CSPCC #0910240
PtC #1430540

Teaching Calculus Now: Current Trends & Best Practices AM Session

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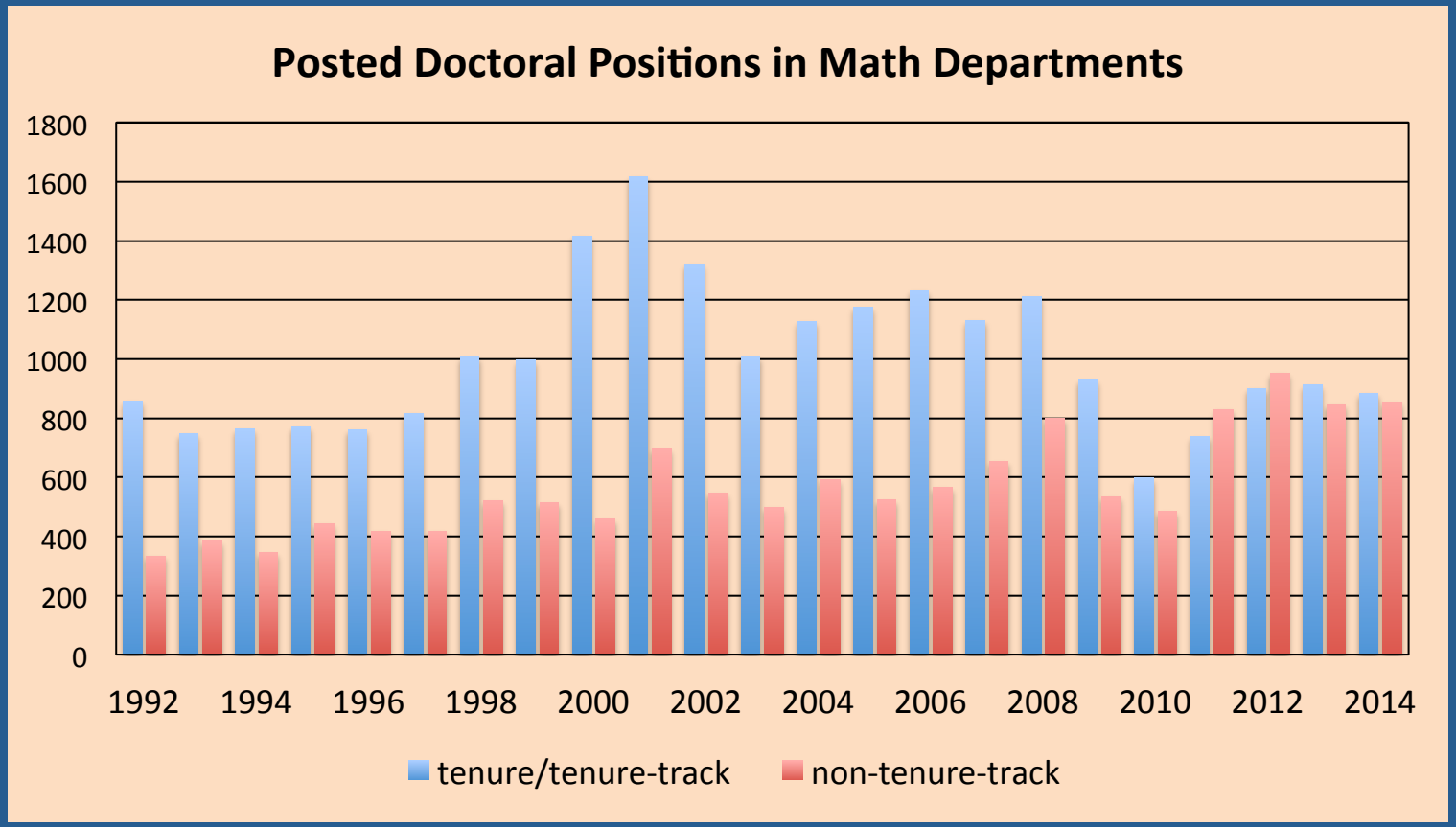
PDF file of these slides available at
www.macalester.edu/~bressoud/talks

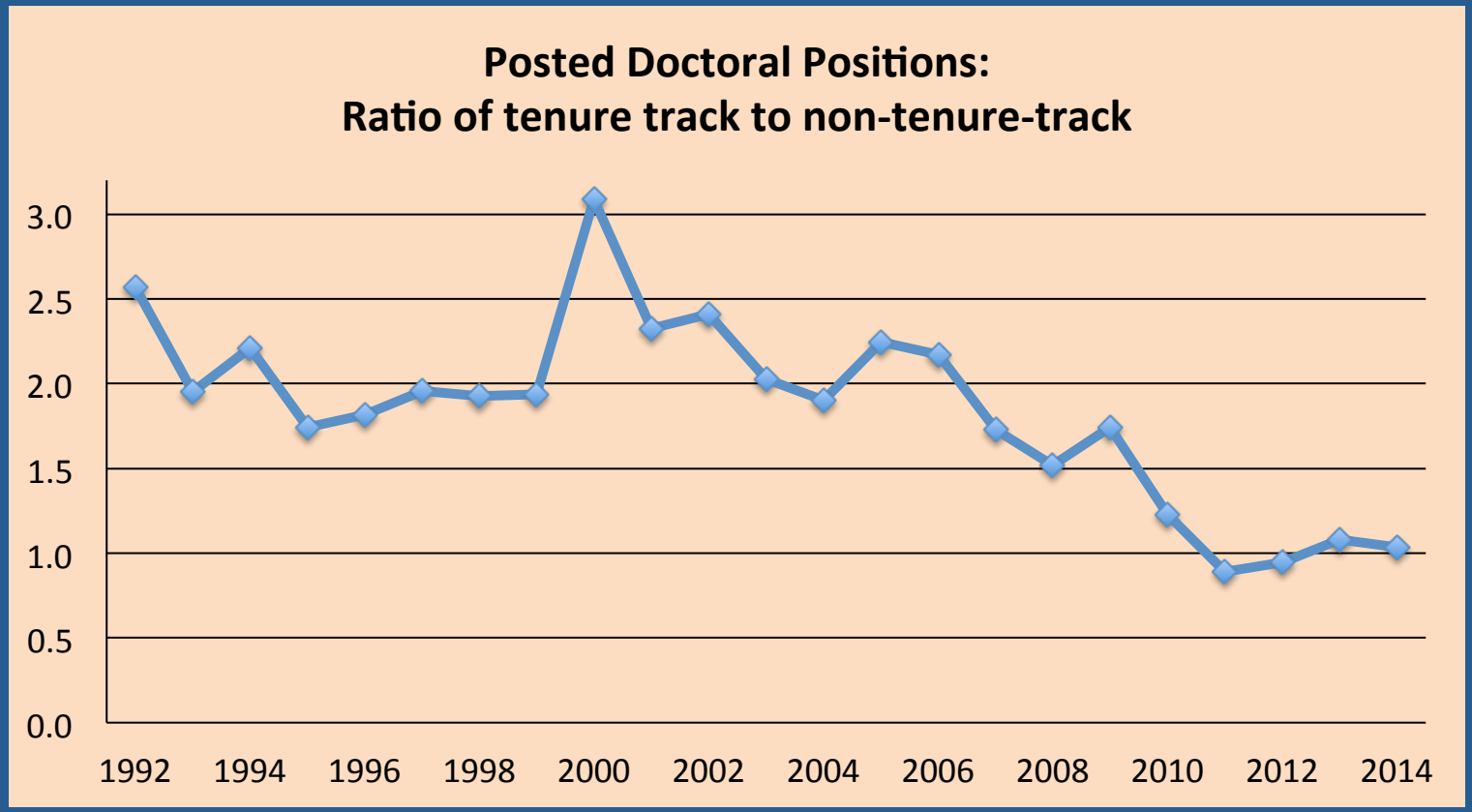
1. Economic realities
2. Demands of the client disciplines
3. The rush to calculus

