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

With Support from the College Futures & James Irvine Foundations
The Quantitative Leap Series

• 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

• 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

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

#### Key Measures:
Four years of mathematics? Completion of Algebra 2?

<table>
<thead>
<tr>
<th></th>
<th>UC applicants</th>
<th>CSU freshmen</th>
<th>CCC students</th>
<th>CA high school graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>93% took four years of math</td>
<td>70% took four years of math</td>
<td>54% completed Algebra 2</td>
<td>70% took math in senior year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>44% completed Algebra 2</td>
</tr>
</tbody>
</table>
Today’s Presenters

Pamela Burdman
Fellow, The Opportunity Institute

Sonya Sedivy
Associate Scientist,
University of Wisconsin-Madison

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

Louise Jaffe
Trustee, Santa Monica College

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

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

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

• 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

• 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

• 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

- 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

- **Math Basics**: Did Not Complete Senior Year Math: 474, Completed Senior Year Math: 574
- **Algebra**: Did Not Complete Senior Year Math: 437, Completed Senior Year Math: 535
- **Trigonometry**: Did Not Complete Senior Year Math: 425, Completed Senior Year Math: 530
Research Question #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?
Placement Levels

Note. Levels 1 and 2 correspond to developmental placement. Level 9 corresponds to Calculus placement.
Question #2: Results

• 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

• 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

- Math Basics
  - Junior year, no senior year math: 485
  - Senior year: 501
- Algebra
  - Junior year, no senior year math: 440
  - Senior year: 466
- Trigonometry
  - Junior year, no senior year math: 436
  - Senior year: 475
Placement Scores by Highest Math Course: Precalculus

<table>
<thead>
<tr>
<th>Math Basics</th>
<th>Algebra</th>
<th>Trigonometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>542</td>
<td>485</td>
<td>481</td>
</tr>
<tr>
<td>550</td>
<td>513</td>
<td>520</td>
</tr>
</tbody>
</table>

- **Math Basics**: Junior year, no senior year math
- **Algebra**: Senior year
- **Trigonometry**: Senior year
Placement Scores by Highest Math Course: Algebra II

- Math Basics: 430, 433
- Algebra: 404, 419
- Trigonometry: 389, 389

- Junior year, no senior year math
- Senior year
The Impact of Academic Rigor

<table>
<thead>
<tr>
<th>Course/Year</th>
<th>Math Basics</th>
<th>Algebra</th>
<th>Trigonometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigonometry/ junior year, no senior year math</td>
<td>485</td>
<td>440</td>
<td>436</td>
</tr>
<tr>
<td>Pre-calculus/junior year, no senior year math</td>
<td>542</td>
<td>485</td>
<td>481</td>
</tr>
<tr>
<td>Algebra II/senior year</td>
<td>433</td>
<td>419</td>
<td>389</td>
</tr>
</tbody>
</table>

- 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

• 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
College Prep for All

- 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?

- 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

• 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

• 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

Courses by End of Grade 11

Expected Graduation Year

Number of Semester Courses

C or Better  
D or Better  
Attempted
Good News: % likely to fulfill the UC/CSU course requirements will likely rise

• 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

• 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

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Number of Additional a-g Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate School</td>
<td>*</td>
</tr>
<tr>
<td>College Graduate</td>
<td></td>
</tr>
<tr>
<td>Some College</td>
<td>**</td>
</tr>
<tr>
<td>High School Diploma</td>
<td>**</td>
</tr>
<tr>
<td>Less Than High School Diploma</td>
<td>**</td>
</tr>
</tbody>
</table>
Dramatic Variations In % Likely To Complete A-g In June 2016

- Hispanic
- Asian/Pacific Islander
- African-American
- White
- Parental Education
  - Graduate School
  - College Graduate
  - Some College
  - High School Graduate
  - Less Than High School
- Special Education
- Not in Special Education
- English Learner
- Not English Learner
23.1% and 11.7% had more than 1 year of English and Math to complete in Senior Year.
Summary and Policy options

