Improving the Targeting of Treatment: Emerging Research on Postsecondary Math Placement Policies

Quantitative Leap! Webinar Series: Webinar 2

Why Math Placement

Concerns: High proportion of students place into developmental math +

Low success rates in developmental math courses =

Placement has high stakes

Goal: More placements into college-level math courses

More students having the quantitative skills they need for success in college and in life

Today's Presenters

Pamela Burdman

Fellow, The Opportunity Institute

Judith Scott-Clayton

Associate Professor of Economics and Education, Columbia University

Michelle Hodara

Senior Researcher, Education Northwest

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Assessing Remedial Assessments: How Useful are Placement Exams— and Can We Do Better?

Judith Scott-Clayton
Teachers College, Columbia University

Motivation: The Role, Prevalence, and Puzzle of College Remediation

- Remediation is one of most widespread/costly single intervention aimed at improving college success
  - Courses are intended to "remediate" skill deficiencies; cost money (and time) but do not bear college credit
  - Half of all entrants take an average of 2.6 remedial courses each

- And yet evidence suggests process has not been working very well – rigorous studies find null or even negative impact of assignment to remediation

- How much of the problem could be due to poor targeting of treatment, i.e. inaccurate placements? And how much better could we do?

No System is Perfect – Will always have mistakes in both directions

- If truly unprepared students are assigned to college-level coursework…
  - They may do worse than they would have otherwise (in terms of grades, persistence, etc)
  - They may depress achievement of their peers

- If truly prepared students are assigned to remediation…
  - They may receive little/no benefit from additional instruction, but incur tuition and time costs
  - May be delayed/discouraged from further study

Our Research on Placement Validity
(Scott-Clayton, 2012; Scott-Clayton et al. 2014)

- We focus on the accuracy of the assignment mechanism—placement exam scores—which determine whether someone receives remediation

- Using administrative data and a rich predictive model of college grades, we ask the following questions:
  - How accurately do placement exams distinguish between those likely/unlikely to succeed?
  - How much could assignment accuracy be improved by incorporating information from high school transcripts into the screening process?
  - What do current remedial assignment thresholds imply about institutional preferences?

- Surprisingly, HS transcript info has not been widely utilized in placement decision-making

Methodology

- We use rich predictive model to estimate individual students' probability of success in college-level work, and then estimate how often mistakes occur under alternative remedial screening policies

- Compute several validity metrics, including severe error rates (SERs), to evaluate outcomes under alternative policies
  - Placement using test scores only (current policy)
  - Placement using HS transcript only, keeping remediation rate fixed
  - Placement using both test scores/ HS transcript, keeping RR fixed
  - Altering threshold for remedial placement under any of the above rules

- Use data from 2 large CC systems (will show only one here); "HS transcript data" included more than just overall GPA but that was by far most important component

Figure 1

Classifications Based on Predicted Outcomes and Treatment Assignment

Treatment assignment	Predicted to Succeed in College-Level Course?	
	No	Yes
Assigned to remediation	(1) accurately placed (true positive)	(2) Under-placed (false positive)
Assigned to college-level	(3) Over-placed (false negative)	(4) accurately placed (true negative)

Table 2. Predicted Severe Error Rates and Other Validity Metrics Using Alternative Measures for Remedial Assignment

	Measures Used for Remedial Assignment					
	Test Scores	HS GPA/ Units	Test+HS Combined	Test Scores	HS GPA/ Units	Test+HS Combined
A. LUCCS Sample	COMPASS® Sample					
Math	*N=37,813*					
Severe error rate	23.9					
Severe overplacement rate	5.3					
Severe underplacement rate	18.5					
CL success rate (>=C), if assigned to CL*	67.5					
Remediation rate	76.1					
English	*N=34,697*					
Severe error rate	33.4					
Severe overplacement rate	4.5					
Severe underplacement rate	28.9					
CL success rate (>=C), if assigned to CL*	71.6					
Remediation rate	80.5					

Table 2. Predicted Severe Error Rates and Other Validity Metrics
Using Alternative Measures for Remedial Assignment

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Math	*N=37,813*					
Severe error rate	23.9	22.9	21.4			
Severe overplacement rate	5.3	5.0	4.7			
Severe underplacement rate	18.5	17.9	16.7			
CL success rate (>=C), if assigned to CL*	67.5	69.8	72.4			
Remediation rate	76.1	74.7	74.7			
English	*N=34,697*					
Severe error rate	33.4	29.4	29.3			
Severe overplacement rate	4.5	2.2	2.7			
Severe underplacement rate	28.9	27.2	26.6			
CL success rate (>=C), if assigned to CL*	71.6	81.8	81.4			
Remediation rate	80.5	79.8	79.8			

Optimal cutoffs: trading off over/under placements

- Analyses up to this point held overall remediation rate fixed

- But allowing diagnostic threshold to vary opens door to larger improvements in accuracy

- If policymakers weight under/over placements equally, then optimal cutoff occurs where overall error rate is minimized

- Our analysis suggested that using multiple measures and lowering cutoffs would both reduce errors AND permit more students to enter CL courses, with very little reduction in CL pass rate

Summary of key findings

- It is not easy to predict who will succeed in college

- But high school transcript info is at least as useful as and often superior to test scores
  - Reduces severe placement errors by up to 30%
  - No tradeoff here: reduces both over/under placement AND improves college-level success rates, without changing the remediation rate

- Remediation rates could be lowered substantially without increasing placement errors or lowering college success rates

- More recent evidence/experience from places like LBCC has supported our predictions

- Status quo policies reflect institutional preference (intentional or not) for under- rather than over placement

For more information:

Please visit us on the web at http://ccrc.tc.columbia.edu, where you can download presentations, reports,   *CCRC Briefs*, and sign-up for news announcements.

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The Opposing Forces that Shape Developmental Education

Michelle Hodara

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System-wide Consistency vs. Institutional Autonomy

The Case For System-wide Consistency

- Communicates consistent, clear college-ready standards to students and high schools

- Facilitates tracking performance across colleges & transfer between colleges.

- Reduces inequity and confusion for students.

The Case For Institutional Autonomy

- No clear evidence on what developmental policy is most effective.

- May guarantee little more than uniform implementation of ineffective policy.

- Colleges have flexibility to tailor policies to their students.

Developing consistent standards through consensus & evidence

New Jersey community colleges varied widely on tests, cutscores, and testing policies until...

- VPs created math and English committees with faculty from each college, testing coordinators, and IR staff

- Committees decided on test, statewide cutscores, test-exemption policies, test procedures, and follow-up studies

- VPs brought decisions to departmental meetings to ensure broad support from college faculty

- After yearlong process, presidents voluntarily agreed to statewide set of policies

- After statewide validity study, decided to use multiple measures for students who score in "decision zones"
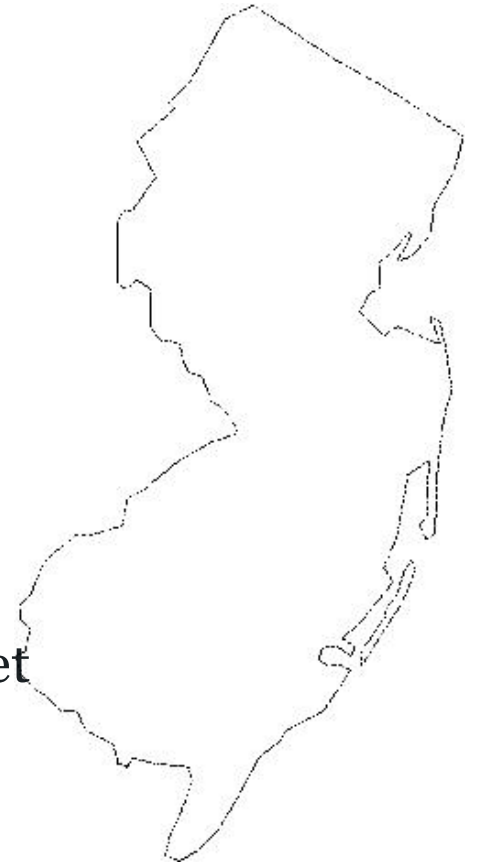
Efficient vs. Effective Assessment

The Case For Efficient Assessment

- Colleges must evaluate thousands of incoming students ever year.
- Computer-adaptive placement tests are quick, inexpensive, and can almost instantaneously determine the placement for each student.

The Case For Effective Assessment

- Current tests not aligned with content students need to know to pass college-level classes.
- Tests do not assess non-cognitive competencies.
- Tests do not provide information to be able to offer targeted interventions.

Supporting Progression vs. Upholding Standards

The Case For Supporting Progression

- National push to increase college completion hampered by high rates of remediation.

- Only 28% of developmental students go on to earn a credential.