Economic Realities



Source: AMS

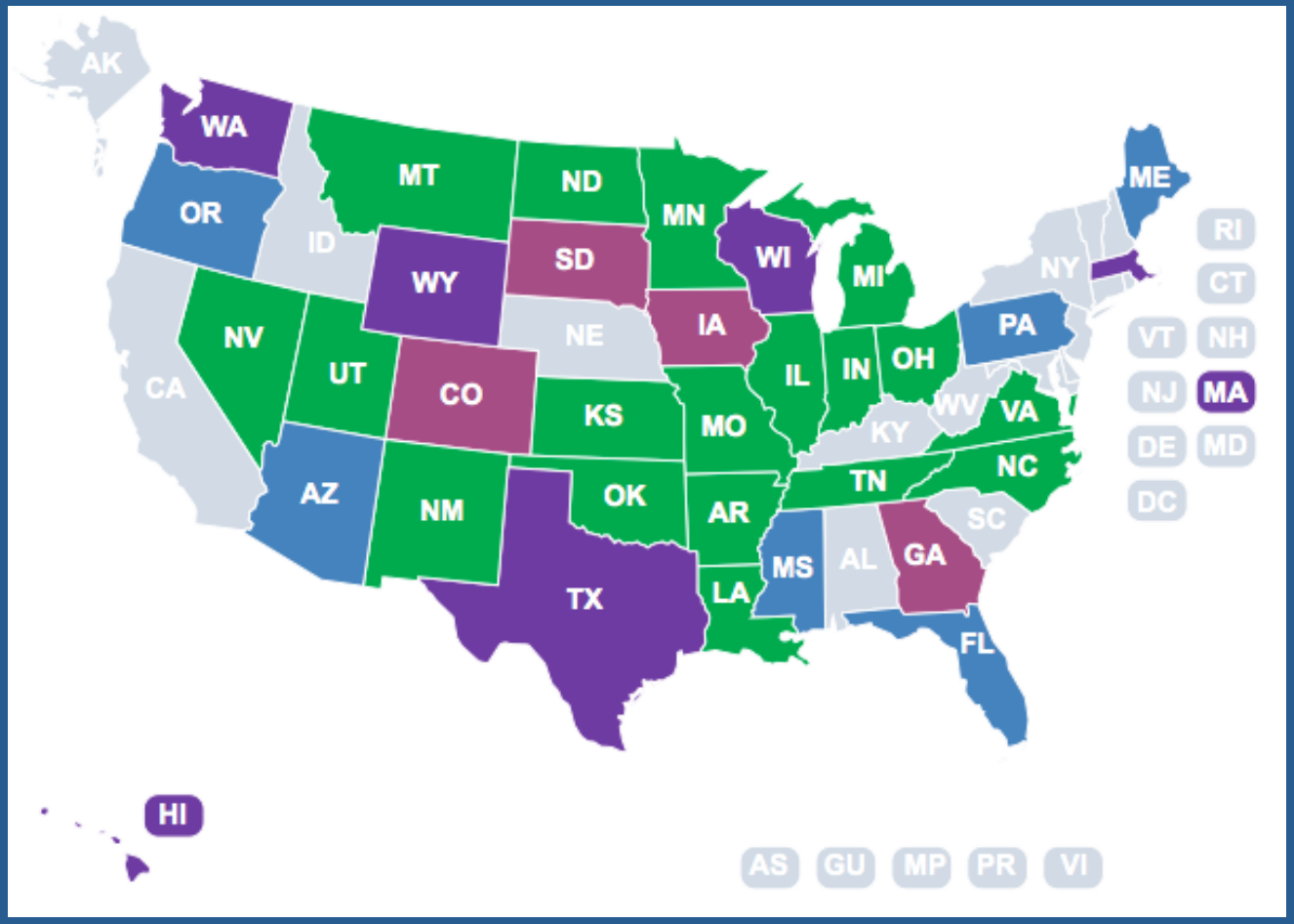
Economic Realities



Source: AMS

Economic Realities

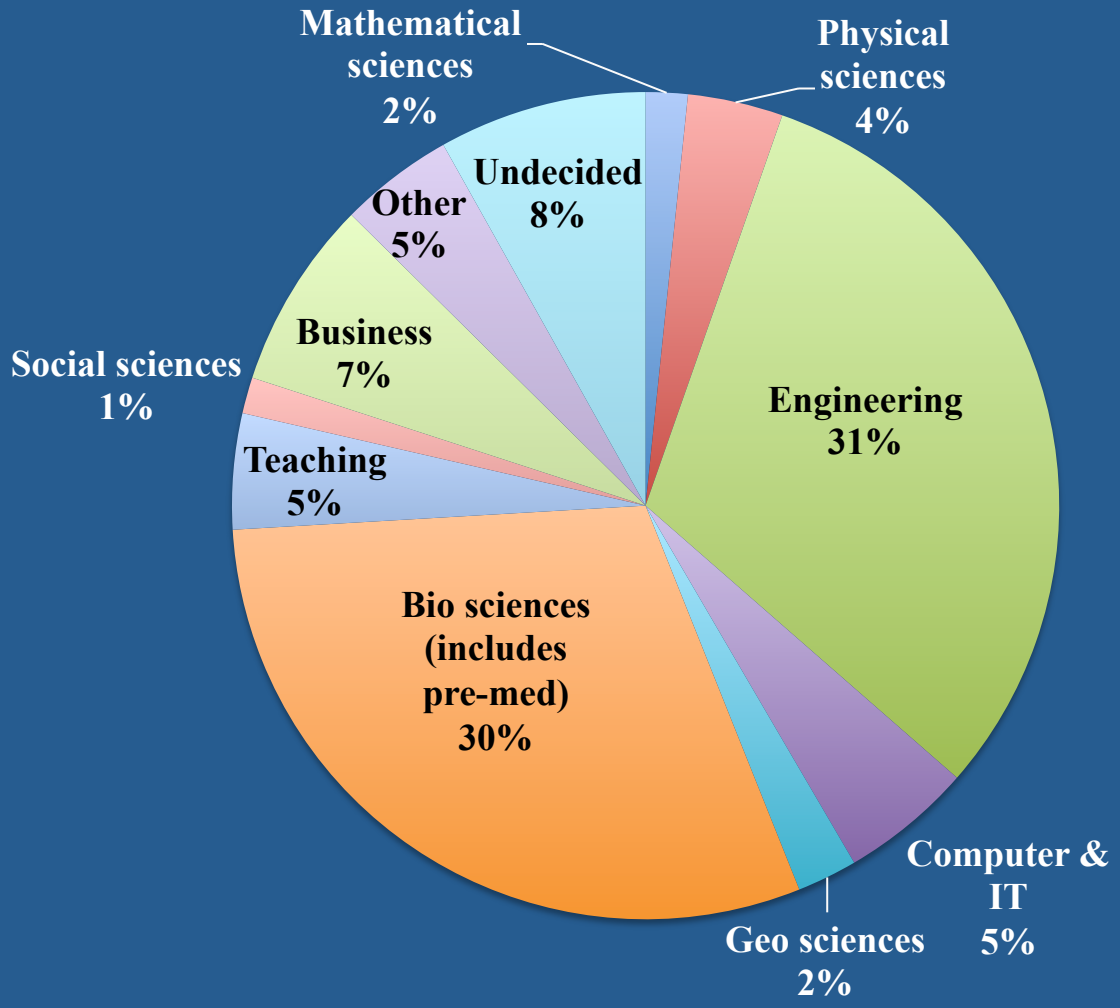
Performance Based Funding by State



Source: National Conference of State Legislatures

Demands of the Client Disciplines

Career goals of students in mainstream* Calculus I

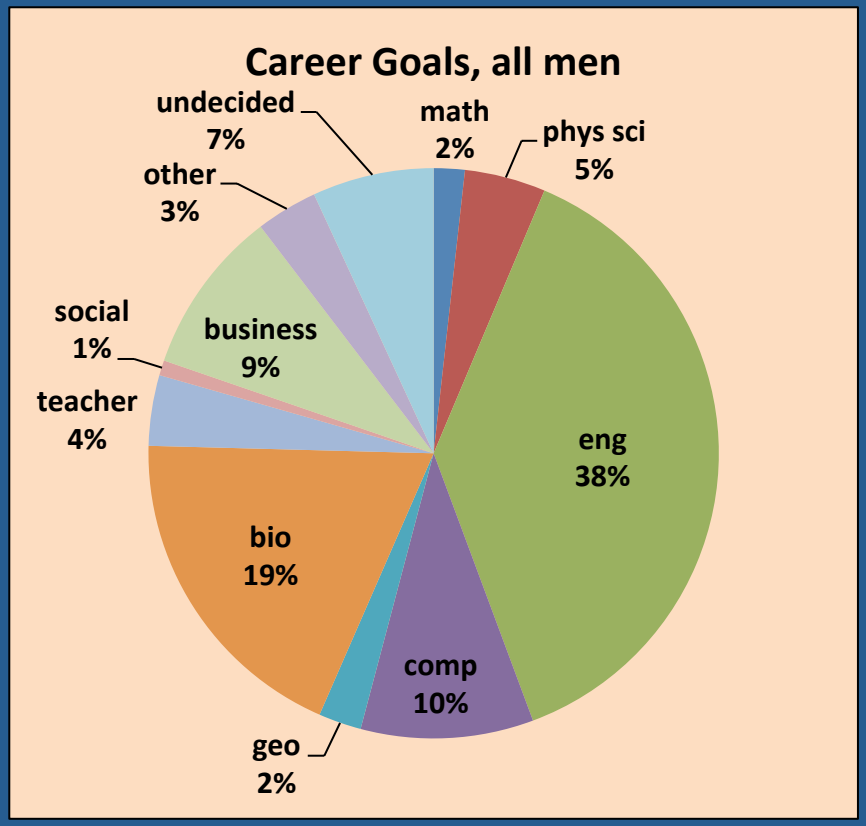


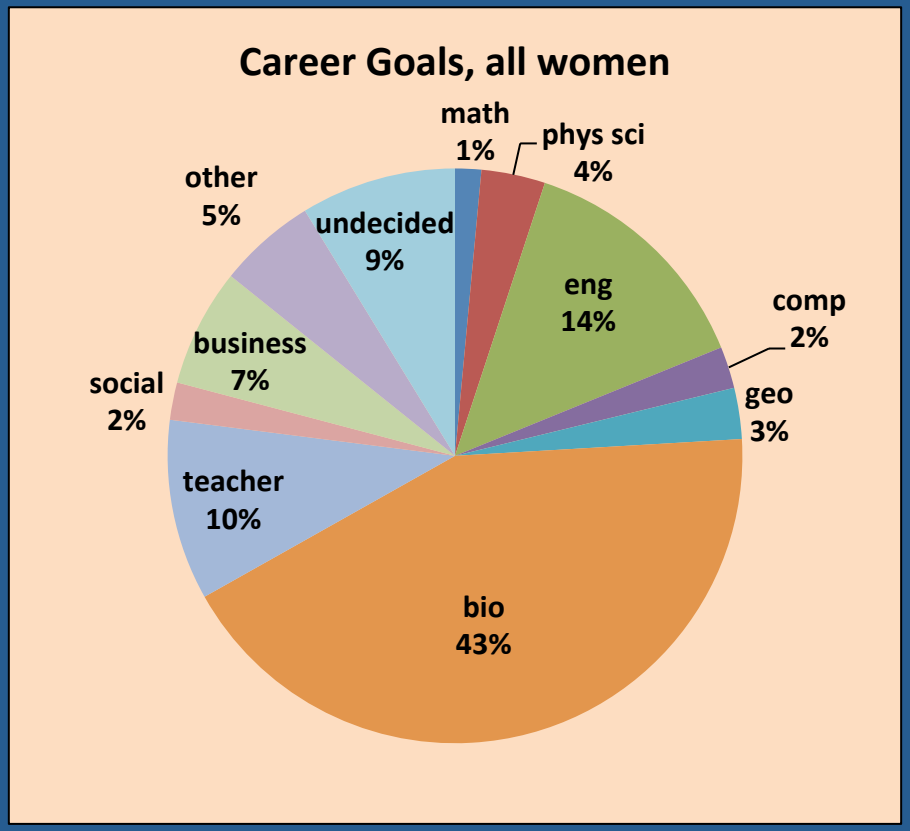
* "Mainstream" implies it can be used as part of the pre-requisite stream for more advanced mathematics courses.

Source: MAA CSPCC

Demands of the Client Disciplines