• 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

• 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

• College Prep for All- Will San Diego Students Meet Challenging New Graduation Requirements?
   By Julian Betts, Sam M. Young, Andrew C. Zau, and Karen Volz 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://sandera.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
Why focus on community colleges? It’s where the students are!
California Students in Higher Education 2014-15

- **Direct HS to CSU or UC**
  - CSU: ≈ 194,000
  - UC: ≈ 133,000
  - ≈ 11% of all CA HE students

- **Transfer Students:**
  - CSU: 52%
  - UC: 31%

- **Do all CA high school students really need to complete a-g?**

College Math Placement Results

State CC Freshmen - Fall 2010

- 15% college-level
- 21% 1-level below Intermediate Algebra
- 24% 2-levels below Algebra I
- 20% 3-levels below Pre-Algebra
- 21% 4 or more levels below Basic Arithmetic

N=350,129
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

Grade 12 Math

Grade 11 Math

Grade 10 Math

Grade 9 Math
In California, Who Took No Math in Grade 12?

2011/12 Sample
(One third of 12th graders)

By Ethnicity
(N= 154,901)

All (N=162,375) 44%
Black (n=10,751) 43%
Latino (n=77,338) 44%
Asian (n=15,563) 28%
White (n=51,249) 49%

Data from Educational Results Partnership
Who took Algebra 2 or higher before grade 12?

Percent of 12th Graders

42%

N=162,375

Percent continued Math in Grade 12

66%

N=67,851

Data from Educational Results Partnership
Algebra 2 or Above Before Grade 12, Percent of 12th Graders by Ethnicity  \((N=154,901)\)

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>% Grade 12</th>
<th>% Continued with Grade 12 Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black (n=10,751)</td>
<td>33%</td>
<td>21%</td>
</tr>
<tr>
<td>Latino (n=77,338)</td>
<td>33%</td>
<td>22%</td>
</tr>
<tr>
<td>Asian (n=15,563)</td>
<td>67%</td>
<td>54%</td>
</tr>
<tr>
<td>White (n=51,249)</td>
<td>49%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Data from Educational Results Partnership
• 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

• 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

• 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 7th 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 11th Graders

- Standard Exceeded: 13%
- Standard Met: 20%
- Standard Nearly Met: 25%
- Standard Not Met: 43%

- Total Students: 432,108

Students by Ethnicity

- Black: 25,369
  - Standard Exceeded: 3%
  - Standard Met: 63%
  - Standard Nearly Met: 54%
  - Standard Not Met: 14%
- Latino: 224,535
  - Standard Exceeded: 11%
  - Standard Met: 26%
  - Standard Nearly Met: 54%
  - Standard Not Met: 14%
- Asian: 40,114
  - Standard Exceeded: 43%
  - Standard Met: 27%
  - Standard Nearly Met: 16%
  - Standard Not Met: 14%
- White: 109,605
  - Standard Exceeded: 18%
  - Standard Met: 25%
  - Standard Nearly Met: 30%
  - Standard Not Met: 26%

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

- 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

- Service Area Population
- Enroll at community college
- Placement in math & English
- On vs off pathway course taking
- Successful course completion
- Obtain Completion Credential

50% - 60%

The biggest driver of inequity emerges at the point of initial assessment

Research question: Are our traditional approaches to student assessment and placement practices contributing to the inequities in outcomes?

*Slide from Greg Stoup, Senior Dean, Contra Costa Community College District*
California Community Colleges Changing Placement Assessment

• 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

Successful completion of transfer-level course

<table>
<thead>
<tr>
<th>Course</th>
<th>Historic Success Rate</th>
<th>Projected Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer-level Math</td>
<td>62%</td>
<td>62%</td>
</tr>
<tr>
<td>Transfer-Level English</td>
<td>72%</td>
<td>71%</td>
</tr>
</tbody>
</table>

Historic success rate
Projected success rate
• 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...

- 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

- 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

**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

• 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?

• 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?

• 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?

• 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

• 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

• 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

Please join us for the final webinar in the series on October 27. More info at theopportunityinstitute.org and learningworksca.org