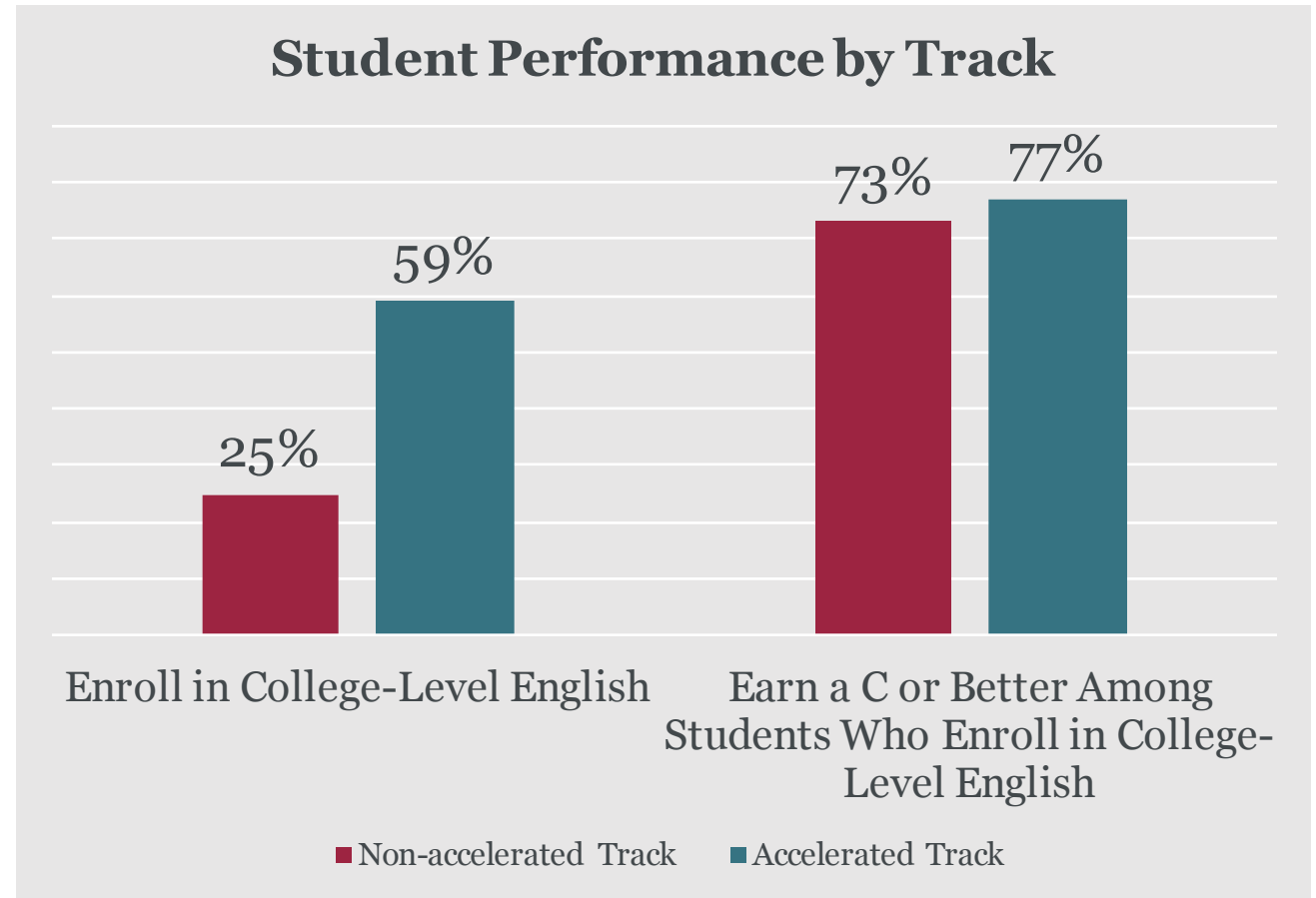- Traditional sequence structure deters college progression.

The Case For Upholding Standards

- Reforms designed to support progression may result in both
  - Greater numbers of under-prepared students in college-level classes.
  - Choice between relaxing standards or failing large numbers of students.

High-Quality Acceleration Models Maintain Pass Rates in College-Level Classes

Chabot College's accelerated pathway raises English college-level enrollment AND accelerated students are equally likely to pass college-level English.

Student Performance by Track

	Non-accelerated Track	Accelerated Track
Enroll in College-Level English	25%	59%
Earn a C or Better Among Students Who Enroll in College-Level English	73%	77%

Questions to ponder...

- What value do you see in statewide consistency around the placement process?

- What would be the ideal process for determining the college readiness of incoming students?

- What kinds of structures would support faculty as they work to both uphold academic standards and promote student progression in embedded supports?

Let Icarus Fly: The Potential for Multiple Measures Placement to Re-imagine Student Capacity in Mathematics

John J. Hetts
Senior Director of Data Science, CalPASS Plus/Educational Results Partnership
Former Director of Institutional Research, Long Beach City College

(In collaboration w/Peter Bahr, Loris Fagioli, Craig Hayward, Dan Lamoree, Mallory Newell, and Terrence Willett)
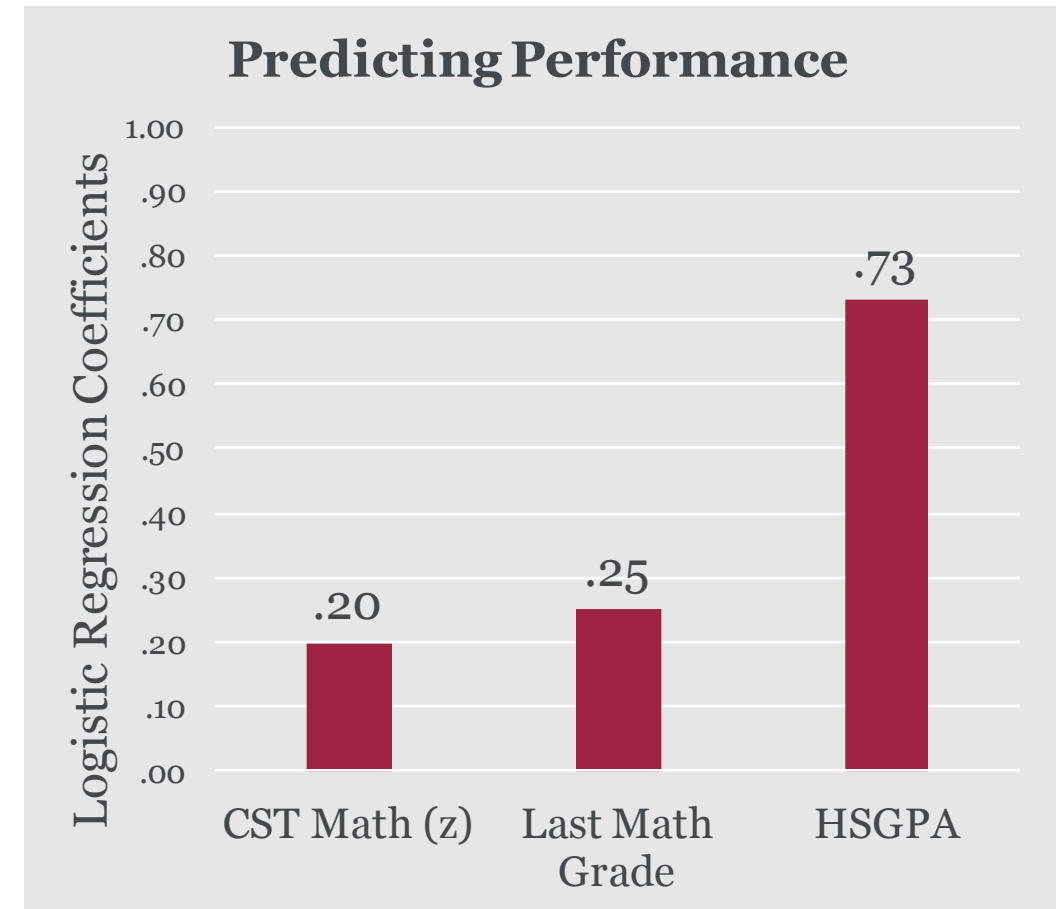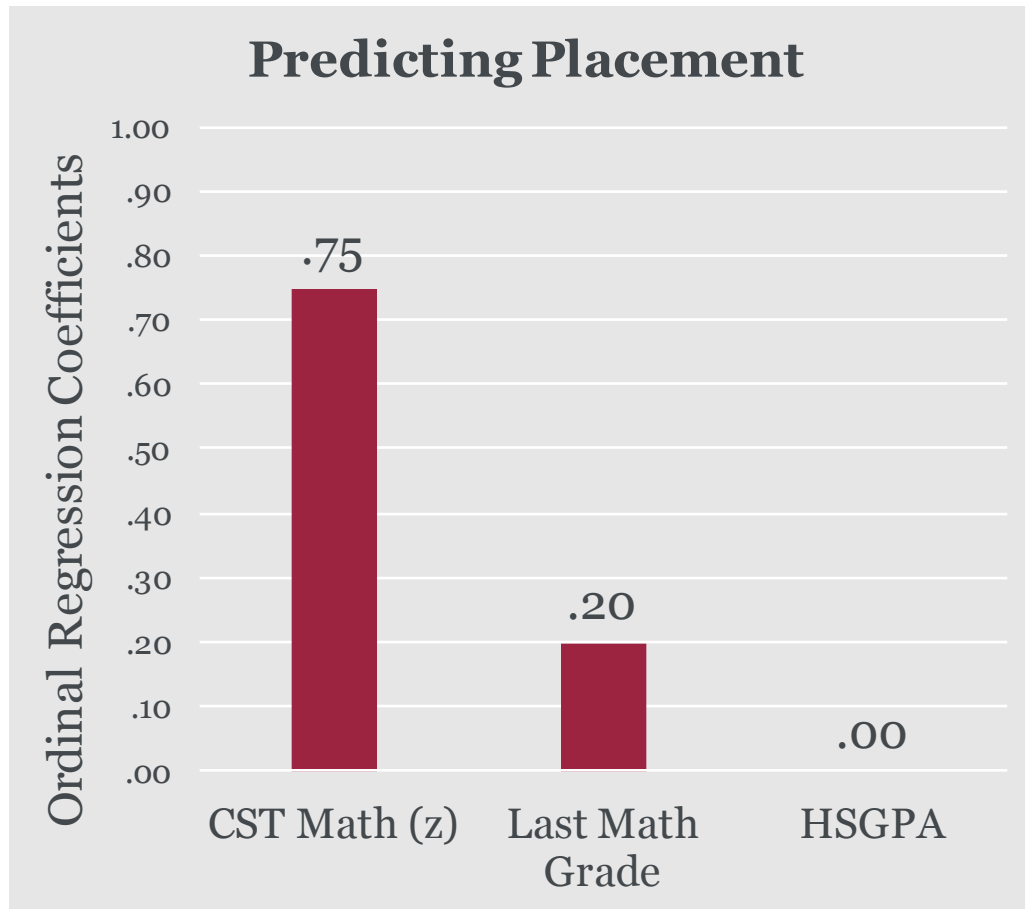
LBCC Multiple Measures Research

