

College-Bound Students' Interest in Engineering: Pathways and Characteristics of the Pre-College Pipeline

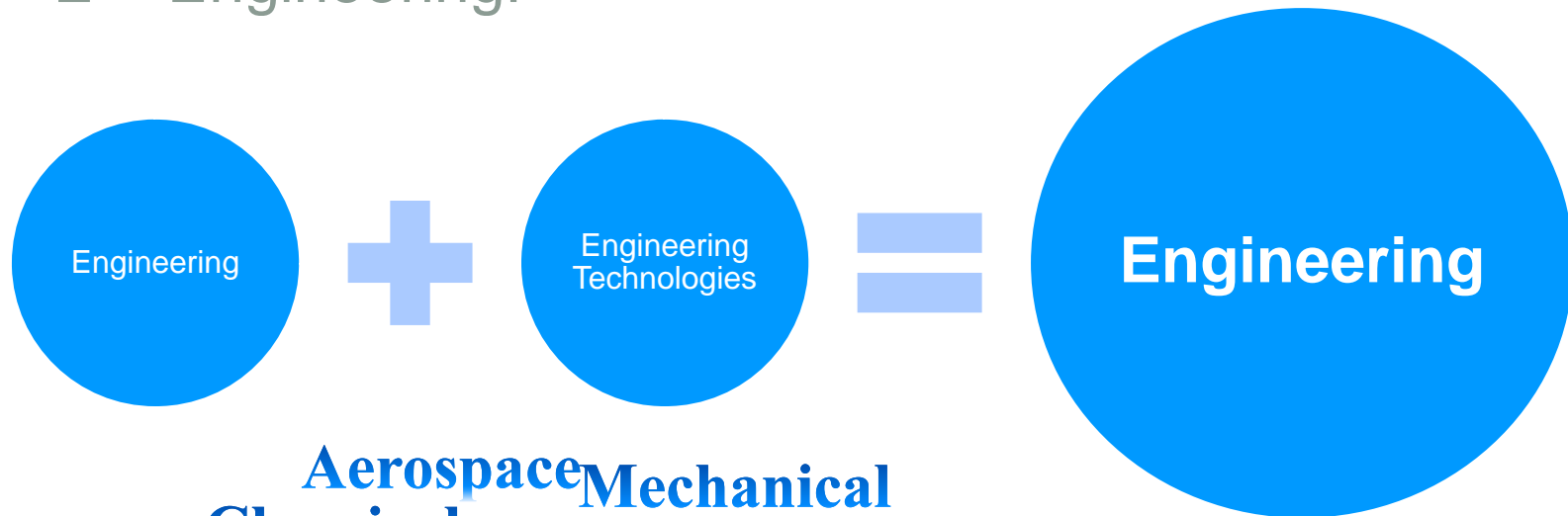
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AERA – April 2011



STEM – Science, Technology, Engineering & Math

- How is it defined?
 - It depends.....
 - E = Engineering!