Gender differences of career goals of students in mainstream Calculus I

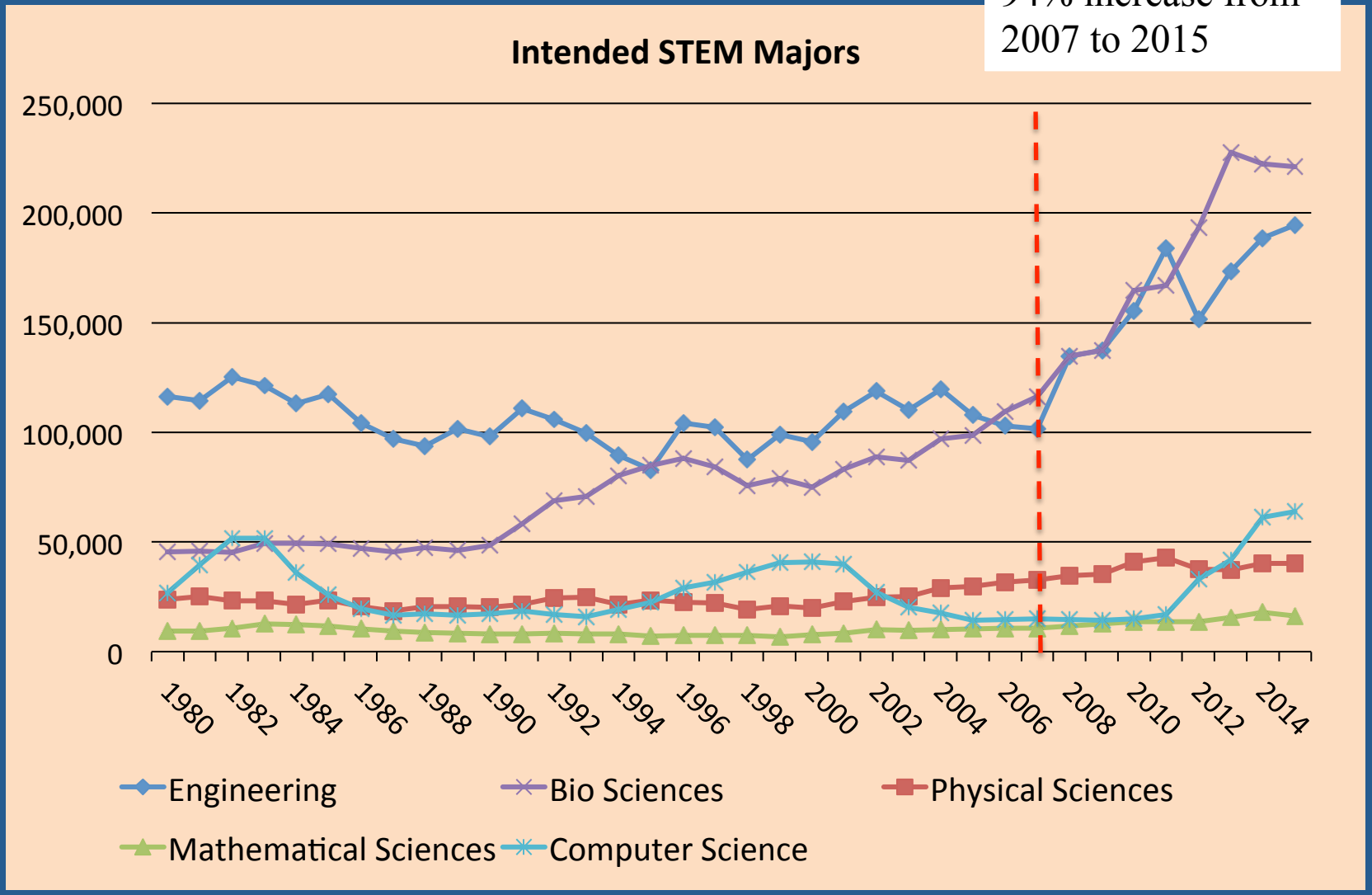




Source: MAA CSPCC

Demands of the Client Disciplines

94% increase from 2007 to 2015



Demands of the Client Disciplines

Office of Science and Technology Policy

Report to the President:
Engage to Excel Feb., 2012

President's Council of Advisors on Science and Technology (PCAST)

Recommendation 3-1: "This national experiment should fund … college mathematics teaching and curricula developed and taught by faculty from mathematics-intensive disciplines other than mathematics, including physics, engineering, and computer science."