- Initial research: Five cohorts tracking more than 7,000 HS grads who matriculate to LBCC directly

- Examined predictive utility of wide range of high school achievement data

- For predicting:
  - How students are assessed and placed
  - How students perform in those classes
  - (and alignment between them)

Alignment in Math

Predicting Placement

Ordinal Regression Coefficients

- CST Math (z): .75
- Last Math Grade: .20
- HSGPA: .00

Predicting Performance

Logistic Regression Coefficients

- CST Math (z): .20
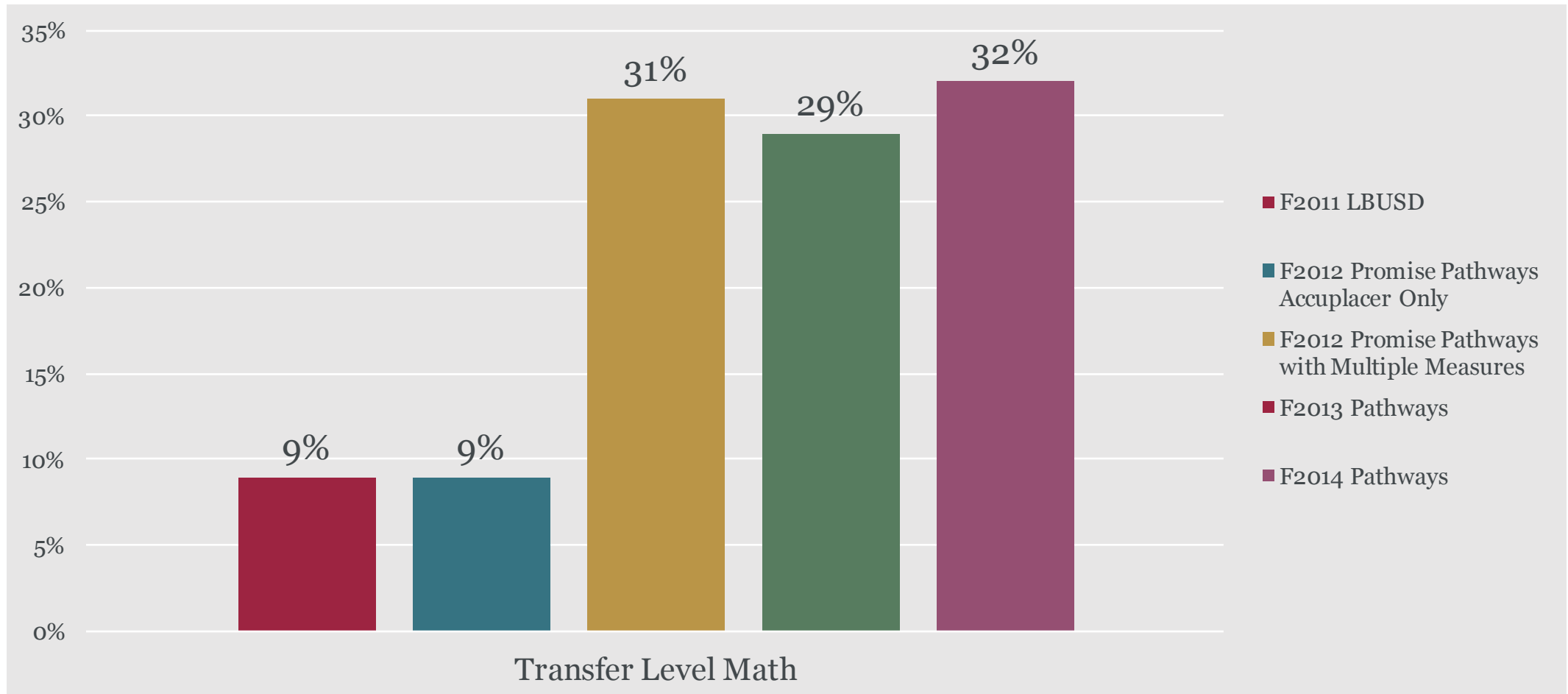- Last Math Grade: .25
- HSGPA: .73

Re-imagined student capacity

- Starting in Fall 2012, students from LBUSD were provided an alternative assessment

- Reverse engineered analysis to place students using:

- Overall HSGPA

- Last high school course in discipline

- Grade in last course in discipline

- Last standardized test in discipline (and level)

- Placed students in highest course where predicted success rate higher than average success rate for that course.

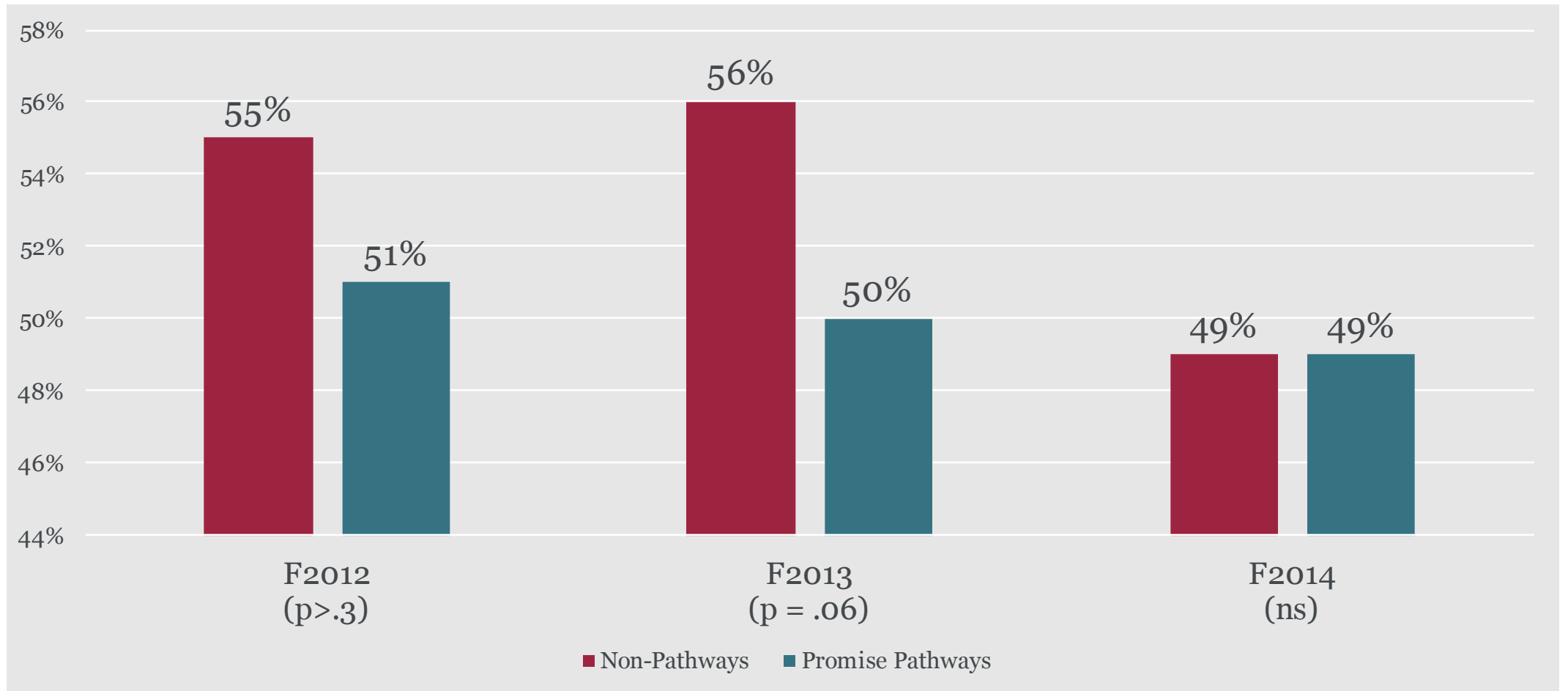- Built semester plans with those placements and courses pre-populated

