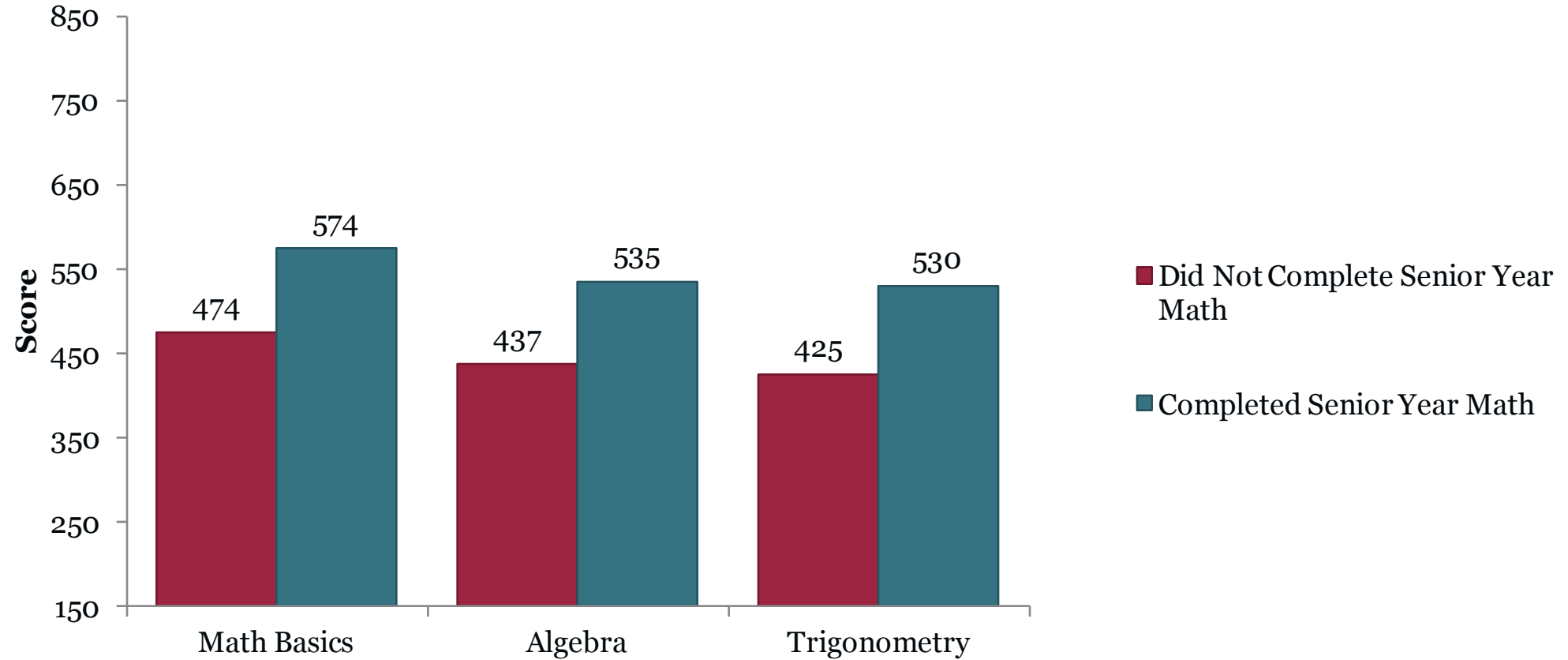
# Research Question #1

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- Do students who complete math during their senior year of high school score higher on the UW System math placement test than students who do not take math their senior year of high school?



# Average Placement Test Scores





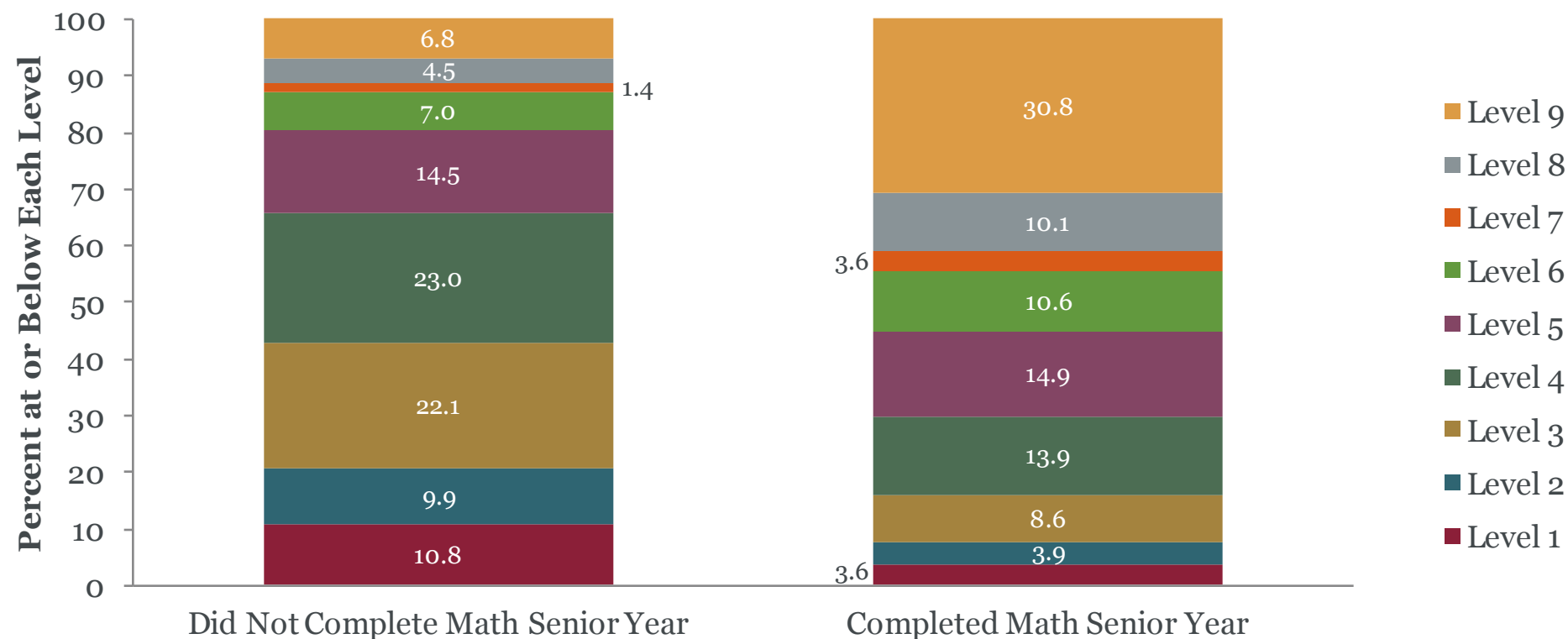
# Research Question #2

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- If there is an observed difference in average math placement test scores for these two groups, does the difference in scores result in different placement levels?



# Placement Levels



**Note.** Levels 1 and 2 correspond to developmental placement. Level 9 corresponds to Calculus placement.



## Question #2: Results

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- Approximately 21% of students who did not take math during their senior year placed into a developmental level math class compared to only 7.5% of students who took a senior year math class.
- Approximately 31% of students who took senior year math received a calculus placement, compared to only 6.8% of students who did not take senior year math.



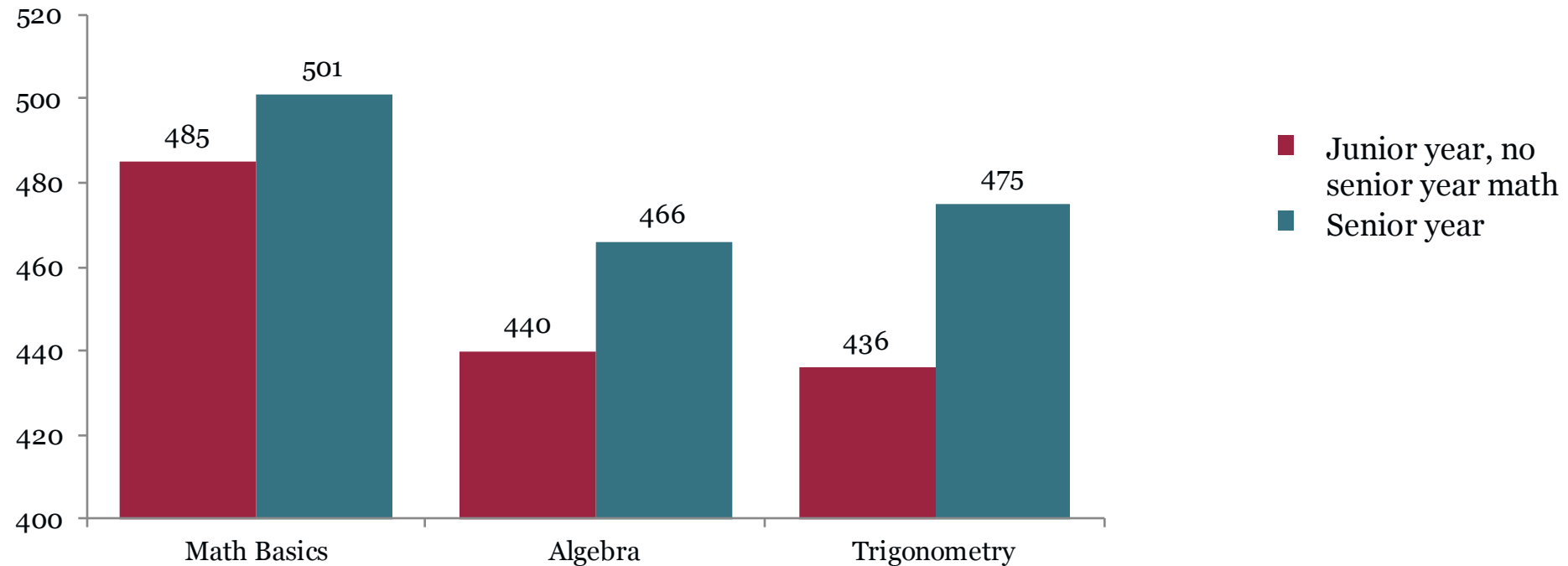
# Research Question #3

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- Do math skills regress for students who do not take math during their senior year of high school?
  - A subset of math classes were investigated.
    - Trigonometry, Precalculus, Algebra II
  - Students who took a particular math class their junior year and no math their senior year, were compared to students to took the same math class during their senior year.