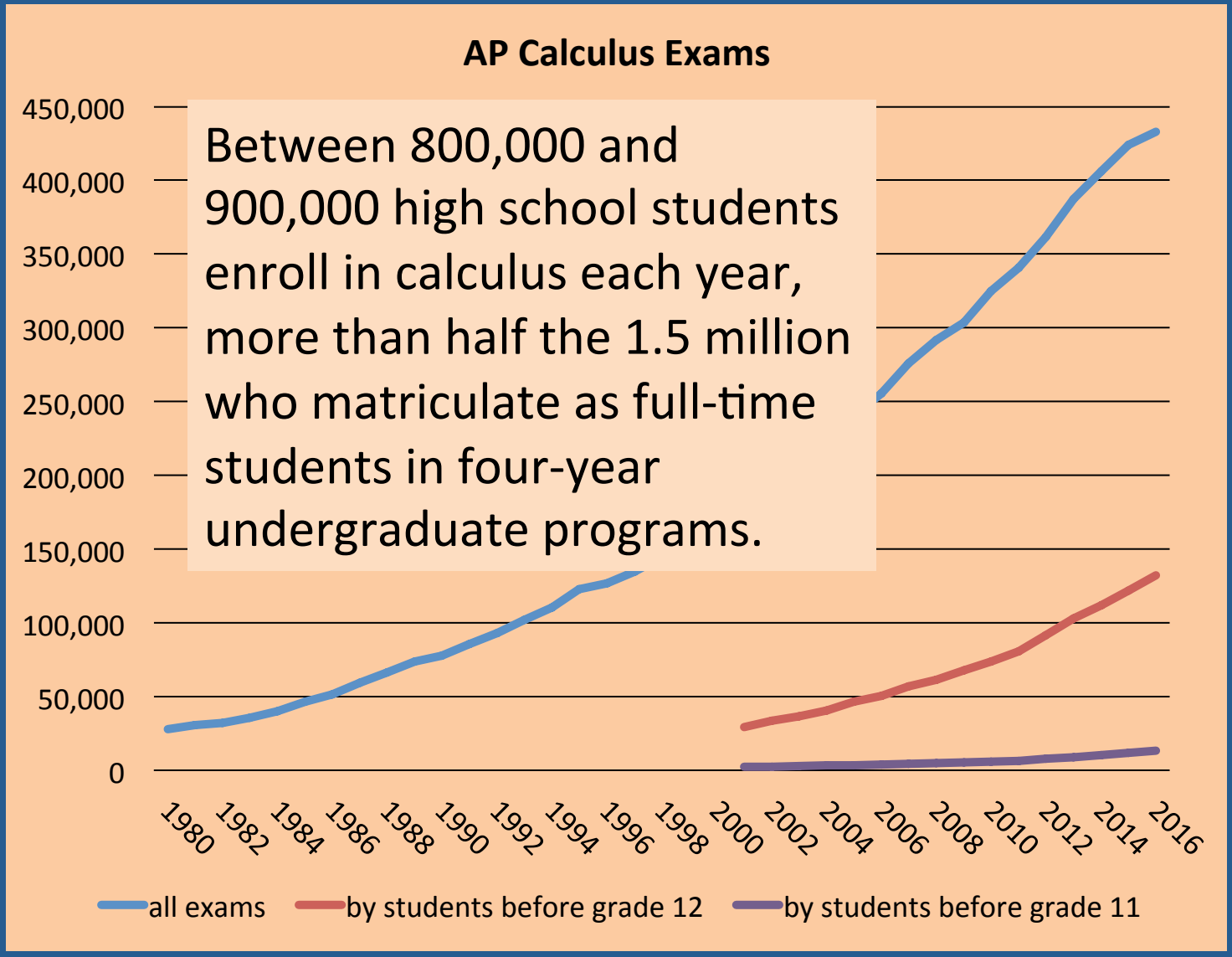
Report to the President: *Engage to Excel* Feb., 2012

Rationale:

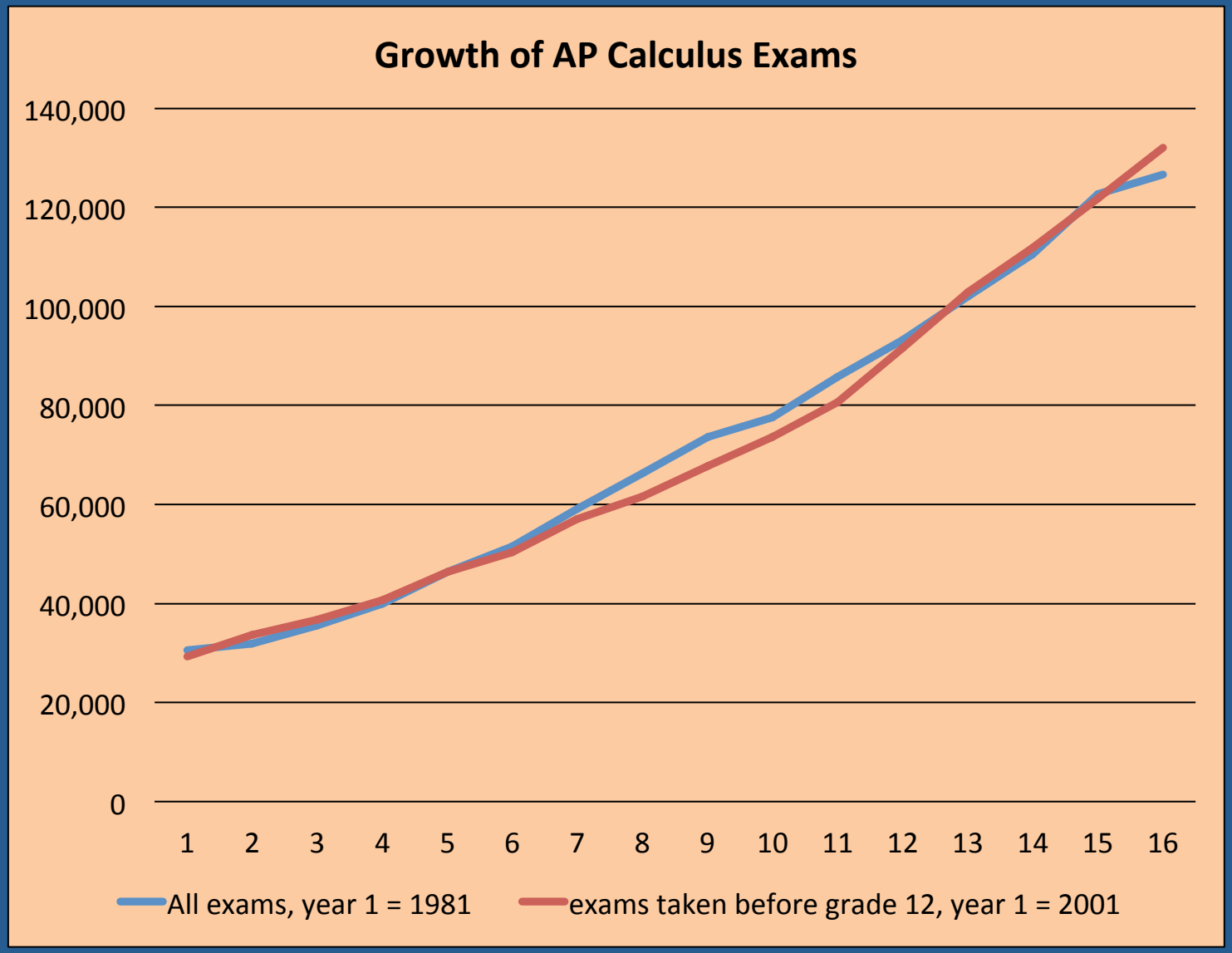
"Discipline-based education [research] on effective undergraduate mathematics teaching also appears less developed when compared with other STEM disciplines."