Implementing Multiple Measures Placement: LBCC Transfer-level Math Placement Rates
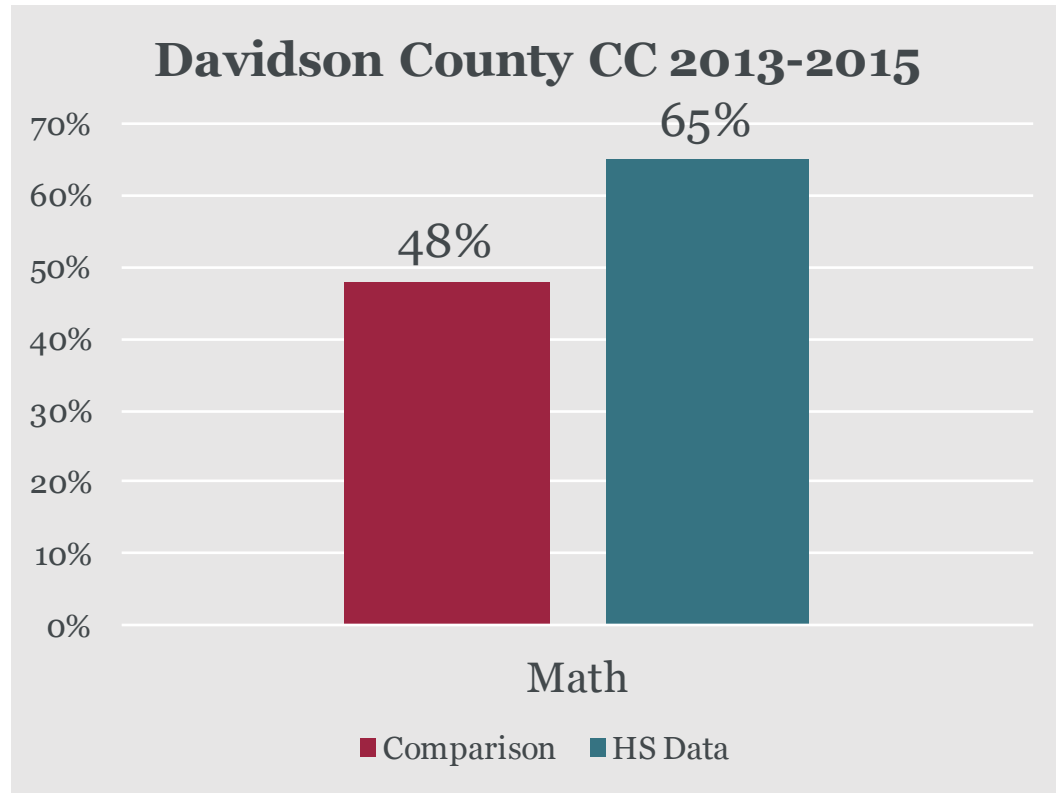

Chart: Transfer Level Math placement rates

- F2011 LBUSD: 9%
- F2012 Promise Pathways Accuplacer Only: 9%
- F2012 Promise Pathways with Multiple Measures: 31%
- F2013 Pathways: 29%
- F2014 Pathways: 32%

Comparison against traditional sequence: LBCC success rates in transfer-level courses

Chart showing success rates with Non-Pathways (red) and Promise Pathways (teal):

- F2012 (p>.3): Non-Pathways 55%, Promise Pathways 51%
- F2013 (p = .06): Non-Pathways 56%, Promise Pathways 50%
- F2014 (ns): Non-Pathways 49%, Promise Pathways 49%

Legend: ■ Non-Pathways ■ Promise Pathways

College-level course completion, other recent national examples: http://bit.ly/CCCSEMM


Davidson County CC 2013-2015

- Math: Comparison 48%, HS Data 65%

Rules used for English and Math: HSGPA >=2.6 and completion of four years of mathematics including one year beyond Algebra 2 in HS

Ivy Tech 2014-2015

- Math: Accuplacer 59%, HS Data 68%
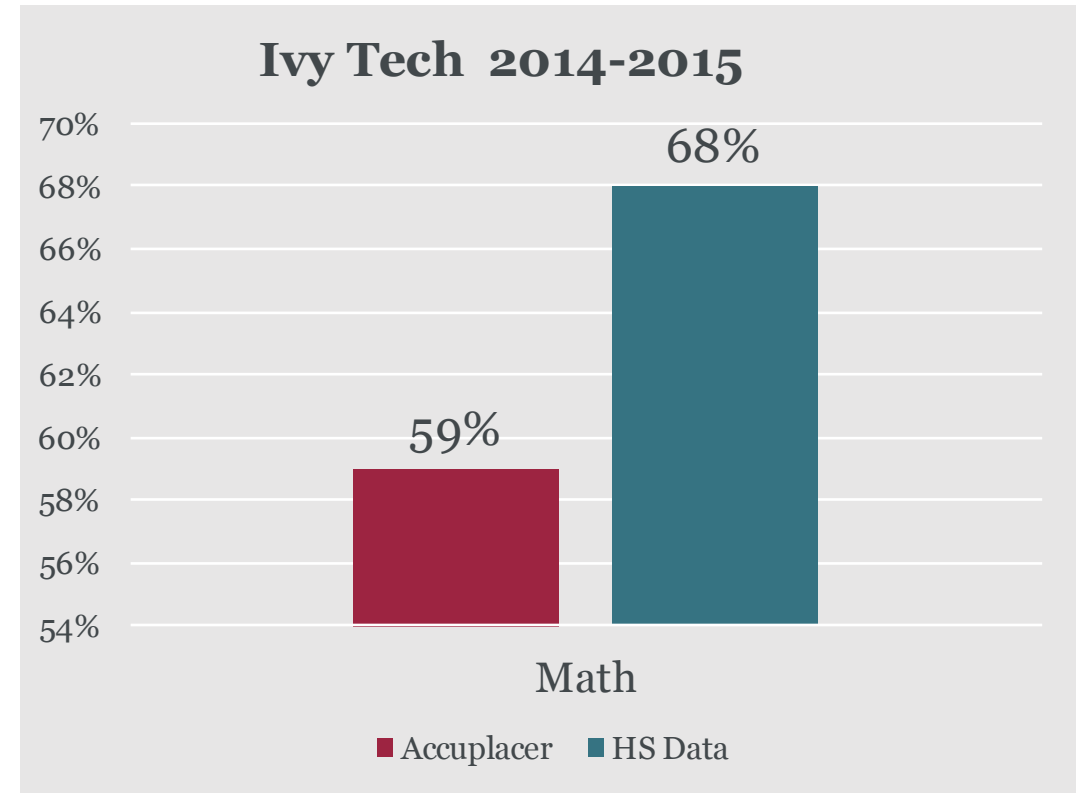
Rules used for English and Math: HSGPA >=2.6

Dramatic impacts on transfer Math completion within first two years – Long Beach City College