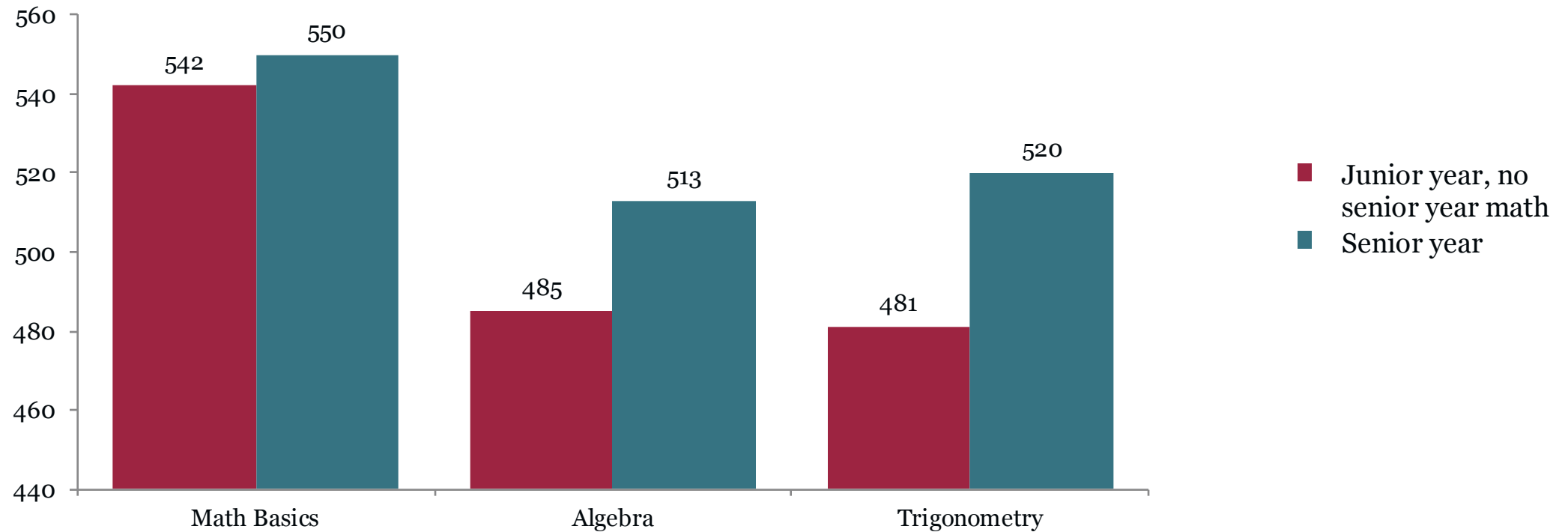


# Placement Scores by Highest Math Course: Trigonometry



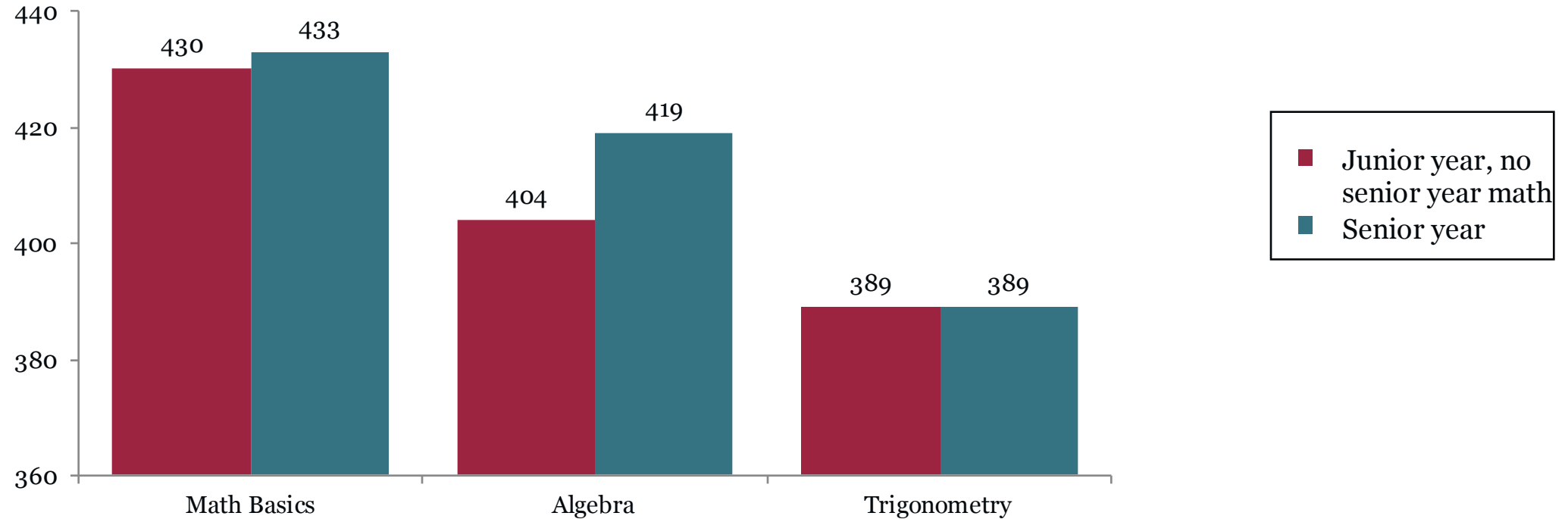


# Placement Scores by Highest Math Course: Precalculus





# Placement Scores by Highest Math Course: Algebra II





# The Impact of Academic Rigor

Course/Year	Math Basics	Algebra	Trigonometry
Trigonometry/ junior year, no senior year math	485	440	436
Pre-calculus/junior year, no senior year math	542	485	481
Algebra II/senior year	<b>433</b>	<b>419</b>	<b>389</b>

- Students who did not complete senior year math, but took either Precalculus or Trigonometry during their junior year, scored higher on all three sections of the MPT than students who took Algebra II course during their senior year.



# Conclusions

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- The results of this study provide evidence in support of students taking a senior year math class.
- In general, students who take math during their senior year of high school score higher on all three sections of the math placement test and place into higher level math courses than students who did not take math their senior year.

# **Investigating the Impact of Challenging New Graduation Requirements in San Diego**

By Julian R. Betts, SanDERA at UCSD

**San Diego Education Research Alliance (SanDERA)**



# College Prep for All

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- President Obama: repeated calls for high schools to prepare all students for college and career
- In California the ACLU has lobbied many large districts to increase access to the “a-g” college preparatory coursework needed for those applying to CSU and UC
- San Diego Unified School District (SDUSD) agreed in 2012 to make a-g coursework a graduation requirement
- Several other major districts have done the same:
  - Los Angeles, San Francisco, Oakland



# What is UC/CSU a-g course sequence?

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- 15 year-long courses in 7 subject areas
- Area C: Mathematics (3 years)
- In SDUSD: 6 semesters of credit (same as before), but now requires intermediate algebra
- Math and world language the areas in which the SDUSD requirement has increased the most



# Lower Grade requirements

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- UC and CSU require students to complete the a-g coursework with grades of C or higher
- SDUSD (and other districts) have made a-g coursework with grades of D or higher the new graduation requirement



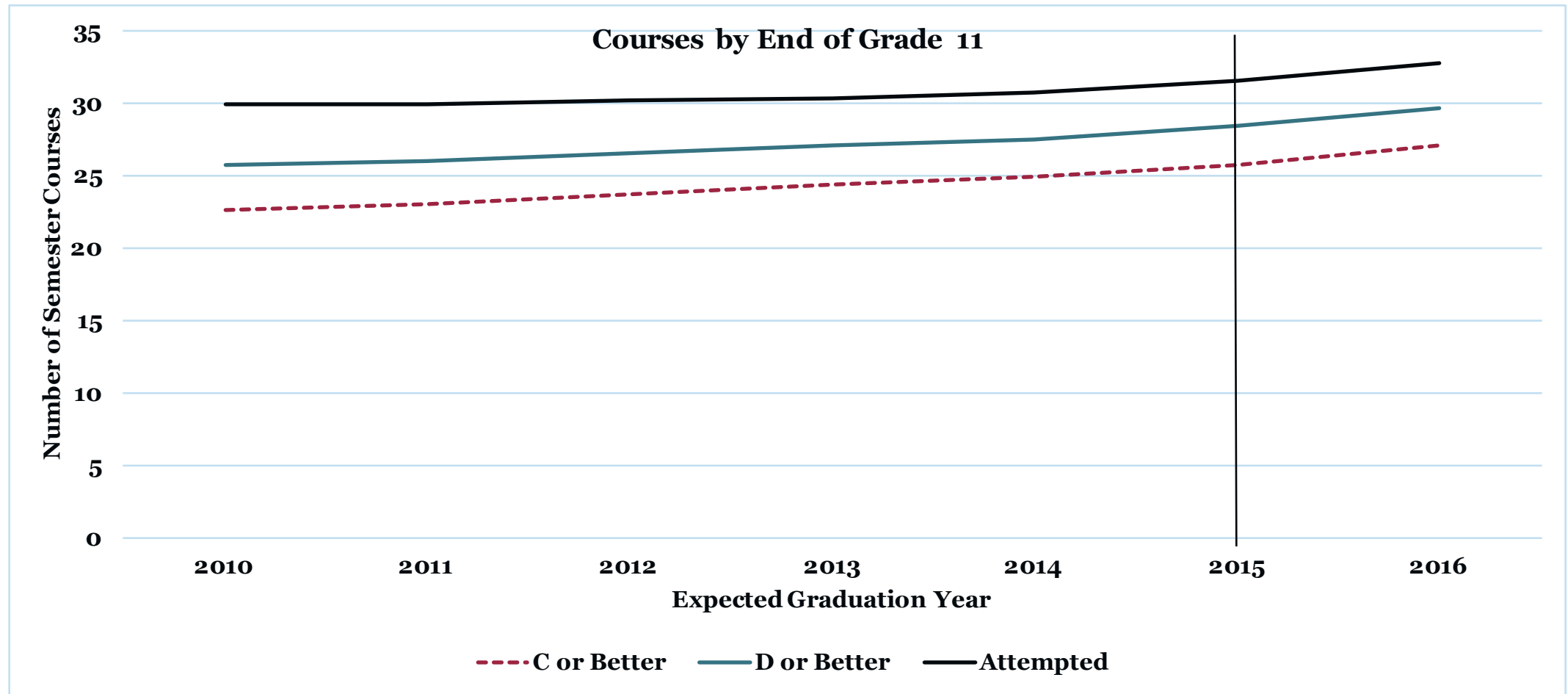
# This Report's Goals

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- Have the classes of 2016-2018 taken more a-g courses?
- How close is the class of 2016 to meeting a-g?
- Who stands to gain? Who stands to lose?
- What is likely impact on college eligibility and graduation rates?
- Policy implications
- Our data include transcripts through August 2015 (summer school right before entering senior year for class of 2016)