"Many college students … often are left with the impression that [mathematics] is dull and unimaginative, and they can extend this judgment to all STEM disciplines."

The Rush to Calculus

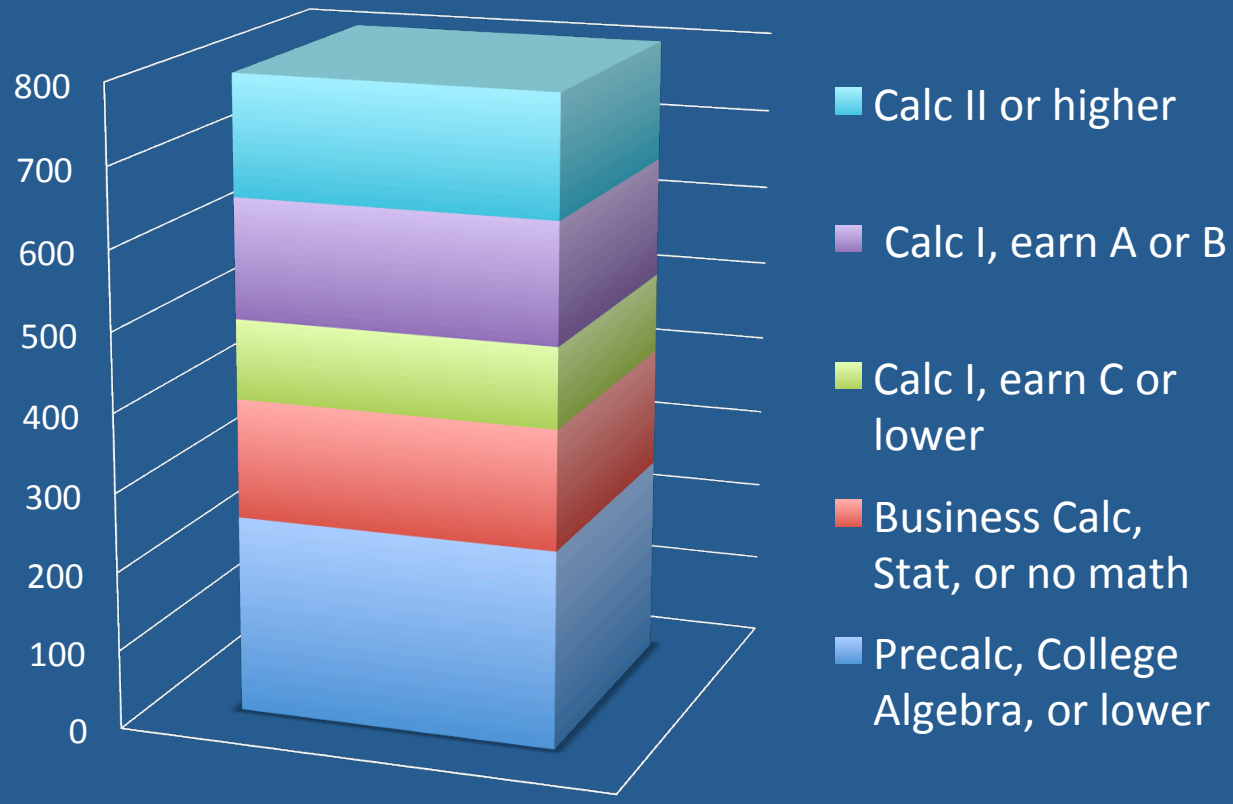


The Rush to Calculus



The Rush to Calculus

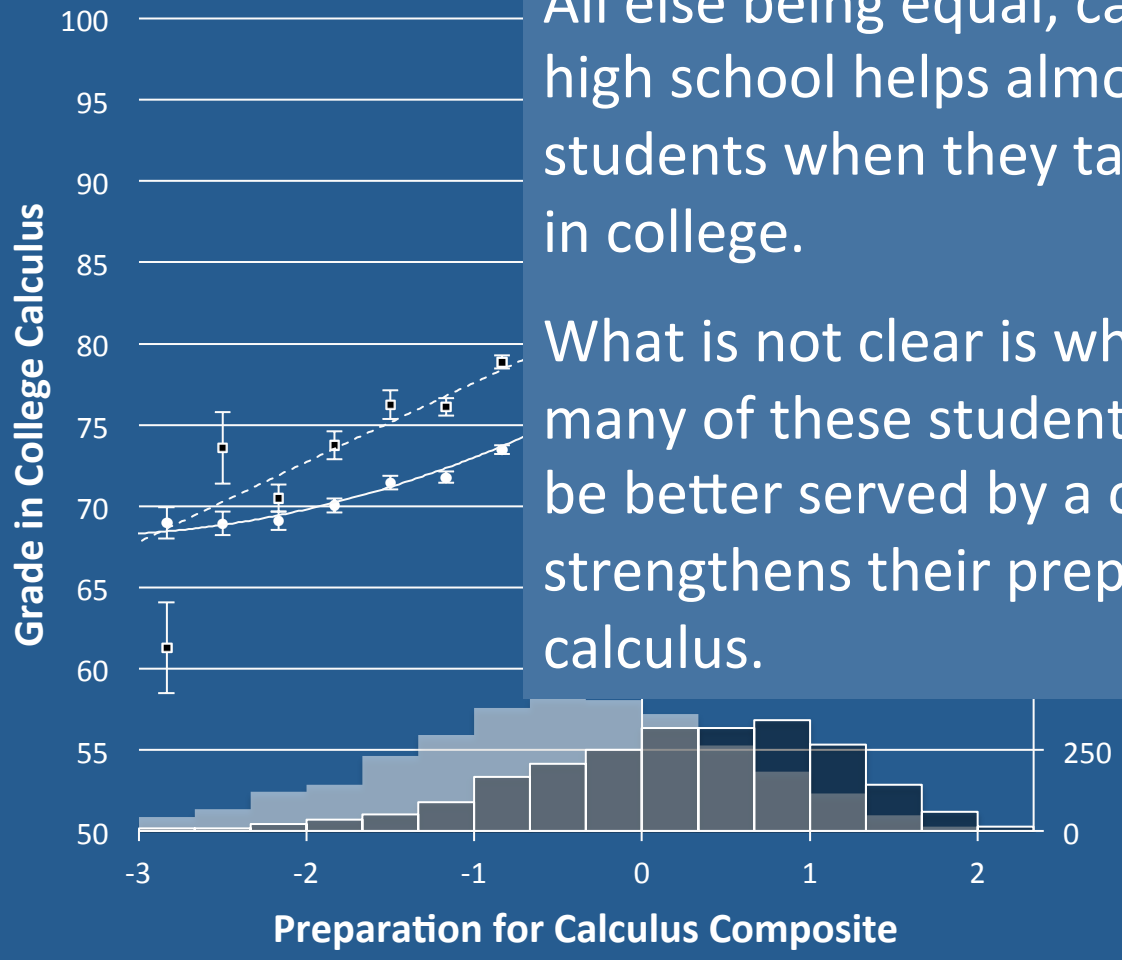
First College Math Class for those who took Calculus in High School (thousands)



The Rush to Calculus

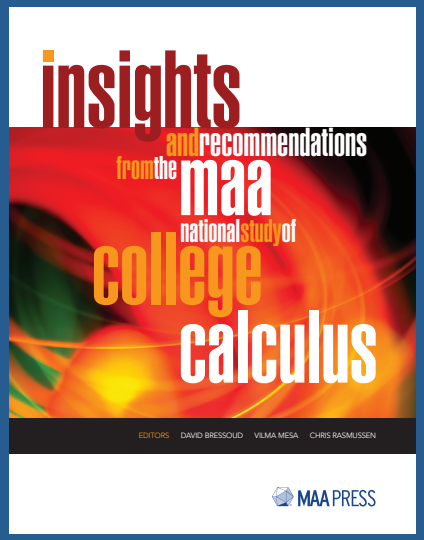
All else being equal, calculus in high school helps almost all students when they take calculus in college.