F2011

F2012

■ Total ■ Black ■ Hispanic ■ Asian ■ White
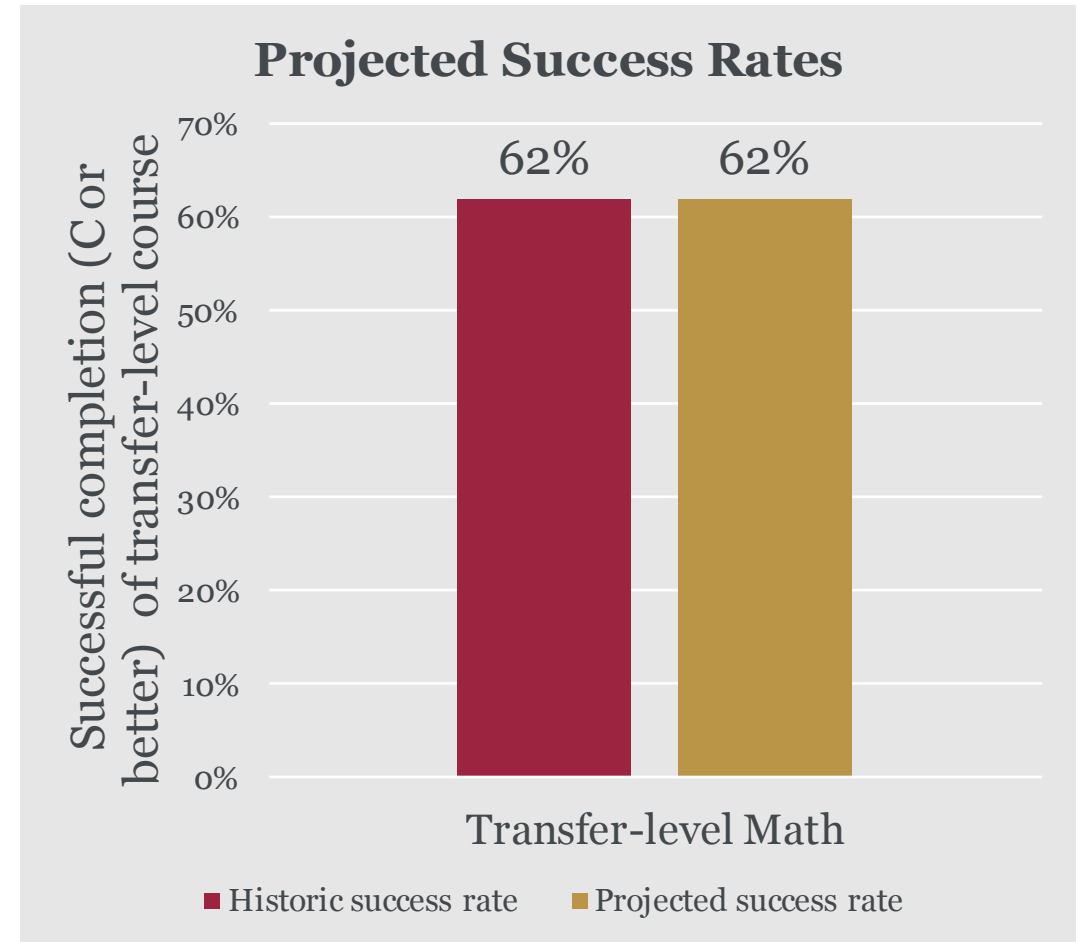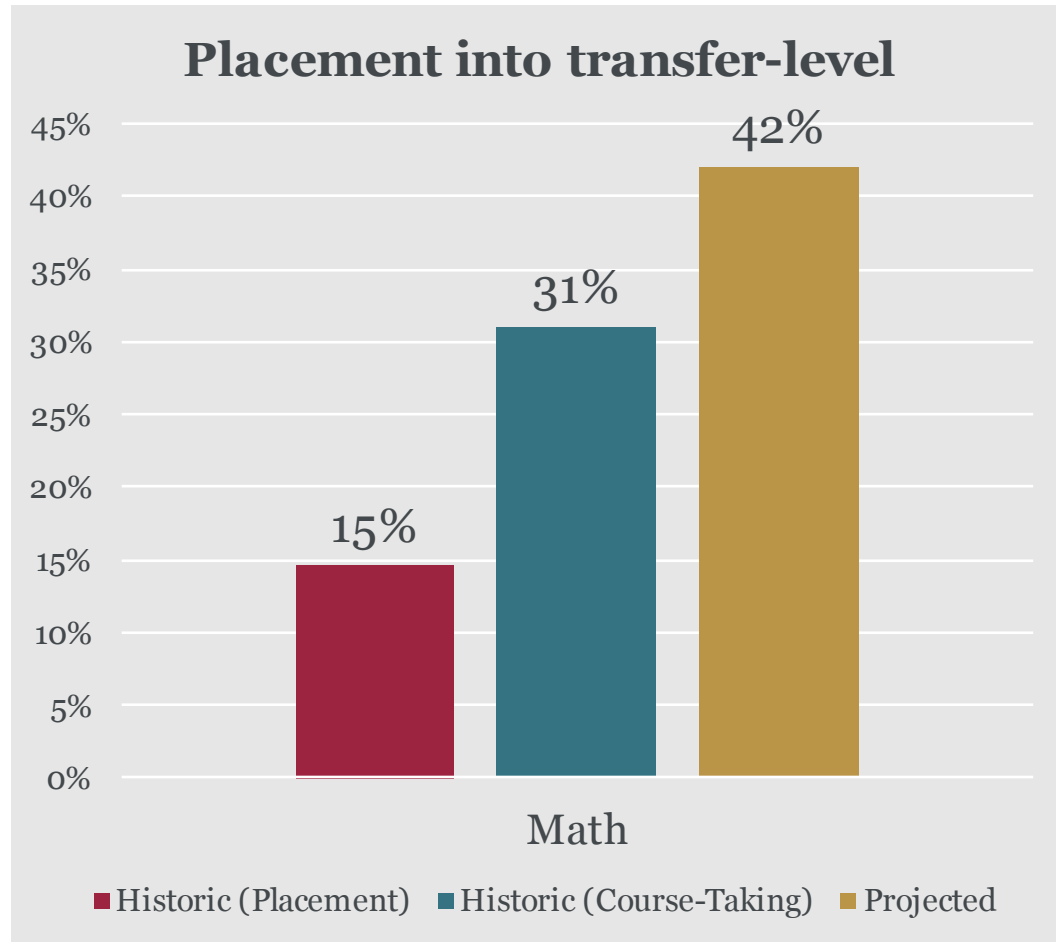
http://www.lbcc.edu/PromisePathways
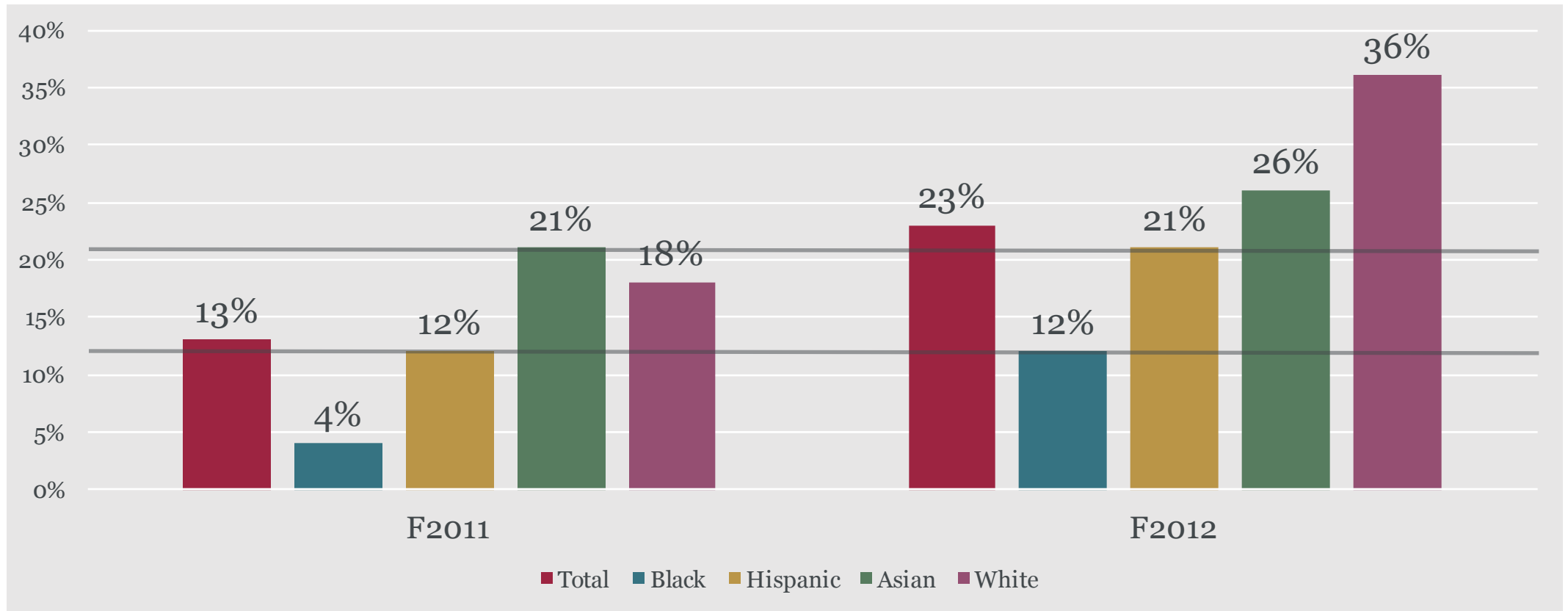
Multiple Measures Assessment Project

- Collaborative effort of CCCCO, Common Assessment Initiative (CAI), Cal-PASS Plus (Educational Results Partnership & San Joaquin Delta College), RP Group and now 58 CCC pilot colleges

- Identify, analyze, & validate multiple measures data (including HS transcript data, non cognitive variable data, & self-report HS transcript data

- For English, Mathematics, ESL and Reading

- Focus on predictive validity (success in course) using categorization and regression tree models (robust to missing data, non-linear effects, and interactions)

- Key variables included HSGPA*, last course in discipline, grade in course, AP course-taking, level of course, delay, CST scores, etc.