# A-G Course Completion Has Risen Modestly By End Of Grade 11





## Good News: % likely to fulfill the UC/CSU course requirements will likely rise

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- We estimate that 59% of students in the class of 2016 are on track to complete the a-g requirements with grades of C or higher, making them eligible to apply to the CSU and UC systems
- Could be a 10 percentage point gain in eligibility for UC/CSU in the class of 2016



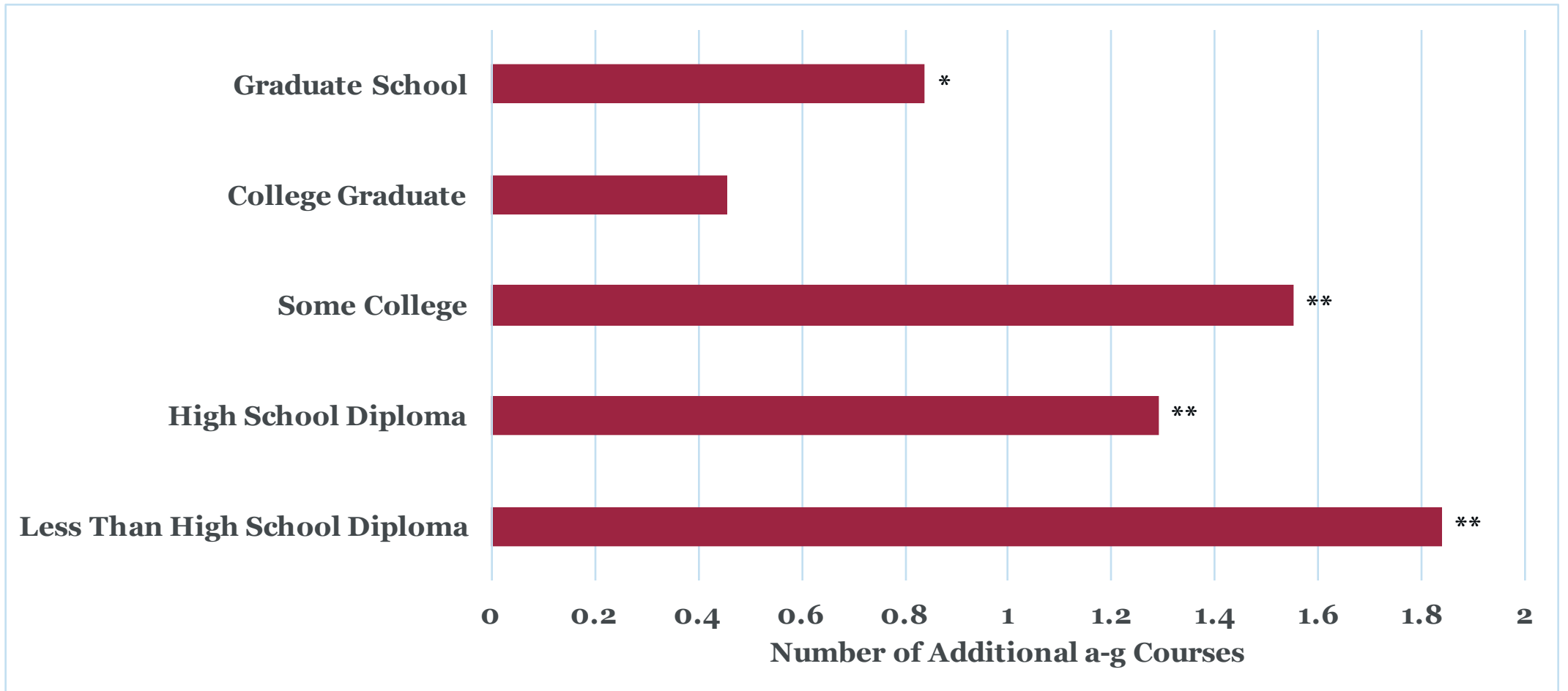
# The Graduation Rate for the Class of 2016 is Likely to Fall Below Recent Rates

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- June 2014 graduation rate: 87.5%, and by August 2014 graduation rate=89.7%
- We projected that if students take a-g courses and pass all of them in 2015-16, 72% would complete a-g with D or higher, while meeting the district's graduation requirement of a cumulative GPA of 2.0
- Represents 15.5% drop from June 2014