What is not clear is whether many of these students might not be better served by a course that strengthens their preparation for calculus.



Source: Sadler, P. & Sonnert, G. The Path to College Calculus: The Impact of High School Coursework. To appear in *Journal for Research in Mathematics Education*

Today we teach greater numbers of students, who are less prepared, using fewer resources, and with increased expectations for student success.



Bressoud, Mesa, & Rasmussen (eds.). 2015. *Insights and Recommendations from the MAA National Study of College Calculus*.

Chapters describing best practices in

- Placement
- Student support
- Pedagogy
- Departmental dynamics
- Preparation for teaching for graduate students

maa.org/cspcc

8 Features of Successful Calculus Programs

1- Attention to placement issues
2- Attention to local data
3- Support for active learning
4- Coordination of courses
5- Regular meetings of course instructors
6- Solid GTA professional development
7- Strong student support services
8- Rigorous courses

MAA PtC

Progress through Calculus

DUE I-USE #1430540

PI: David Bressoud

co-PI's and senior personnel:

Chris Rasmussen
San Diego State

Jess Ellis
Colorado State

Estrella Johnson
Virginia Tech

Sean Larsen
Portland State

Linda Braddy
Tarrant County College

Spring 2015, surveys on the precalculus through single variable calculus sequence sent to all 330 US math departments offering a graduate degree in mathematics.

Response rates:

- PhD departments: 134/178 = 75%
- MA departments: 89/152 = 59%
- Overall: 223/330 = 68%

PROGRESS THROUGH CALCULUS
NATIONAL SURVEY SUMMARY

Go to maa.org/cspcc
Under Progress through Calculus
click on Publications and Reports

Research team:
David Bressoud
Chris Rasmussen
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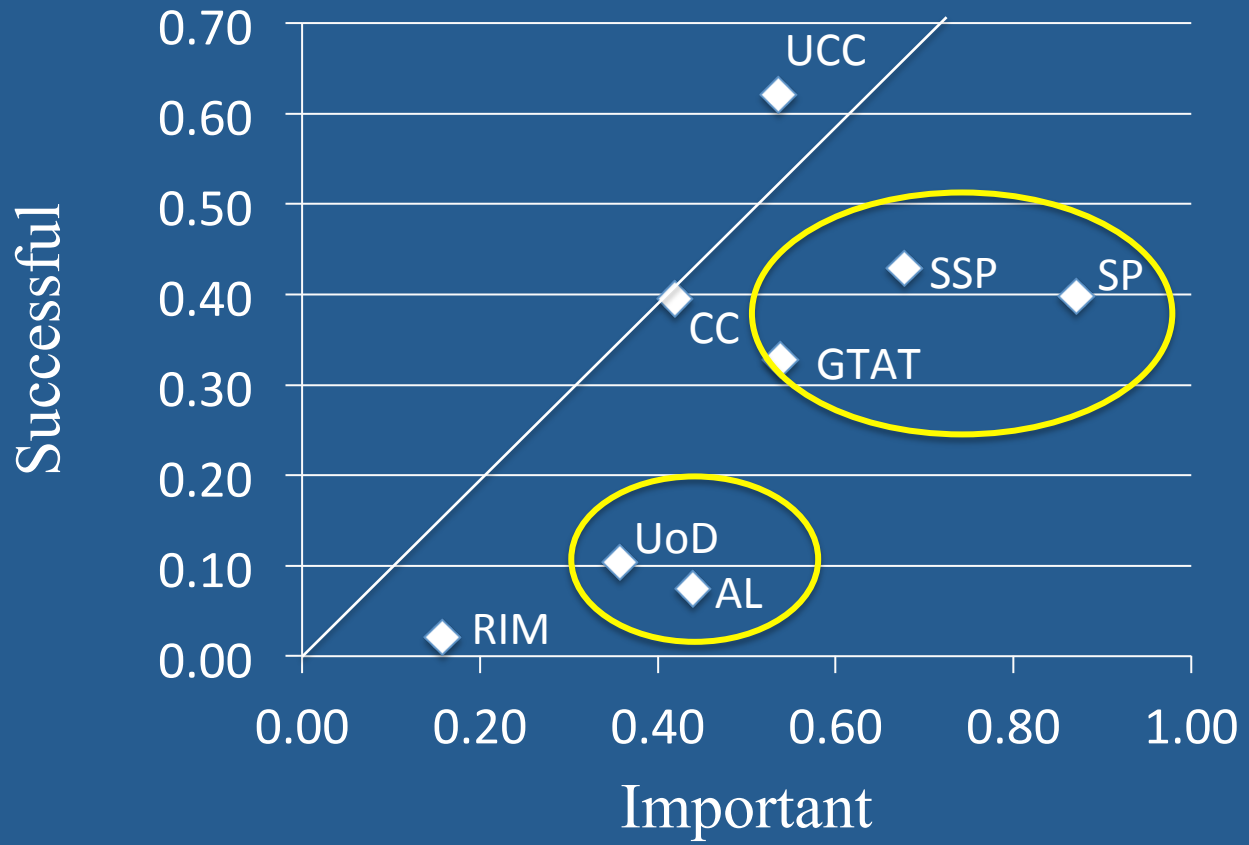
Linda Braddy
Estrella Johnson

Report prepared by
Naneh Apkarian

MAA PtC
Progress through Calculus

NSF Award #1430540

Variation	PhD (133)	MA(89)
Precalc over 2 semesters as option	33	29
Precalc contemporaneous with calculus	2	1
Stretched out Calculus I	13	7
Stretched out Calculus 1 & 2	6	1
Calculus infused with precalculus	7	4
Mainstream Calculus for biology	11	4
Mainstream Calculus for engineering	14	0
Mainstream Calc for another subject	3	0
Calculus for first-timers	1	0
Accelerated/AP Calculus	12	2
Transition to mainstream	2	1



Weighted average of responses:
very important or successful, +1
somewhat, 0
not important or successful, – 1