- Engage pilot colleges to conduct local replications, test models and pilot their use in placement, and provide feedback

- http://bit.ly/MMAP2015 and http://bit.ly/MMAPRules

Projected impact on placement and success

Placement into transfer-level

- 15% — Historic (Placement)
- 31% — Historic (Course-Taking)
- 42% — Projected

Math

Legend: ■ Historic (Placement) ■ Historic (Course-Taking) ■ Projected

Projected Success Rates

Successful completion (C or better) of transfer-level course

- 62% — Historic success rate
- 62% — Projected success rate

Transfer-level Math

Legend: ■ Historic success rate ■ Projected success rate

Common Concerns/Multiple Measures Myths

- Students placed via multiple measures will not be successful
- Our test is different/better/more awesome
- It won't work at my school/type of institution
- Students would be better off going through developmental education
- Students will only get a "C" in transfer-level work which will reduce opportunity to transfer to four-year institution
- High school GPA is only predictive for recent graduates
- It's too hard to get or use transcripts/it's not worth it
- Will threaten my college's enrollment/FTES
- It will take us 2-3 years to make progress at my college

Your test/system/school/segment is exceptionally unlikely to be different

Our test wasn't different - Compass

Course	Compass Test	Compass	HSGPA	HSGPA + Compass
Arithmetic	Pre-Algebra	**.57**	.34	.66
Algebra	Pre-Algebra	.36	**.65**	.80
Intermediate Algebra	Algebra	.47	**.66**	.84
College Algebra	Algebra	.41	**.76**	.88
College Algebra	College Algebra	.51	**.76**	.94

http://bit.ly/COMPASSValidation (Table 4 - Median Logistic R)

Our test wasn't different - Accuplacer

Math	Accuplacer	11th Grade GPA
Transfer - STEM	.19	.24
Transfer – Stats	.16	.31
Transfer – GEM	.09	.26
1 level below	.21	.28
2 levels below	.11	.26
3 levels below	.11	.23
4 levels below	.05	.19

MMAP (in preparation): Correlation with success (C or better) in course in CCC

MAT141-171 Grades: Correlation Coefficients
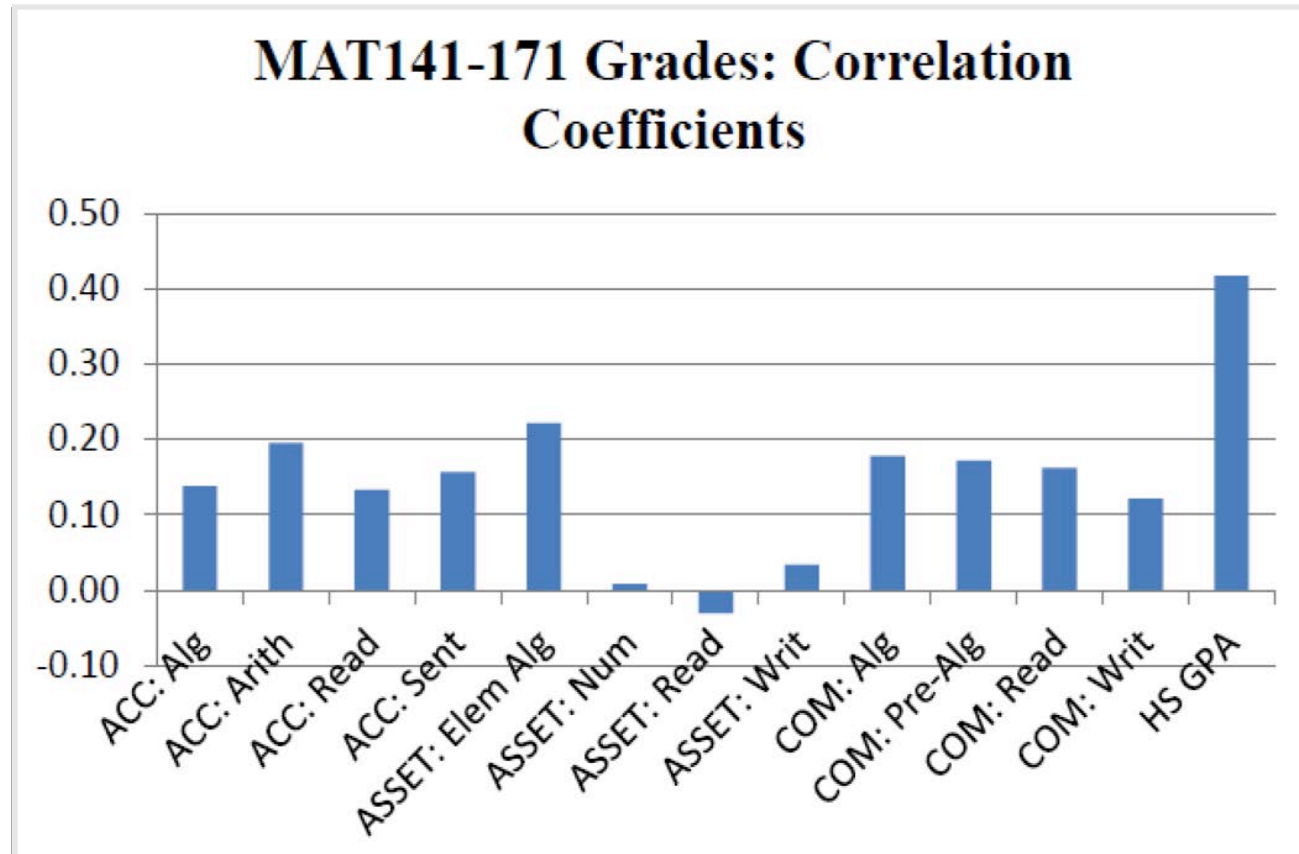
From Bostian (2016), North Carolina Waves GPA Wand, Students Magically College Ready adapted from research of Belfield & Crosta, 2012 – see also Table 1)

Figure 7. Among University of Alaska students who enrolled directly in college math courses, high school grade point average explained more of the variation in college math grades than did exam scores, 2008/09–2011/12
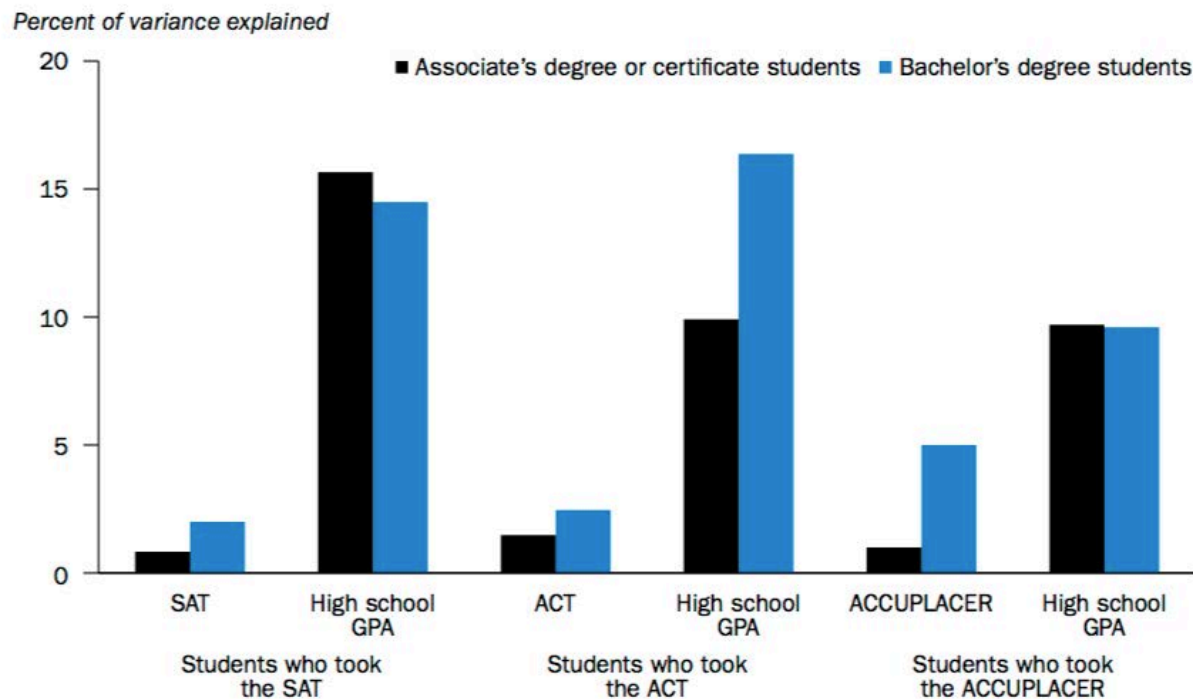
From Hodara, M., & Cox, M. (2016), **Developmental education and college readiness at the University of Alaska**: http://bit.ly/HSGPAAK

Scant evidence that developmental education improves student outcomes

On balance, massive, costly semester-long intervention has far less impact than expected

Overview of Findings on Outcomes for Developmental Students[9]

■ Positive ■ Negative □ Null

DEVELOPMENTAL MATH STUDENTS

| Study	Level	Short-Term Impacts			Medium- & Long-Term Impacts		
		Persistence	Passed College-Level Math	Grade in College-Level Math	Persistence	College-Level Credits Earned	Credential and/or Transfer
TENNESSEE[10]	UPPER	NEG		NULL (conditional)	NULL	NULL (conditional)	NEG (credential)
TEXAS[11]	UPPER	NULL					NULL
OHIO[12]	UPPER				NULL		POS (transfer)
LUCCS[13]	UPPER		NEG	NEG	NULL	NULL	NULL
FLORIDA[14]	UPPER	NULL	NULL			NULL	NULL
VIRGINIA 1[15]	LOWER vs. MIDDLE		NULL				NEG (credential)
TENNESSEE	LOWER vs. MIDDLE	NULL		NULL (conditional)	NULL	NULL (conditional)	POS (credential)

http://bit.ly/CCRCDEVED

Even if students get lower grade in transfer-level course, potentially increases students' likelihood of transfer