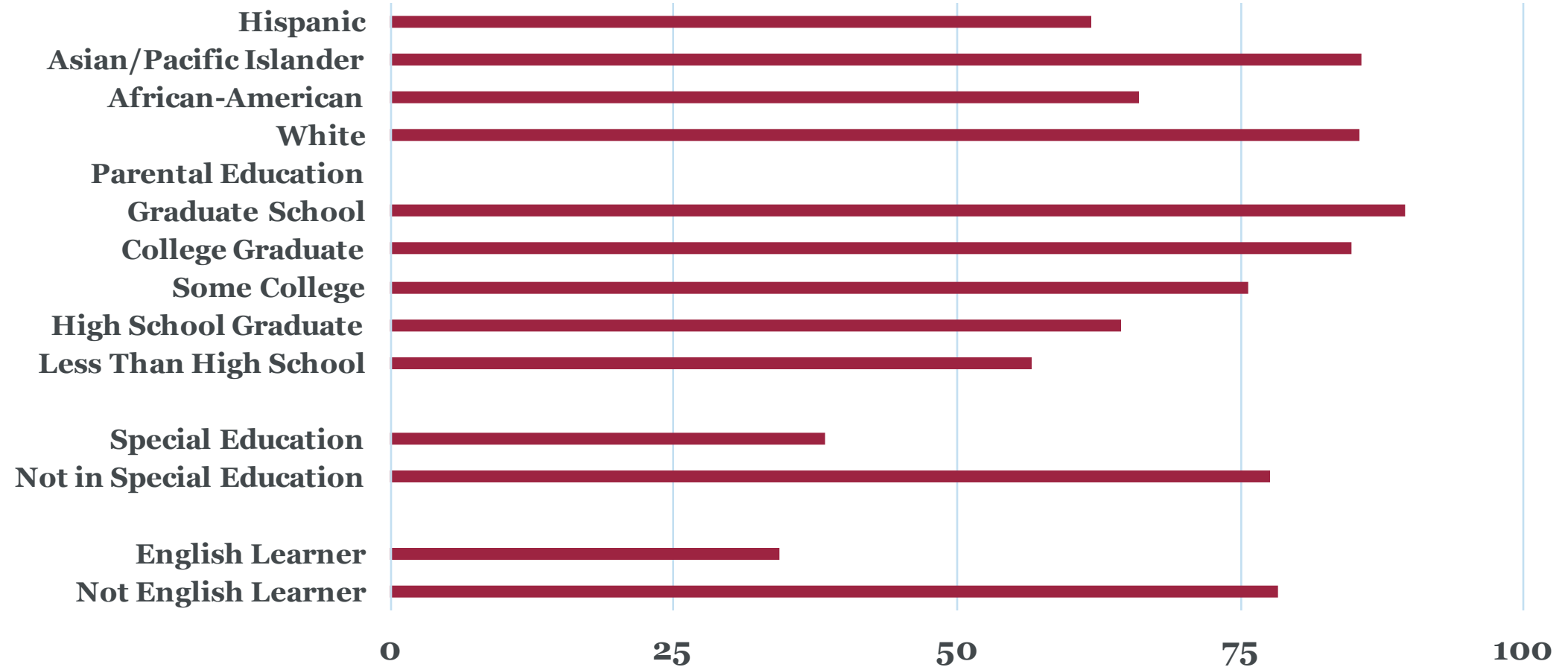


# Students with Lower Parental Education Generally have increased course-taking more



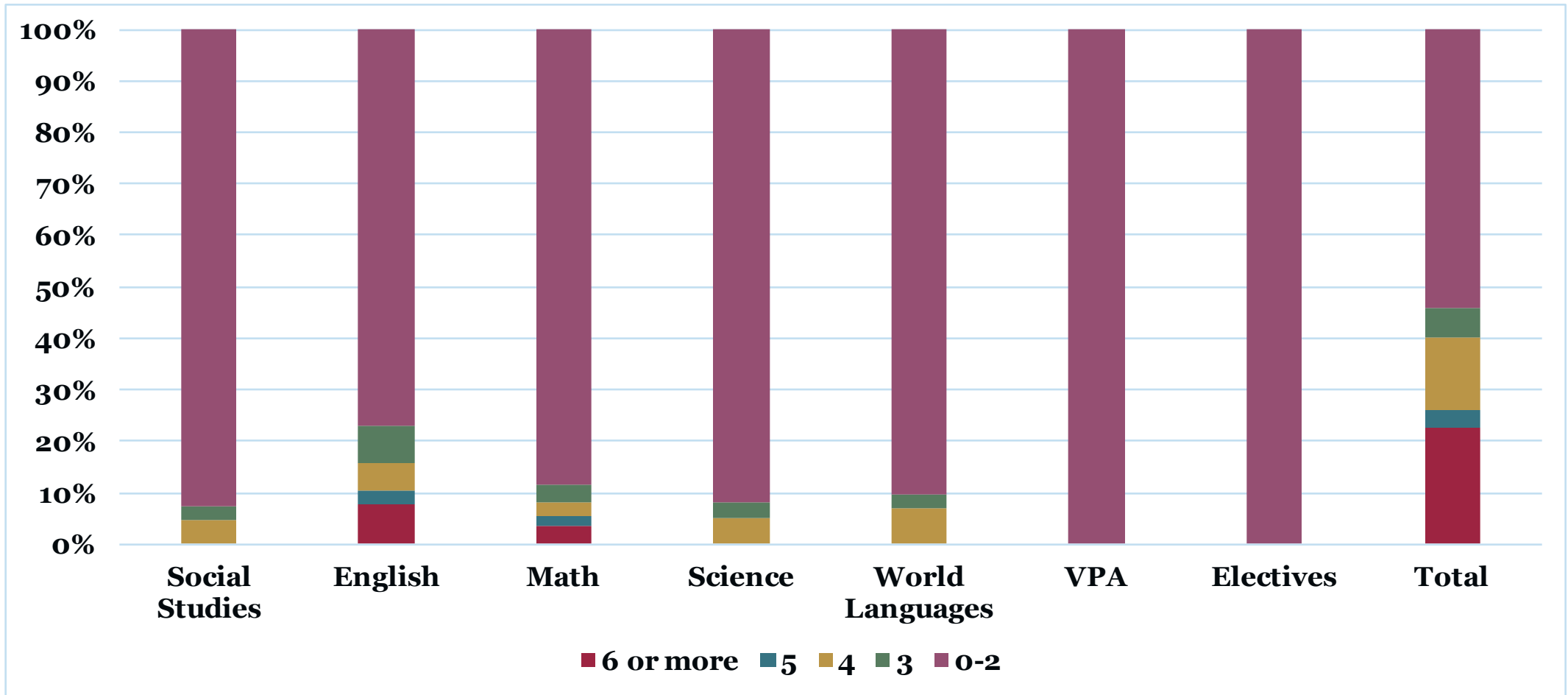


# Dramatic Variations In % Likely To Complete A-g In June 2016





# 23.1% And 11.7% Had More Than 1 Year Of English And Math To Complete In Senior Year





# Summary and Policy options

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- The new graduation policy is likely to generate students who win and students who lose in San Diego
  - **Students who gain:** an extra 10% could become eligible for UC/CSU
  - **Students who lose:** an extra 15.5% could not graduate at all
- The state will issue actual graduation rates next spring
- Summer school and online credit recovery could mitigate the predicted decline—District believes graduation rate will not fall



# Additional Policy Options

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- More preventive programs are probably needed
  - Intensive supports in grade 12 do not seem optimal when about 1/8 of students entering grade 12 have completed 1.5 or fewer of the 3 required math courses
- Interventions before high school
  - Our grade 6 forecasting model showed that can identify and support at-risk students in middle school or even earlier.
  - Middle school interventions to solidify understanding of pre-algebra concepts are much needed



# Reports Available

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- College Prep for All- Will San Diego Students Meet Challenging New Graduation Requirements?  
By Julian Betts, Sam M. Young, Andrew C. Zau, and KarenVolz Bachofer
  - <http://www.ppic.org/main/publication.asp?i=1191>
- For earlier studies (progress through the end of grade 9, and historical a-g completion in SDUSD) see:
- SanDERA report by Betts et al. (2015) on grade 9 progress at:
  - <http://sanderu.ucsd.edu/research-and-publications/index.html>
- 2013 Publication on historical a-g completion:
  - <http://www.ppic.org/main/publication.asp?i=1049>

# **Mathematics from High School (Preparation) to Community College (Placement)**

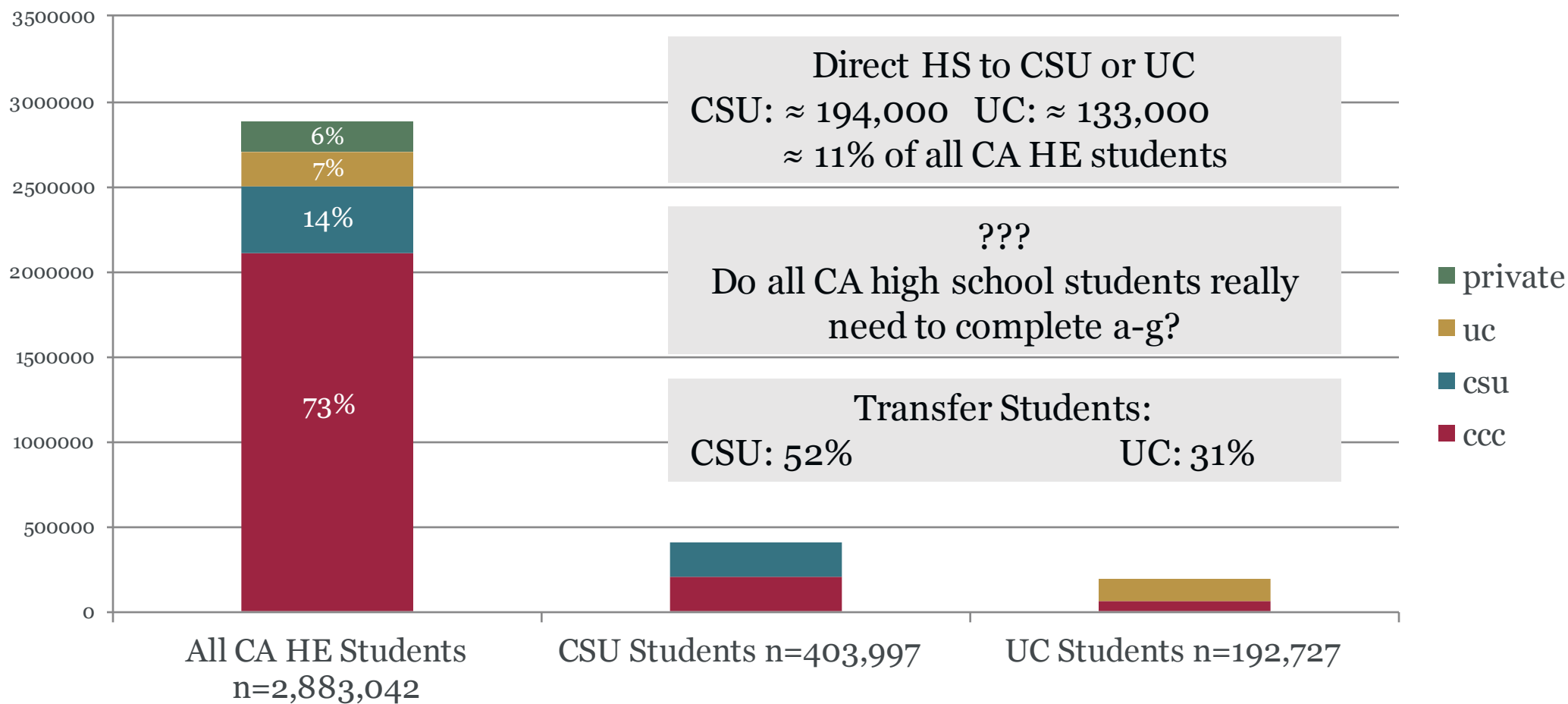
**Louise Jaffe, Ed.D., Trustee, Santa Monica College**

A group of six diverse young adults, three men and three women, are smiling and posing outdoors. They are dressed in casual clothing like t-shirts, jeans, and a beanie. The background shows green foliage. The text "Why focus on community colleges? It's where the students are!" is overlaid in white on the lower half of the image.

**Why focus on community colleges?  
It's where the students are!**



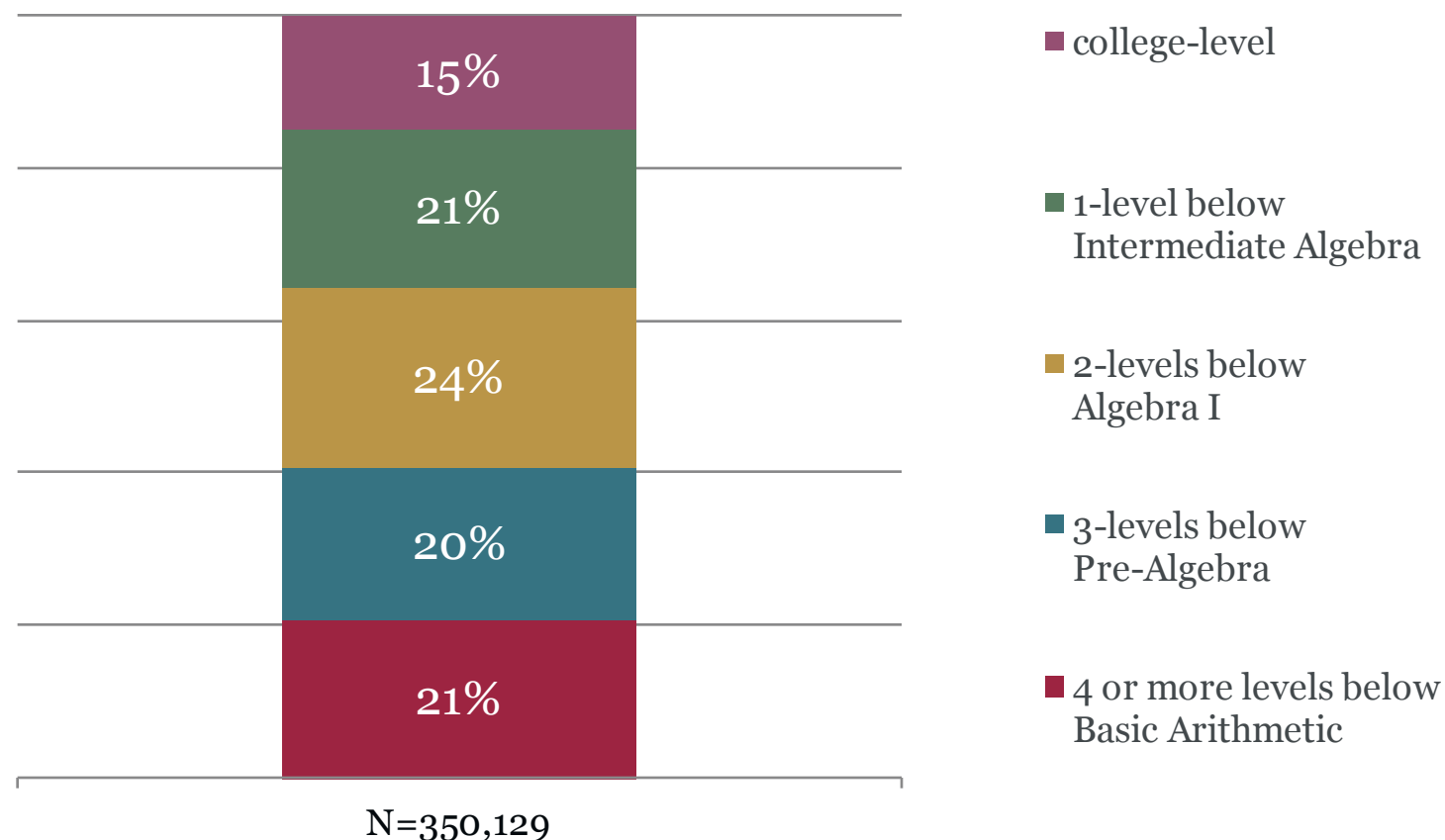
# California Students in Higher Education 2014-15