UCC = uniform course components

CC = challenging courses

GTAT = graduate teaching assistant training

SSP = student support programs

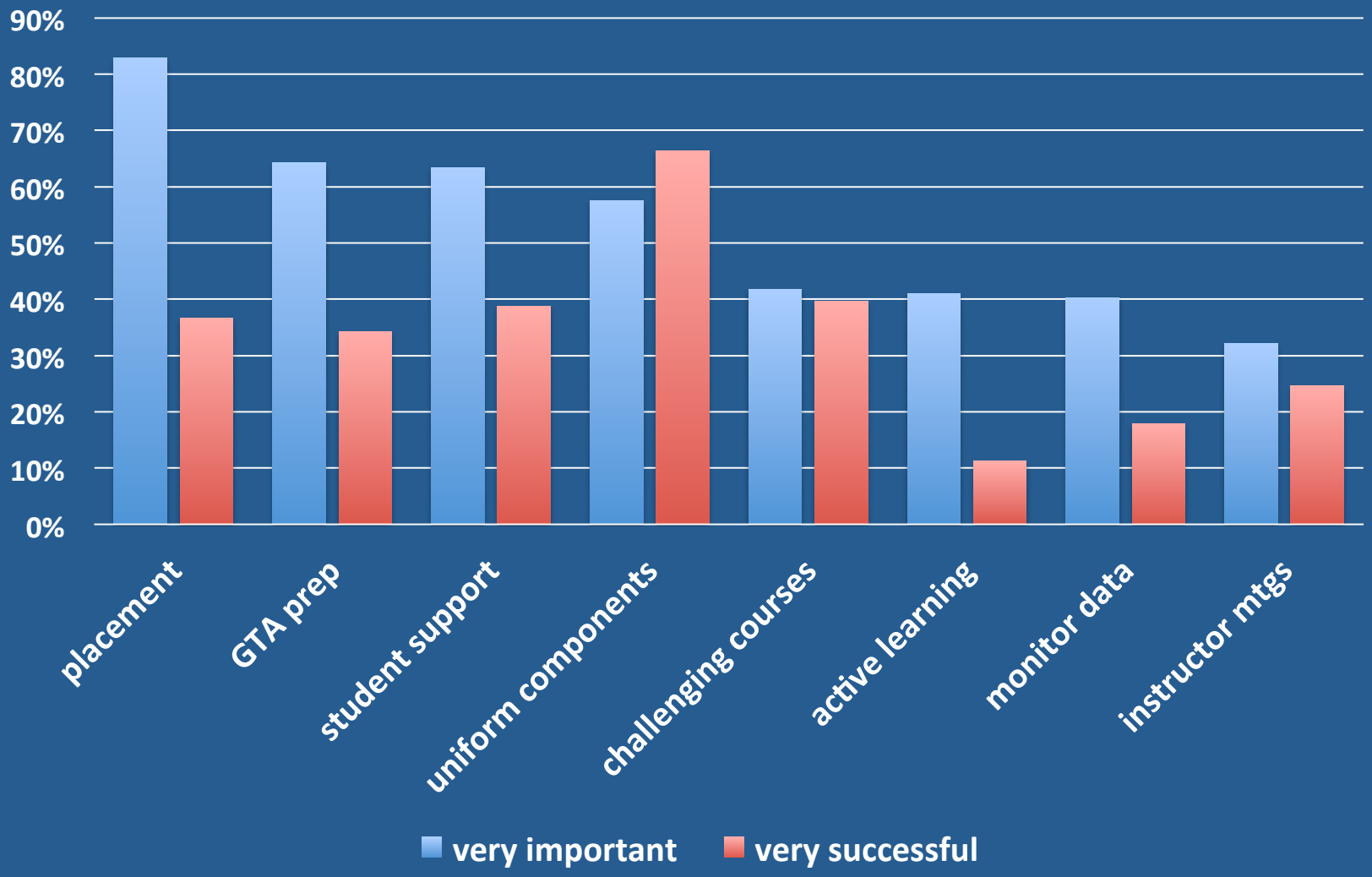
SP = student placement

RIM = regular instructor meetings

UoD = use of data

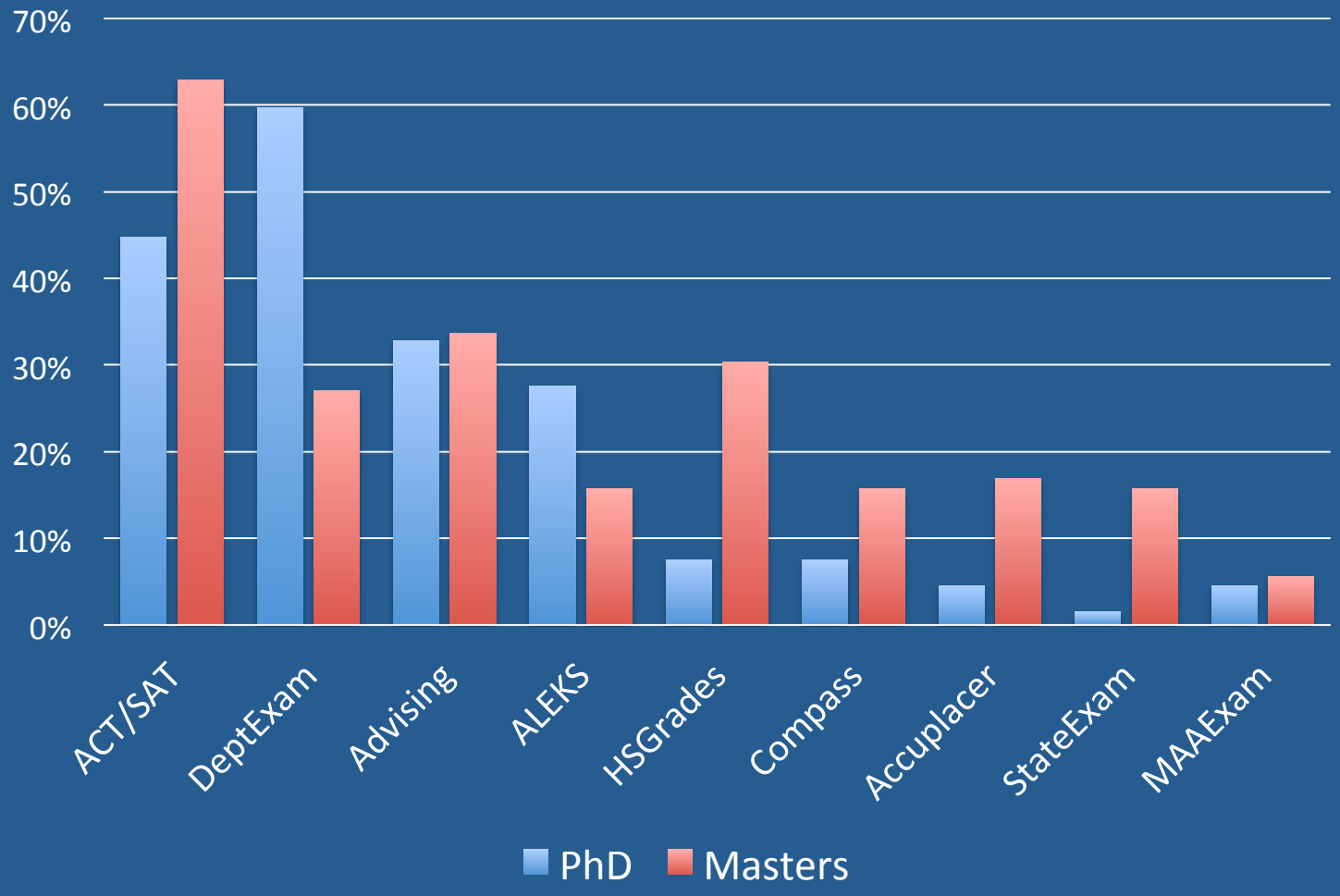
AL = active learning

What is important vs where they are successful PhD programs



Placement

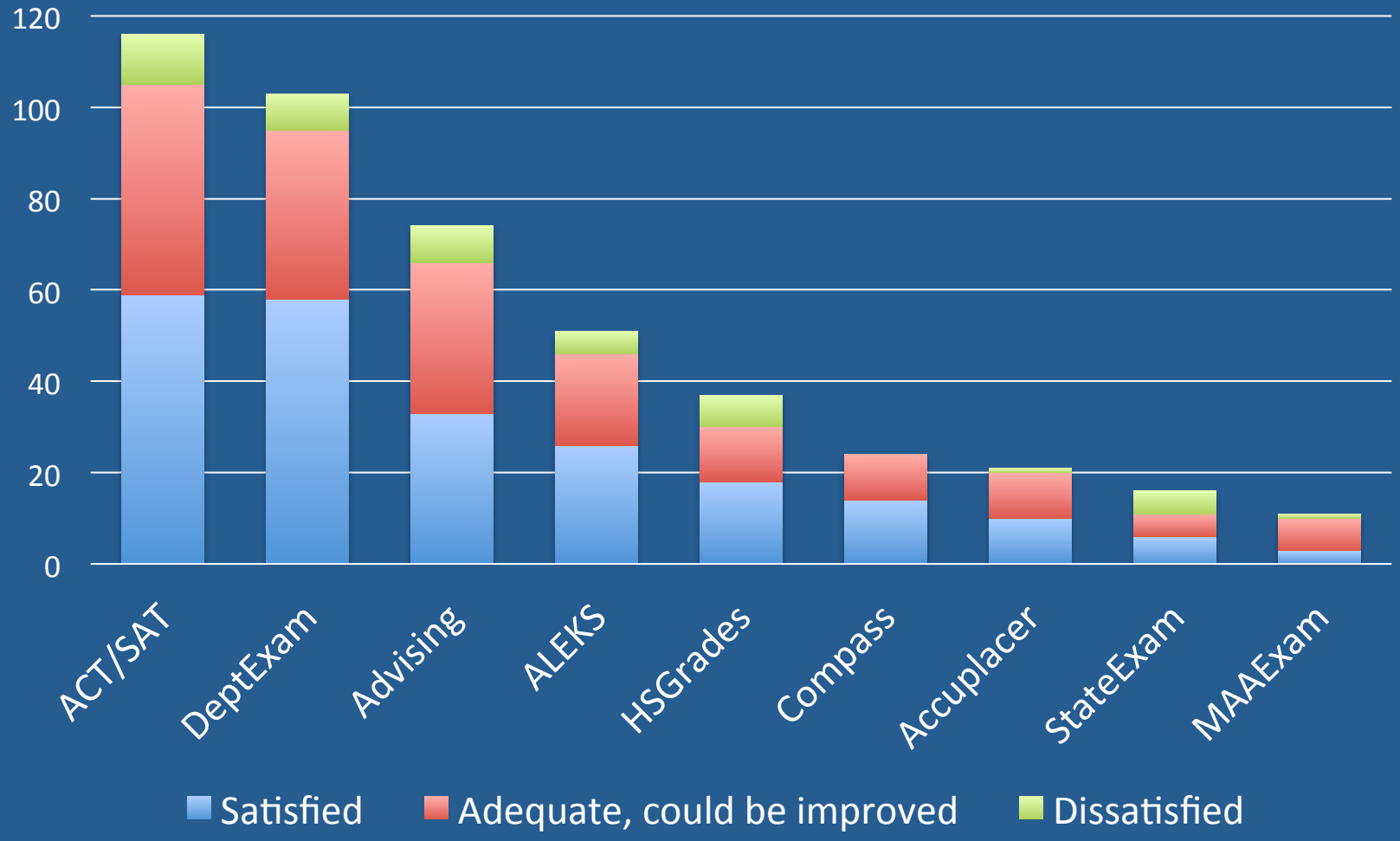
Percentage of respondents using placement tool (could select multiple placement tools)



From 2010 to 2015, use of ALEKS for placement at universities with PhD programs has jumped from 10% to 28%.

Adaptive questioning
Includes focused instructional modules
Opportunities for retesting
Does not use multiple choice questions

Number (out of 223) using each placement tool With degree of overall satisfaction with placement

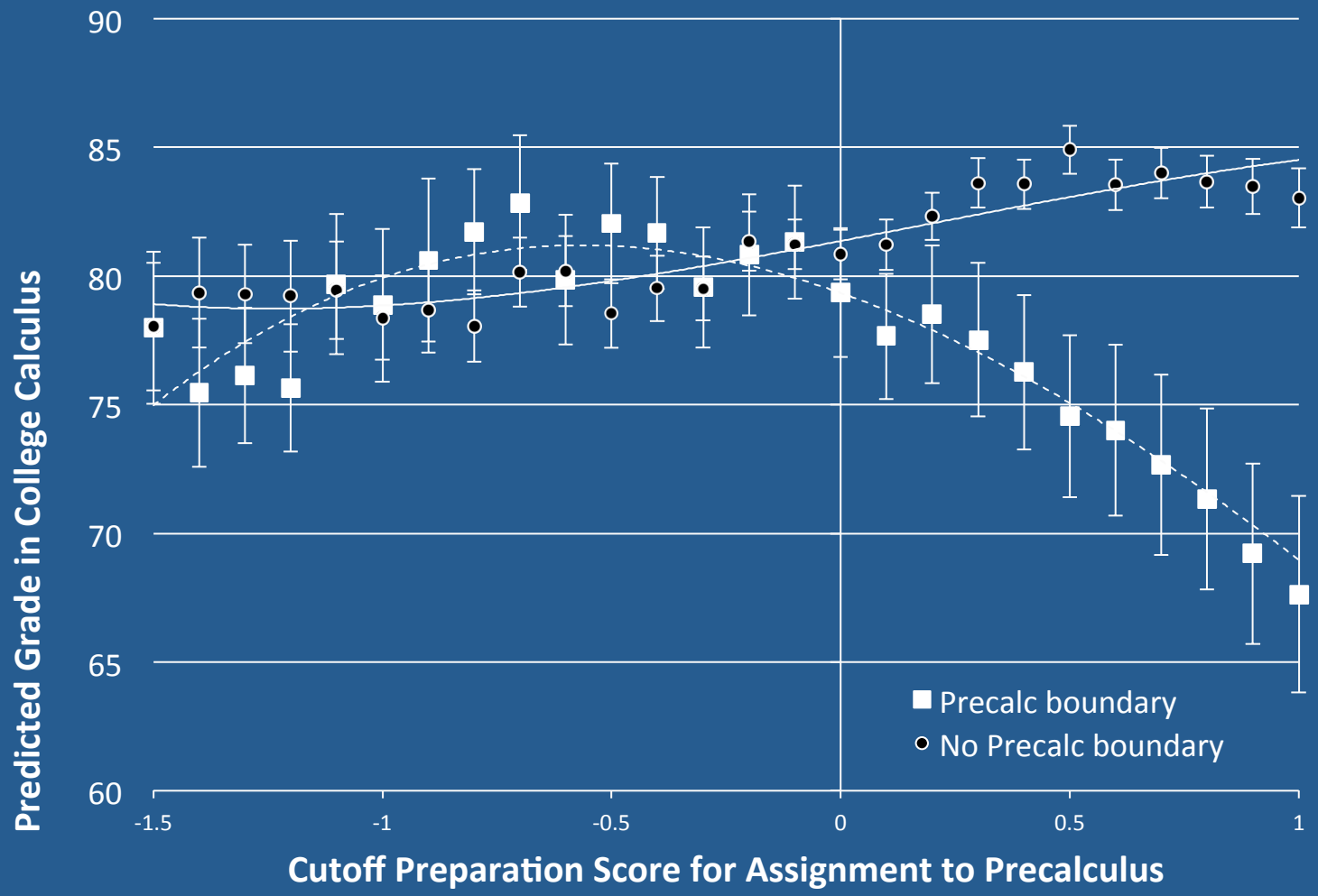


Across all placement instruments

- 9% are not satisfied
- 39% consider them adequate, but could be improved

30% are currently replacing or have recently replaced their placement instrument(s)

29% are considering changing their placement instruments



Source: Sonnert, G., & Sadler, P. M. (2014). The impact of taking a college precalculus course on students' college calculus performance. *International Journal of Mathematical Education in Science and Technology*, *45*(8), 1188-1207

Discussion Questions:

1. What do you see as the main purpose of your precalculus course, and how do you measure if it is fulfilling that purpose?
2. What do you see as acceptable outcomes of your precalculus/calculus sequence? What do your client disciplines see as acceptable outcomes? How do you evaluate if those outcomes are being reached?
3. What alternative course structures have you attempted in the precalculus/ calculus sequence? What has worked or has not worked? Why?
4. What placement system are you using and how effective is it for placing students in a course that is right for them?
5. How, if at all, do you reassess students for appropriate placement AFTER the term begins?
6. What student supports does your institution have in place? How does your institution know how well they are working?
7. What could your institution do to improve student success and retention for at risk students?

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