Students who get a C in transfer-level Math are more likely to transfer

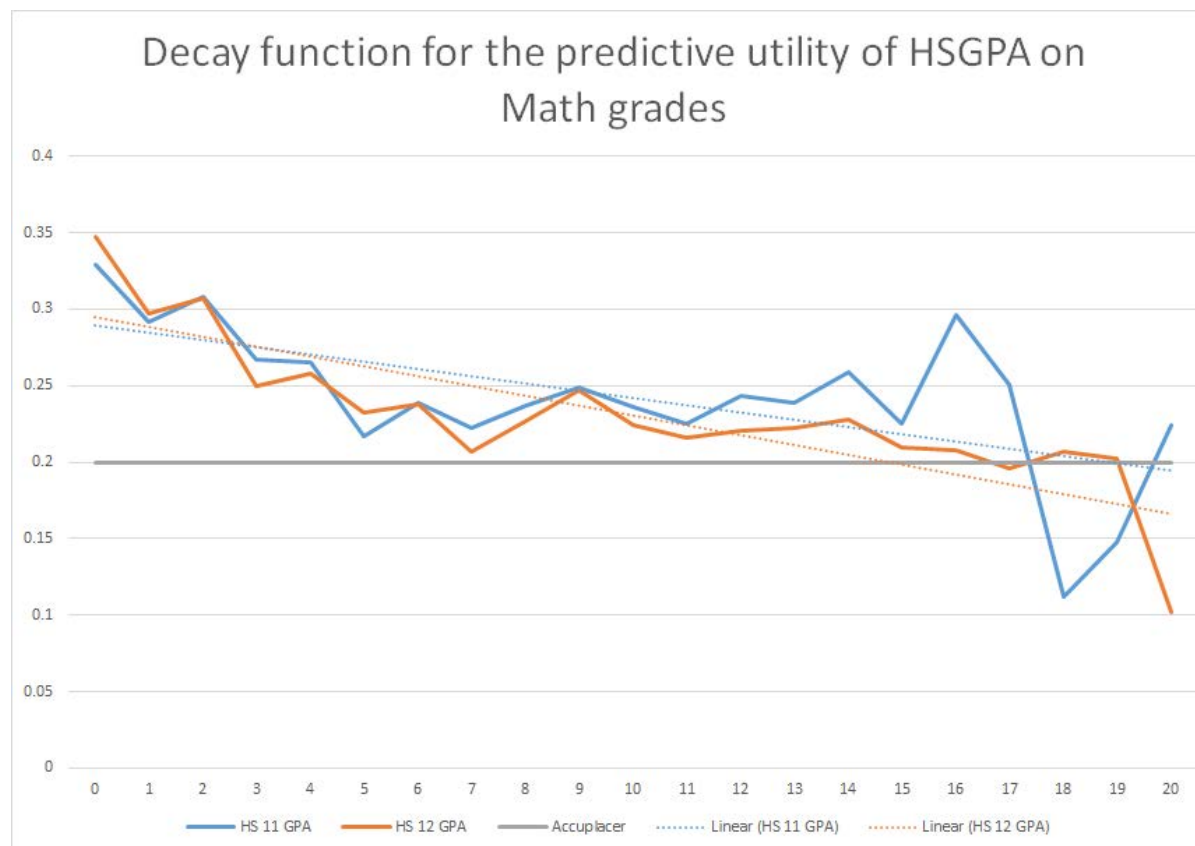**Transfer rates by level of first Math course and grade**
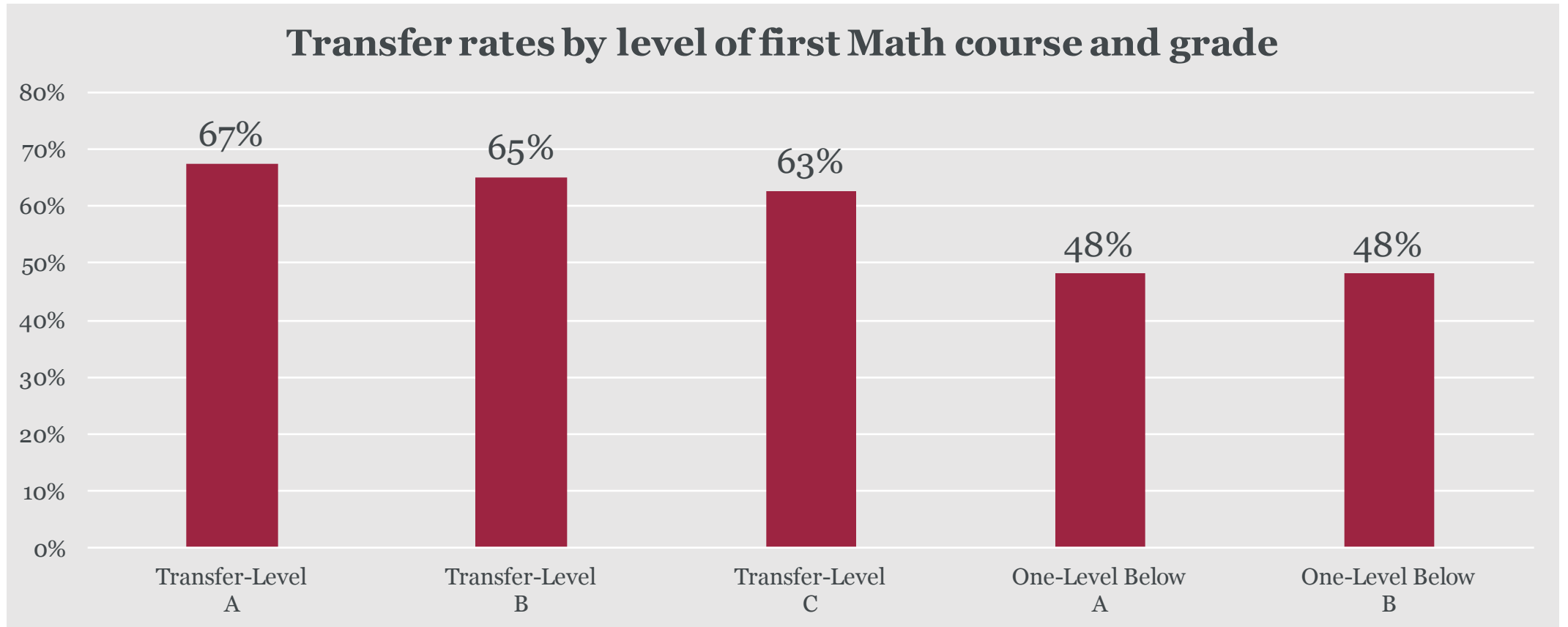
Hayward & Fagioli (in preparation) Irvine Valley College Multiple Measures Research: First course enrolled in, Spring 2000 to Fall 2011 - transfer within 4 years of course