Data from <http://www.ccleague.org/files/public/Publications/FF2016.pdf>

# College Math Placement Results

## State CC Freshmen - Fall 2010

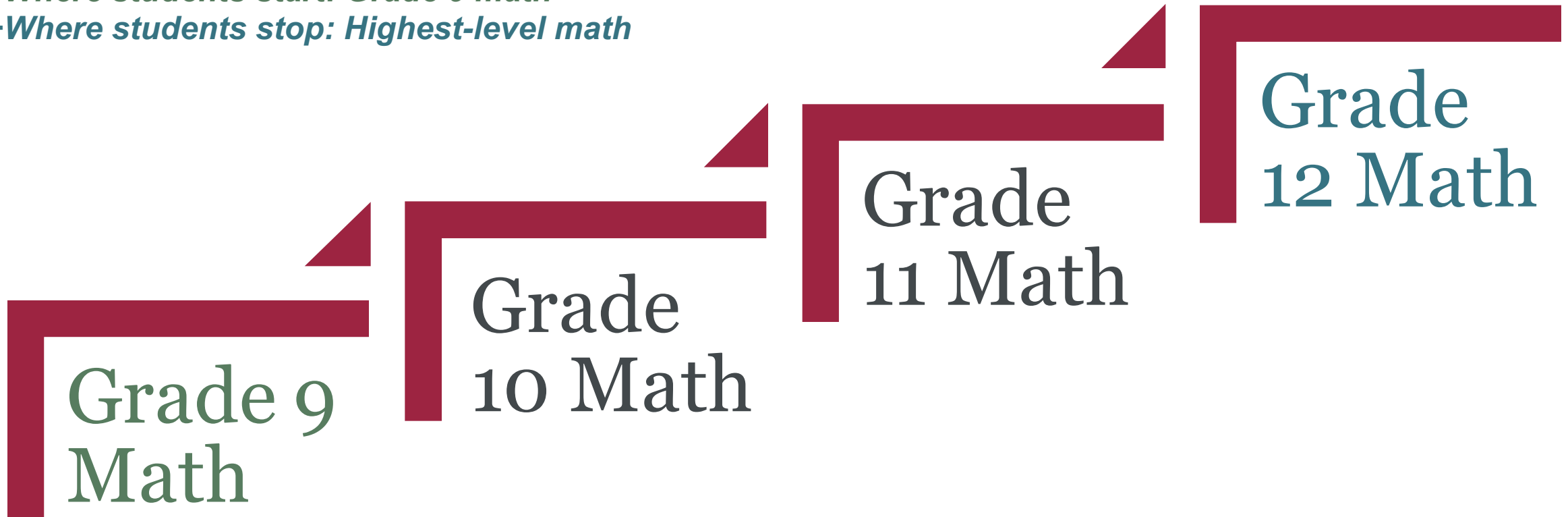




# High School Mathematics Pathway Markers

*+Where students start: Grade 9 math*

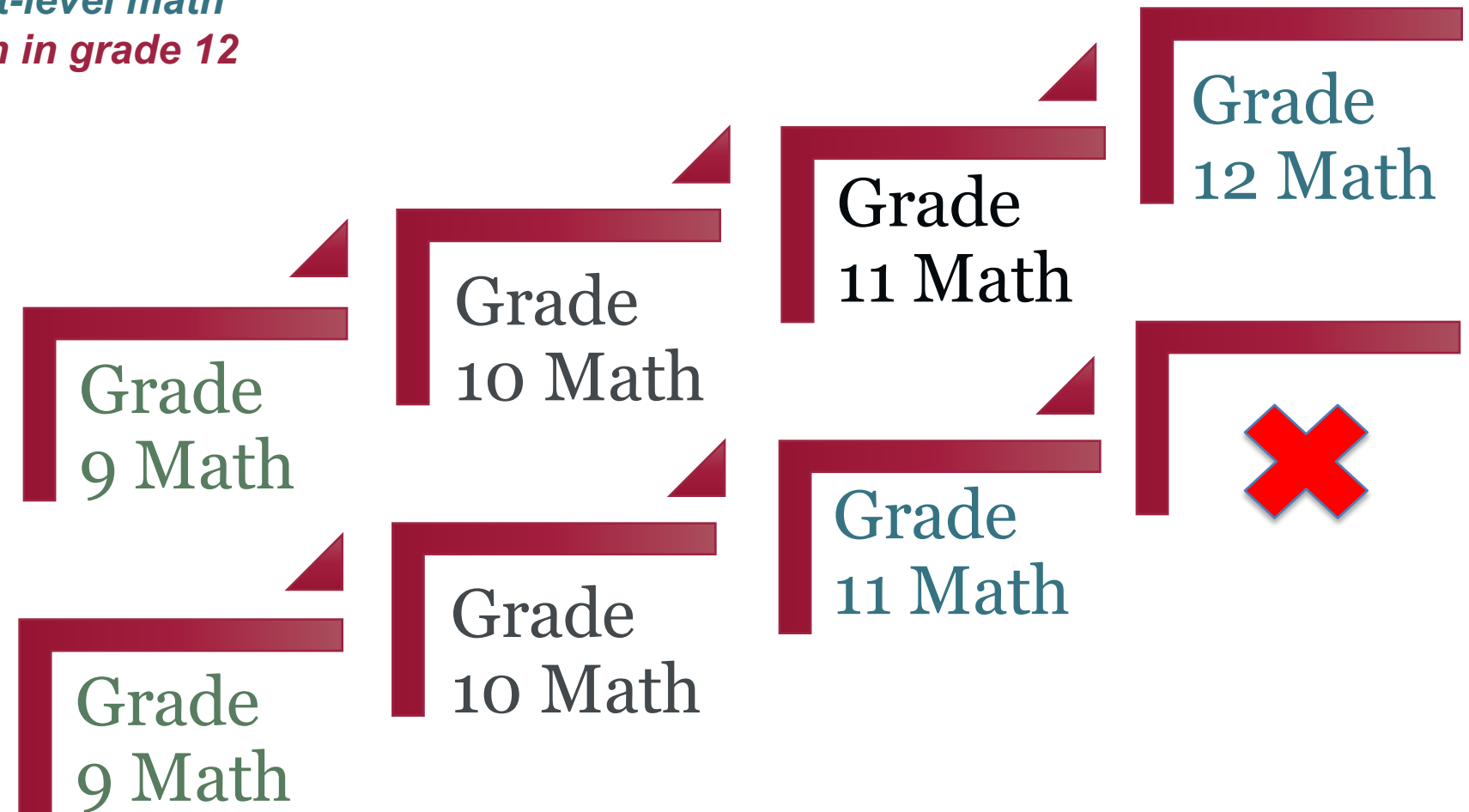
*+Where students stop: Highest-level math*





# High School Mathematics Pathway Markers

- +Where students start: Grade 9 math*
- +Where students stop: Highest-level math*
- +When students stop: No math in grade 12*





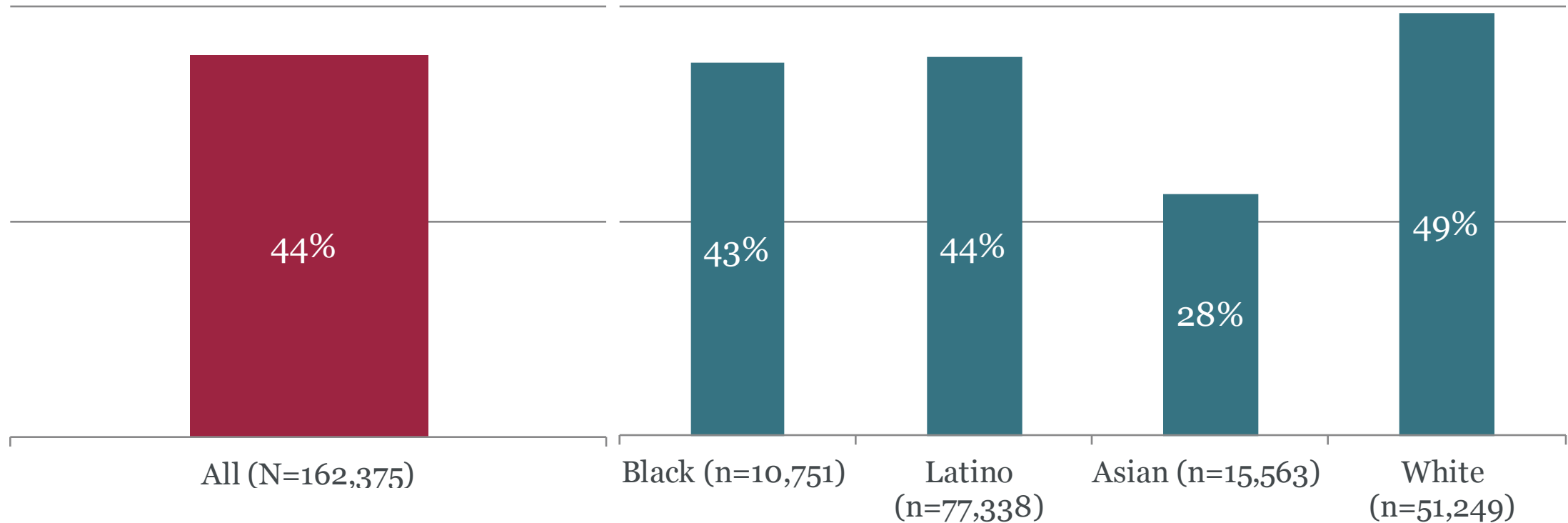
# In California, Who Took No Math in Grade 12?

2011/12 Sample

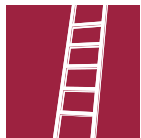
(One third of 12<sup>th</sup> graders)

By Ethnicity

(N= 154,901)

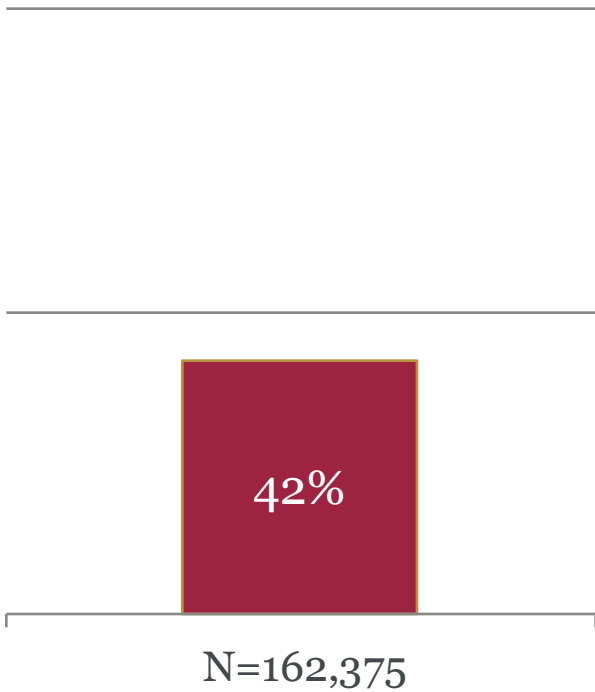


*Data from Educational Results Partnership*

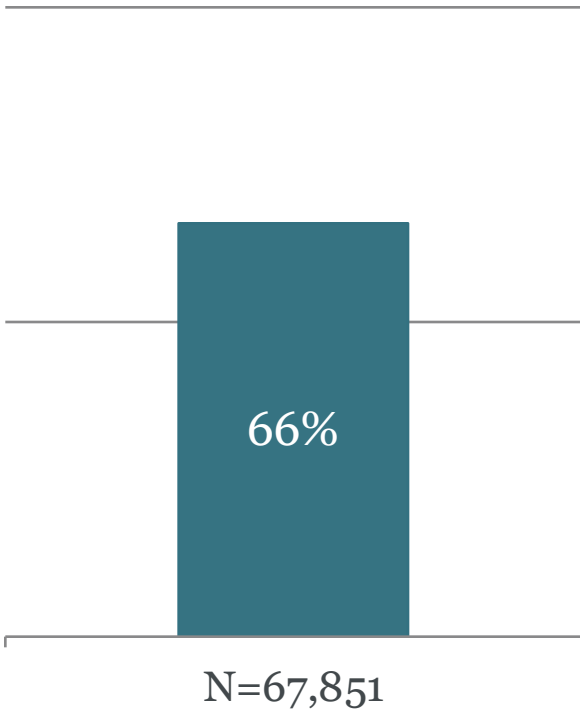


# Who took Algebra 2 or higher before grade 12?

Percent  
of 12<sup>th</sup> Graders



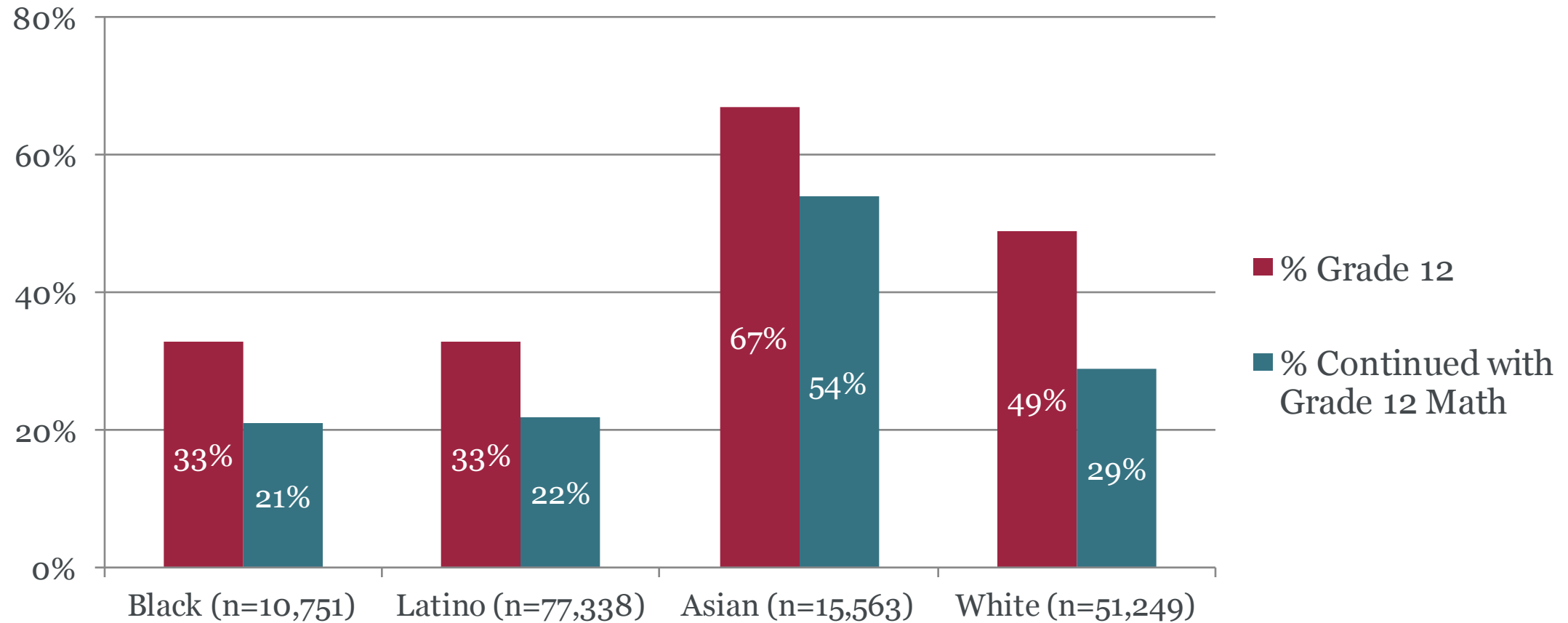
Percent continued Math  
in Grade 12



*Data from Educational Results Partnership*



# Algebra 2 or Above Before Grade 12, Percent of 12<sup>th</sup> Graders by Ethnicity *(N=154,901)*



*Data from Educational Results Partnership*



# Key Findings

from descriptive analysis of course-taking patterns

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- Course-taking patterns indicate many students do not understand expectations for college
- Community college-bound students were less likely to take math in grade 12 but not taking grade 12 math was commonplace for all groups
  - Not taking math in grade 12 was a significant predictor\* at 2, 3, and 4 levels below college-level
  - 55% of CC students who placed 2, 3, or 4 levels below college-level took no math in grade 12
  - but 32% of students who placed into college level also took no grade 12 math

*\*multinomial logistic regression analysis using standardized assessment for placement*



# Key Findings

from descriptive analysis of course-taking patterns

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- No Math in Grade 12: Huge Opportunity!
- Where students stopped was determined in part by when students stopped (Duh!)
- Most no-math-in-grade-12 students passed grade 11 math
- Students who advanced beyond Algebra 2 were more frequently assessed as college ready\*\*

*\*\* based on standardized placement assessment*



# Key Findings

from descriptive analysis of course-taking patterns

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- Failure to master middle school math --- big issue.
  - Almost 80% of students who *passed* the California High School Exit Exam (CAHSEE) Math were assessed into 3 or 4 levels below transfer-level math
    - CAHSEE measured 7<sup>th</sup> grade math
    - CAHSEE Math was significant predictor of placement\*
    - Students who “passed” were congratulated
  - no curriculum in high school to fill in gaps from prior grades

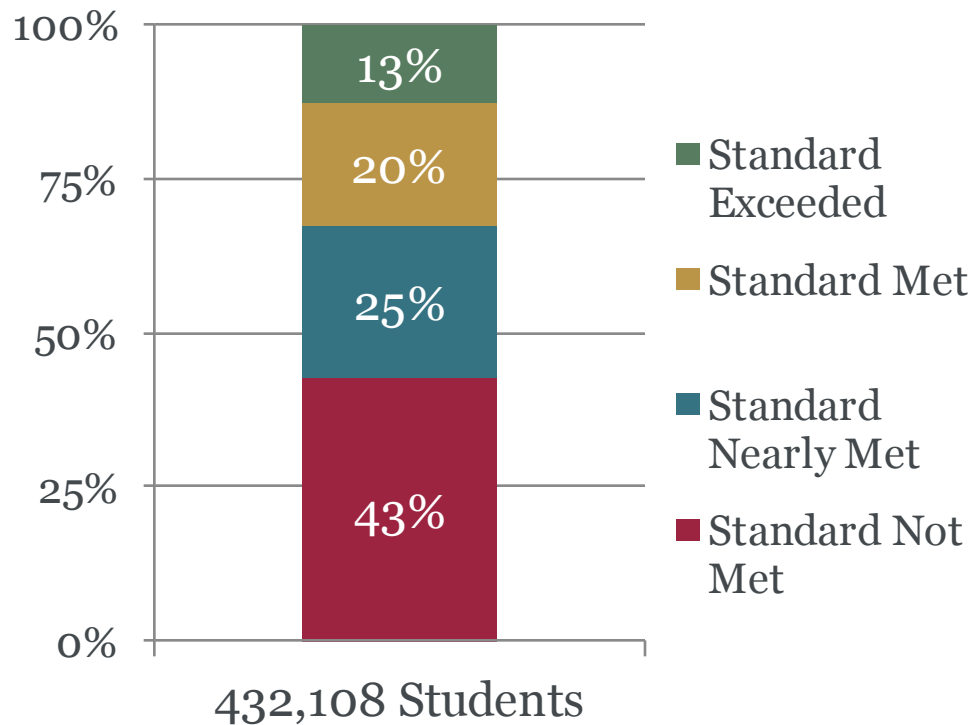
*\* multinomial logistic regression analysis using standardized assessment for placement*