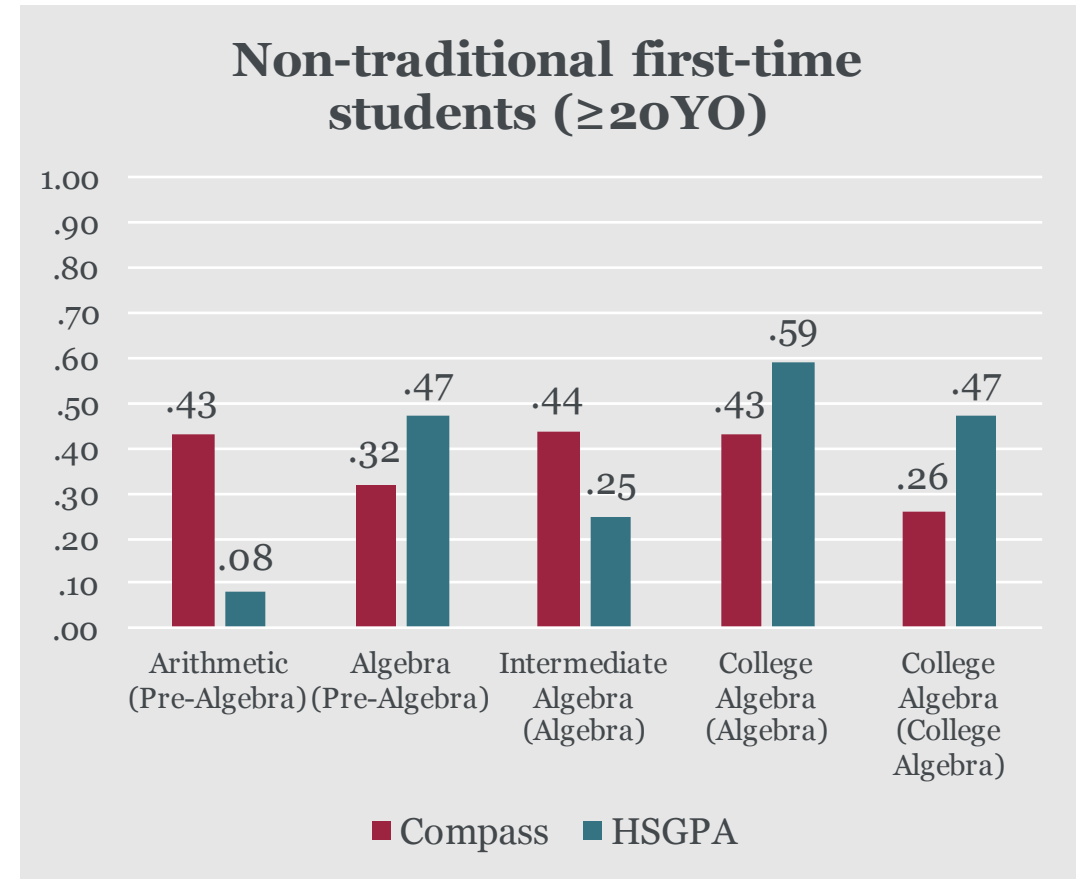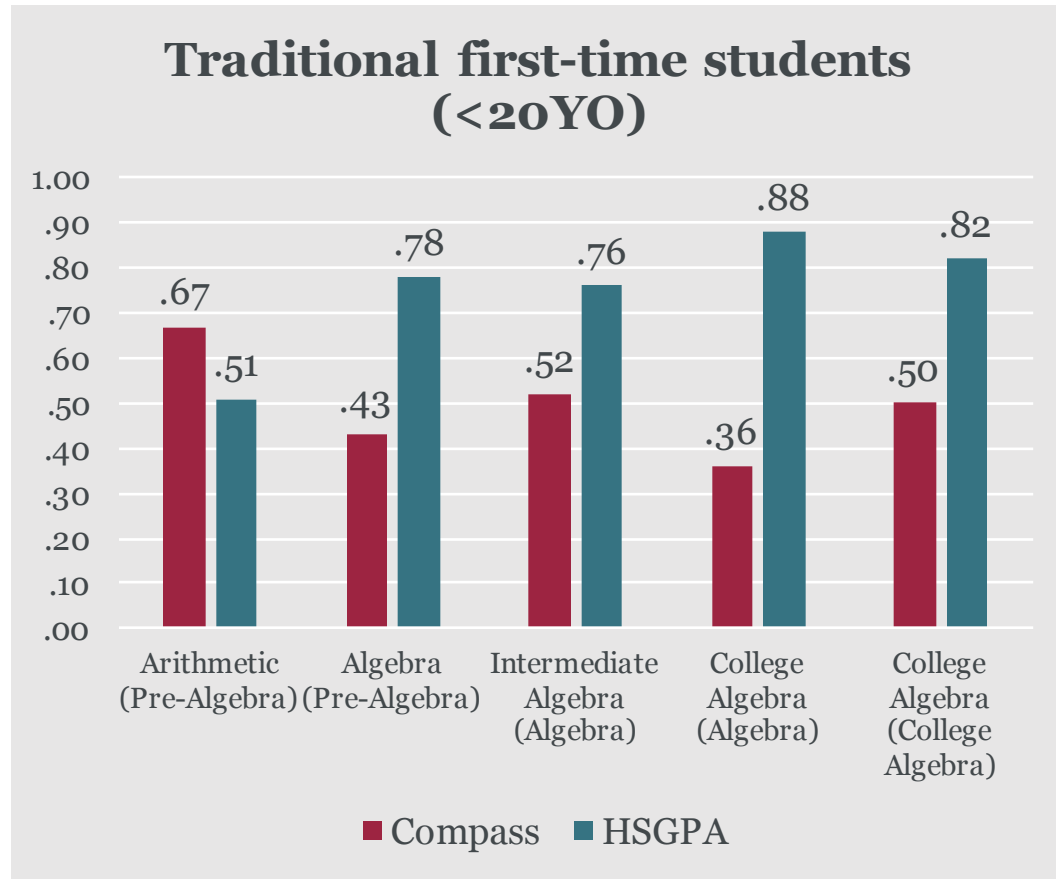# High School GPA is more predictive than tests for far longer than people think

MMAP (in preparation): correlations b/w predictor and success (C or better) in transfer-level course by # of semesters since HS

Utility of HSGPA vs. Compass for non-traditional students

Traditional first-time students (<20YO)

Non-traditional first-time students (≥20YO)

Logistic regression coefficients of HSGPA and test (in parentheses) for each courses (Table 6) http://bit.ly/COMPASSValidation

Summary

- On average, evidence-based multiple measures
  - maintains or improves success rates in transfer-level courses
  - dramatically increases transfer-level placement & completion of sequence
  - **saves students 1-2 semesters of developmental education**

- Majority of concerns hold little to no water - reveal stereotypes about community college students or high school preparation that just aren't true/not based on evidence

- Coupled with work on acceleration, corequisite developmental education, and cutscore reform, demonstrates that higher education generally and community colleges specifically have been systematically and substantially underestimating our students' capacity
  - **Your students capacity....**
  - Until you get back to campus.

- It's probably an order of magnitude more effective at changing student outcomes and reducing student equity gaps than virtually any initiative at your college
  - and is vastly less expensive and entirely possible with existing staff & resources

The California State University and Five Math Placement Challenges

Eric Hsu
Director, Center for Science and Mathematics Education
Professor, Mathematics

Entry Level Math Requirement

- All incoming first-year 64K students at 23 CSU campuses need to meet ELM requirement

- 53% Exempt

- 11% Pass ELM Test
  - (~30% of takers, cut scores set centrally)

- 8% Early Start coursework summer before enrollment

- 24% Remediation, pass within a year
  - Non-college credit Algebra 1 and 2 at CSU

- 3% Remediated, dis-enrolled after year (12% of remediated)
  - Typically passing, go to 2-year colleges and hope to transfer back

Basic Remediation Numbers

- Fall 2015 Incoming 1st Yr Math Proficient
  - Overall 72.6%
  - Latino ~63%; Af Am ~52%
  - Male 80.5%, Female 66.7%

Five Current Placement Challenges

1. Exemptions and Test Validity
2. New Wave of Exemptions
3. Attrition vs Math Readiness
4. Mandatory or Advisory Placement?
5. Modernizing Standards and Policy

1. ELM Exemptions and Test Validity

- Exemptions
  - SAT Reasoning, Math 1 or Math 2 >= 550
  - ACT >= 23; AP Calc AB, Calc BC, Stats >= 3
  - Transfer of college Quantitative Reasoning >= C
  - *Standard Exceeded* - CA Assessment of Student Performance and Progress (CA Smarter Balanced)
  - *Conditional Exempt* CAASPP + Gr 12 Math >= C
- More Exemptions => Lower Scoring Test Pool
  - So Test gets easier, for discrimination (bad face validity)
  - (pass score not changing)
  - ETS pre-testing items on smaller non-representative group

2. New Wave of Exemptions

- Early Assessment Program: Ready / Conditional / Not Ready
- 2014 and Before
  - voluntary extra 15 Qs on California Standards Test.
  - 21K / 85K / 100 K
- 2015 and After
  - CST replaced by California Assessment of Student Performance and Progress (CAASPP) (Smarter Balanced)
  - Now automatic EAP via CAASPP subscore.
  - 46K / 75K / 280K
- Big Increase in Students Exempt via EAP (even though overall performance average drops)
- Will test the effectiveness of this new placement system!

3. Attrition vs Math Readiness

- Test is written to content specifications by CSU math faculty set in 1987, revision in 2002. Pre-Common Core.
  - Algebra, geometry, data analysis (in thirds)
- Burdman's bootleg ETS internal report on college level math success without remediation.
  - Data is bad, but we need to create good data!
- 2 Year College Studies Alarming
  - Remediated pass rate 79%, unmediated 72%
  - Counting dropout rate, remediated
    - 27% pass; 11% dropped out AFTER passing

Bailey, Jeong, & Cho (2010), Calcagno & Long (2008), Martorell & McFarlin Jr. (2011)

4. Mandatory or Advisory Placement?

- Attrition plus morale in classes is low

- In MAA National Study of College Calculus
  - Precalculus also poor preparation for calculus
  - Successful case studies: about 1/2 had advisory, non-mandatory placement (> 70% of smaller sites)

- At SFSU, English moved to non-mandatory self-placement for remediation.

- Alternate developmental math models
  - Statway - two semesters from Algebra 1 to College Stats
    - just-in-time algebra for college-level stats
    - official policy requires Algebra 2
    - not preparing at Algebra 2 level
- Post-Common Core
  - REAL Algebra at SFSU
    - more aligned with ELM and Common Core - renaming ELM 1 and ELM 2
    - team problem solving
    - students performing much better in most next college-level math courses

Future CSU Working Group on Placement

- (probably) recommend changes to
  - 2002 ELM specifications
  - EO 665 (Systemwide Remediation Policy)
  - Statement on Competencies in Math

Resources

- [The Opposing Forces That Shape Developmental Education: Assessment, Placement, and Progression at CUNY Community Colleges](#)

- [Improving the Targeting of Treatment: Evidence from College Remediation](#)

- [Assessing Developmental Assessment in Community Colleges: A Review of the Literature](#)

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.

Stay tuned for information on Webinars 3 and 4 beginning in August.