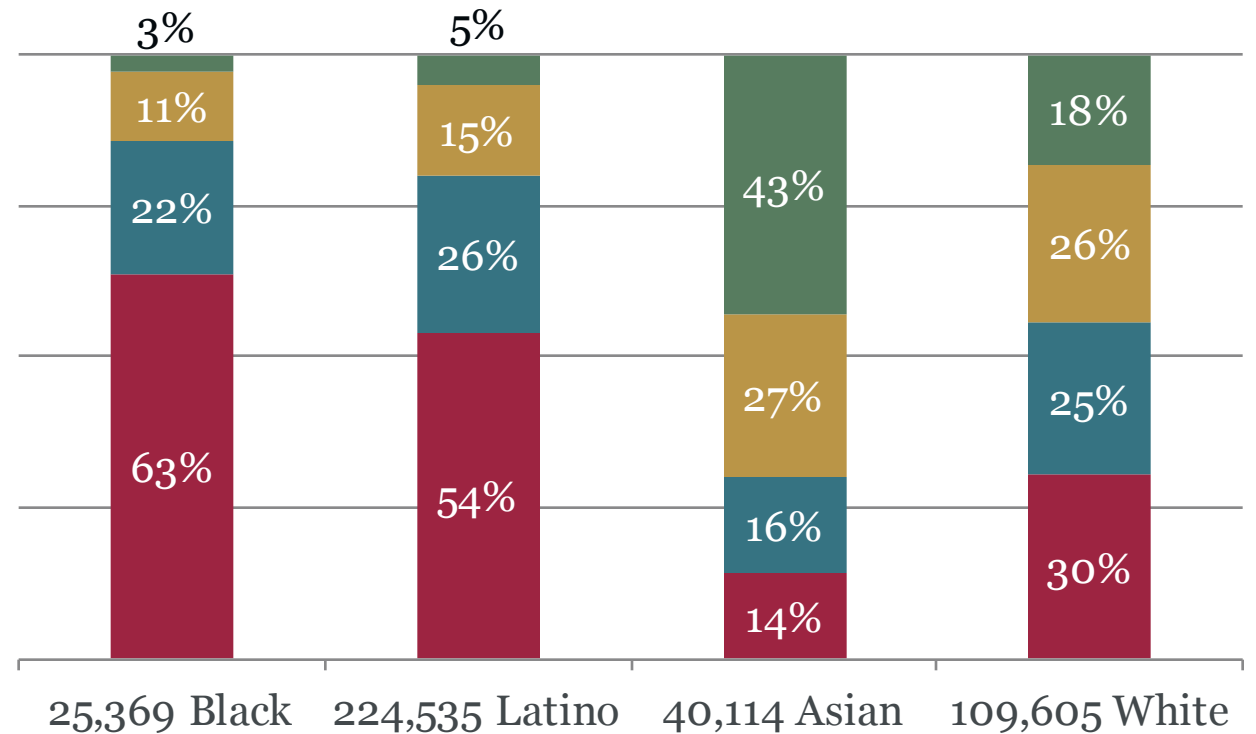
# 2016 NEW California Math Assessment-Grade 11

*LOTS of CA students going into Grade 12 “behind”*

All 11<sup>th</sup> Graders



Students by Ethnicity



*Data from CDE – 2016 California Assessment of Student Performance and Progress (CAASPP)*



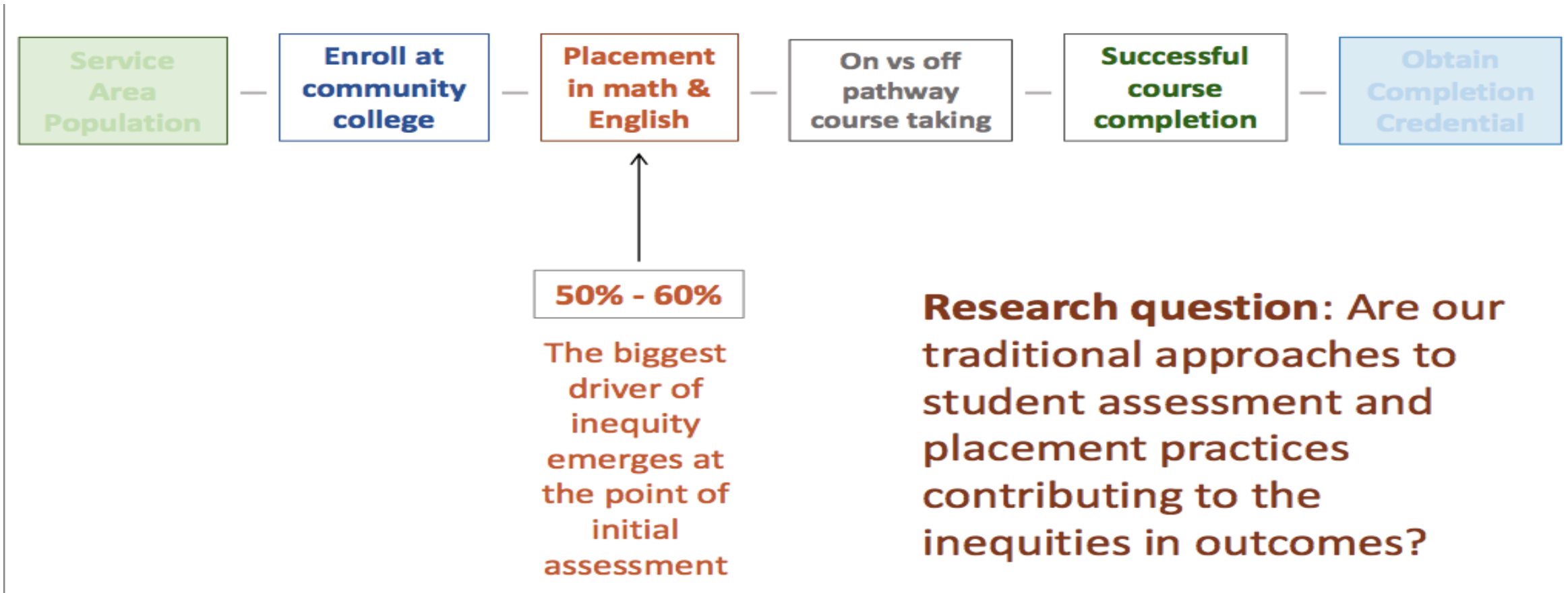
# But...

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- My research used an existing standardized assessment to determine the outcome placement level
- Performance in high school coursework better predicts performance in college coursework than does current standardized placement assessments
  - Best for students when both are used, disjunctively
- Placement accuracy — what's the *highest* level community college course the student will likely successfully complete — has implications for student success and equity



# Implications of Placement Practices



*Slide from Greg Stoup, Senior Dean, Contra Costa Community College District*



# California Community Colleges Changing Placement Assessment

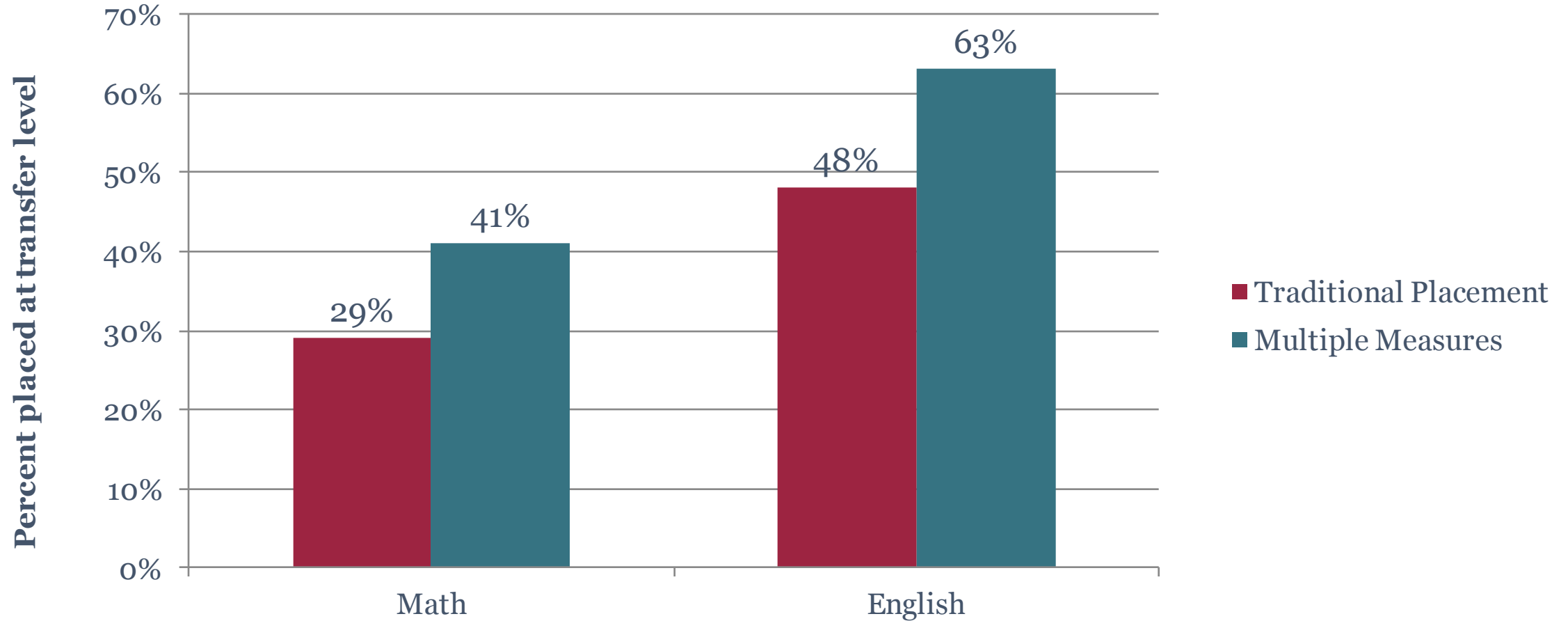
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- California Common Assessment Initiative
  - Whole new adaptive assessment
  - Designed for CCC students by CCC faculty
  - Competency map model
  - Statewide tool; local placement decisions
- Multiple Measures Assessment Project
  - Many colleges piloting new multiple measures algorithms/rule sets
  - Algorithms based on students' high school records

*GOALS: Improve accuracy of placement  
Reduce unnecessary remediation!*



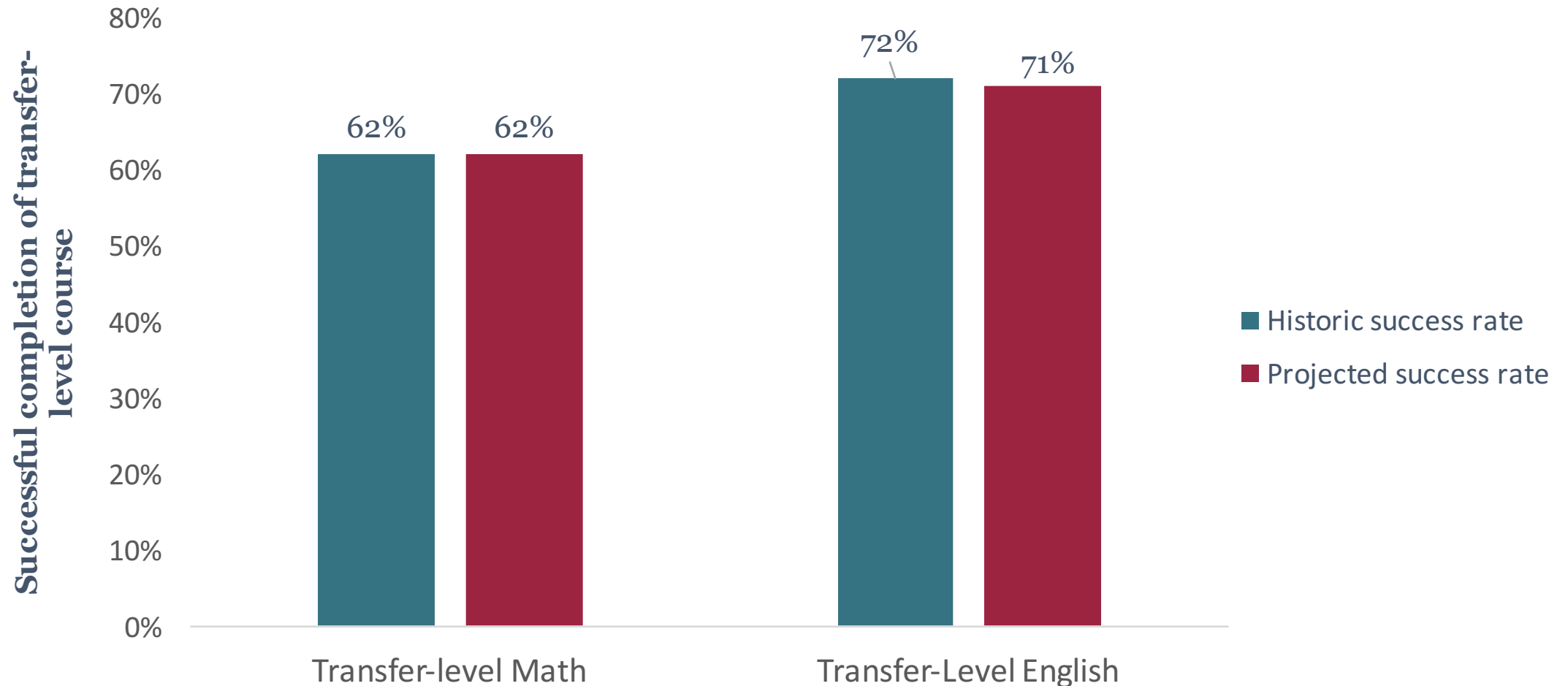
# Middle Of Road Statewide Projection Of MMAP Impact



*Slide from CAI presentation at CCLC Annual Trustees Convention, May 2015*



# With Little Impact on Course Success





# Multiple Measures & Grade 12<sup>th</sup> Math

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- Not all Grade 12 math is the same (Duh, again!)
- The MMAP rule set does not identify taking math in Grade 12 as an important predictor of student performance once you measure how far students get in HS math.
- The two are related – students who take math in Grade 12 tend to go farther in math, and vice versa.



# Conclusions...

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- Statewide dis-use of grade 12 to advance preparedness in mathematics for college
- Grade 12: Huge Opportunity
- Need for different curricula opportunities to increase preparedness for different groups of students
- (Not discussed: Also a need for different math degree requirements for different career opportunities)

# High School Math Course-Taking & Readiness for CSU

David J. Barsky, Associate Professor, California State University-San Marcos



# The Challenge

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- 1996 CSU Board of Trustees Goal for the System: Increase the proficiency of entering first-year freshmen to 90% by 2007.
- Strategies:
  - Outreach/communication to students, families and schools
  - Collaborative efforts with high schools
  - Early Assessment Program
  - Early Start Program



# CSU Shared Governance

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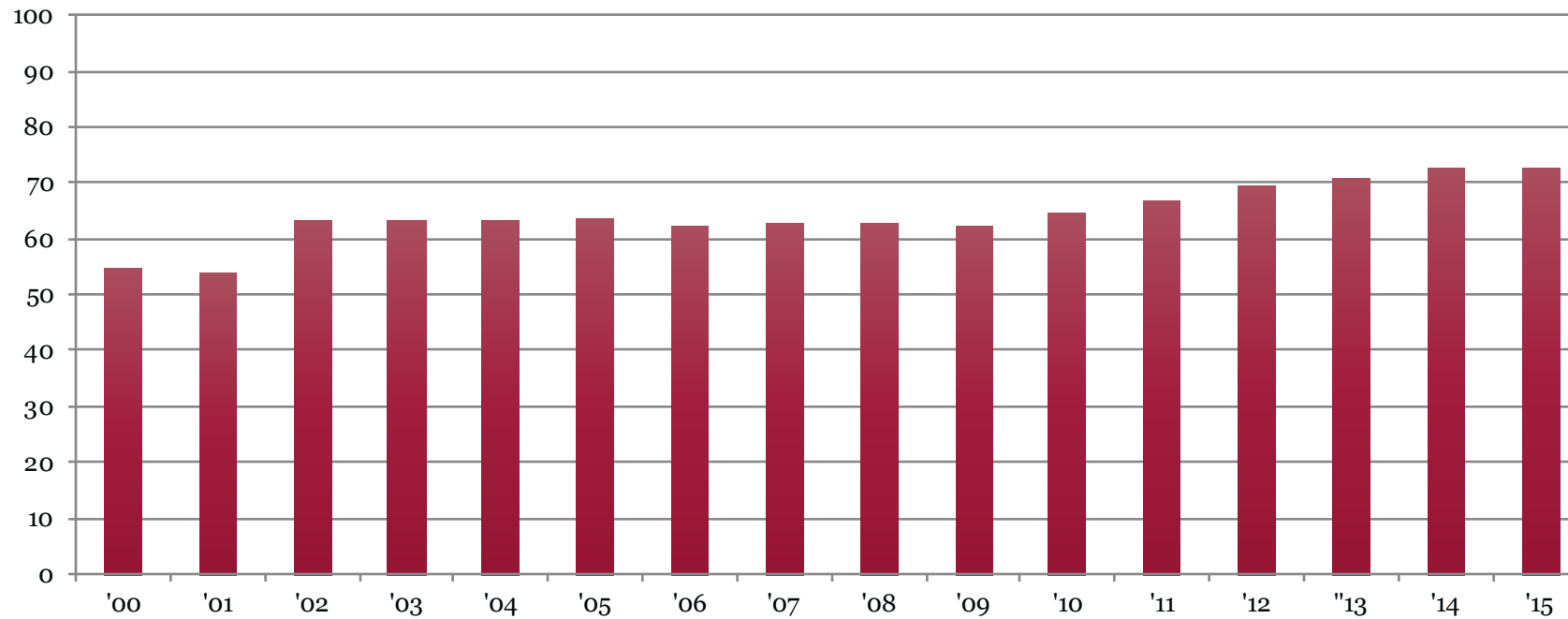
**Academic Senate of the California State University (ASCSU):**  
“official voice of the faculty in matters of system-wide concern”

**Academic Preparation and Education Programs (APEP) Committee:** makes recommendations to the ASCSU on numerous matters including:

- students’ academic preparation prior to matriculation,
- admissions policies and procedures,
- academic entry-level requirements and testing,
- remedial education, and
- intersegmental efforts to improve teaching at all levels



# CSU System First Time Freshman Mathematics Proficiency Percentage



Source: CSU Freshman Proficiency Rates (<http://asd.calstate.edu/performance/proficiency.shtml>)



# The Result: ASCSU Resolution

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- Calls for the CSU to require a fourth year of mathematics/quantitative reasoning as an admission requirement, with a course to be completed in the senior year.
- This is just a call.
- There are a lot of steps (and consultation and time) between this proposal and the adoption of a new admission requirement.



# ASCSU Resolution: Why?

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- Strong quantitative reasoning skills form a foundation for future success in college and careers.
- It is important that students continue practicing and developing quantitative abilities throughout their academic careers, since these skills decline with disuse.



# ASCSU Resolution: What Else?

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- Offers a broad interpretation of what could count as a “fourth year course.”
- Recommends that the CSU investigate impact that this requirement may have on student success, particularly for students from historically underserved groups.
- Calls for the CSU to continue engaging with K-12 and intersegmental constituencies to address the impact of this requirement.”



# Would such a requirement be unprecedented?

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- Although the CSU only requires three years of mathematics at or above the level of Algebra I, it recommends four such years.
- Many other universities and university systems across the U.S. now require four years of mathematics for admission.



# The Hope for the Long-Term Picture

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- The CSU continues serving a diverse and broad cross-section of California's students.
- More students are entering the CSU prepared to take required college-level math courses without the need for remediation.
- Instead of mathematical deficiencies keeping students from being able to complete college, students have mathematical proficiencies that opens up academic and career opportunities.



# Resources

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- [University of Wisconsin Senior Year Math Webinar](#)
- [College Prep for All: Will San Diego Students Meet Challenging New Graduation Requirements?](#)
- [Mathematics from High School to Community College: Using Existing Tools to Increase College Readiness](#)
- [Support for Requiring a Fourth Year of Mathematics/Quantitative Reasoning for Admission to the California State University](#)

# Thank You For Joining Us!

The webinar will be posted on the websites of  
The Opportunity Institute and LearningWorks.

For more information, please contact Pamela Burdman,  
[pbstrategy@gmail.com](mailto:pbstrategy@gmail.com)

Please join us for the final webinar in the series on **October 27**.  
More info at [theopportunityinstitute.org](http://theopportunityinstitute.org) and [learningworksca.org](http://learningworksca.org)