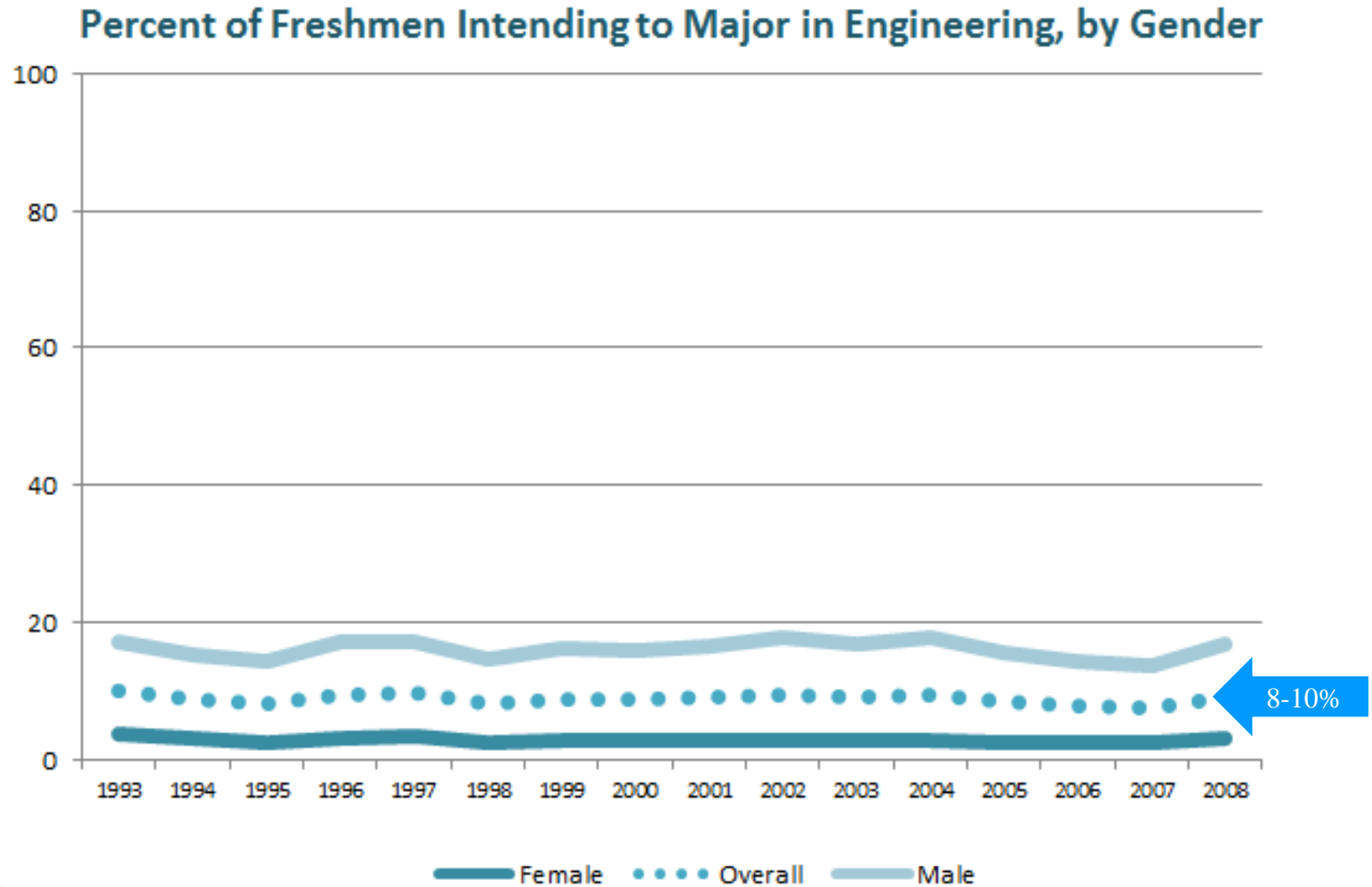


Aerospace Mechanical
Chemical Materials
Electrical Civil
Industrial

Overview

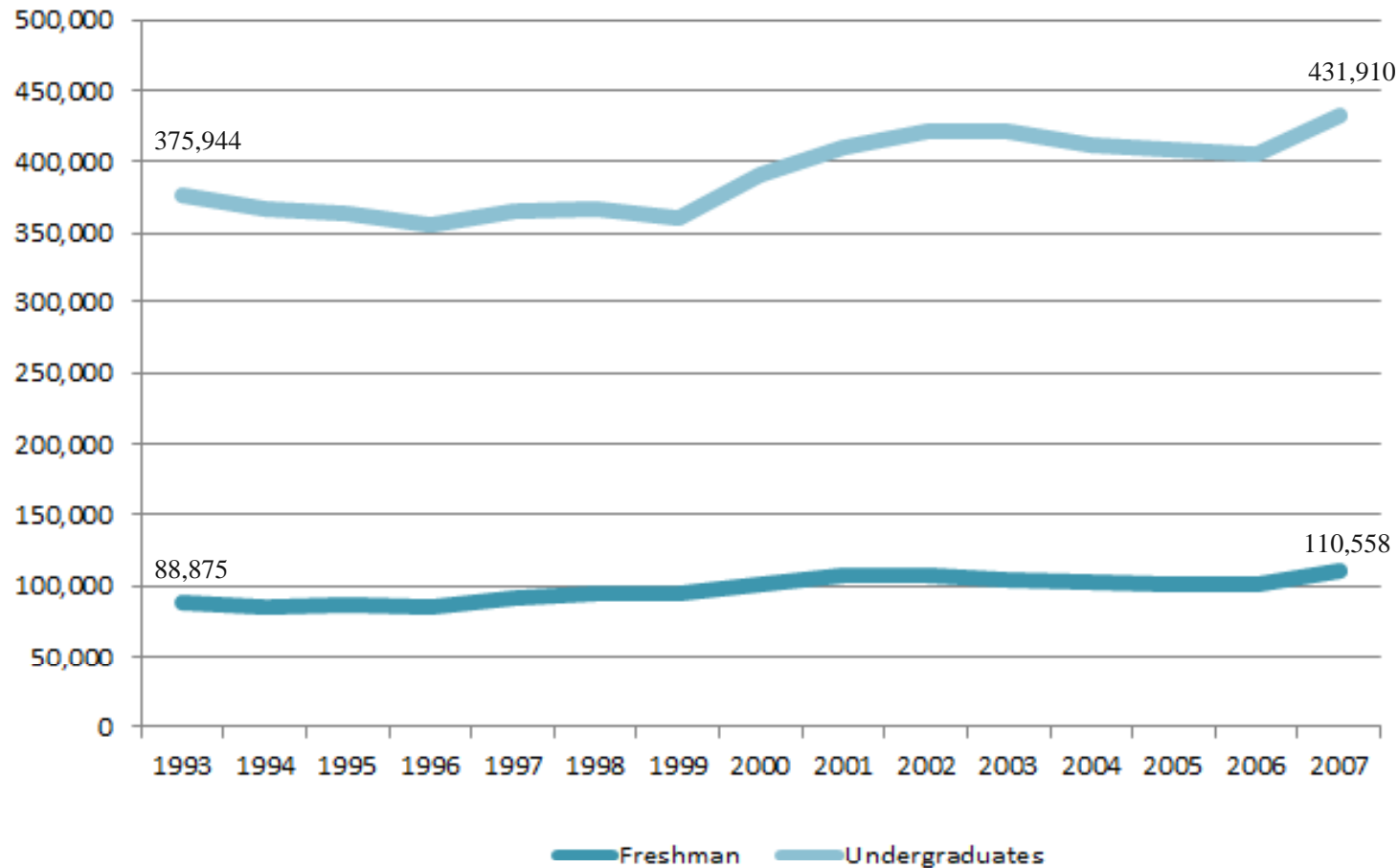
- Post-Secondary Engineering Pipeline
- Pre-College Engineering Pipeline
 - I. Engineering Interest and Academic Preparation in the Class of 1997-2007
 - II. Patterns of Engineering Interest in the Class of 2009

Post-Secondary Pipeline



Post-Secondary Pipeline

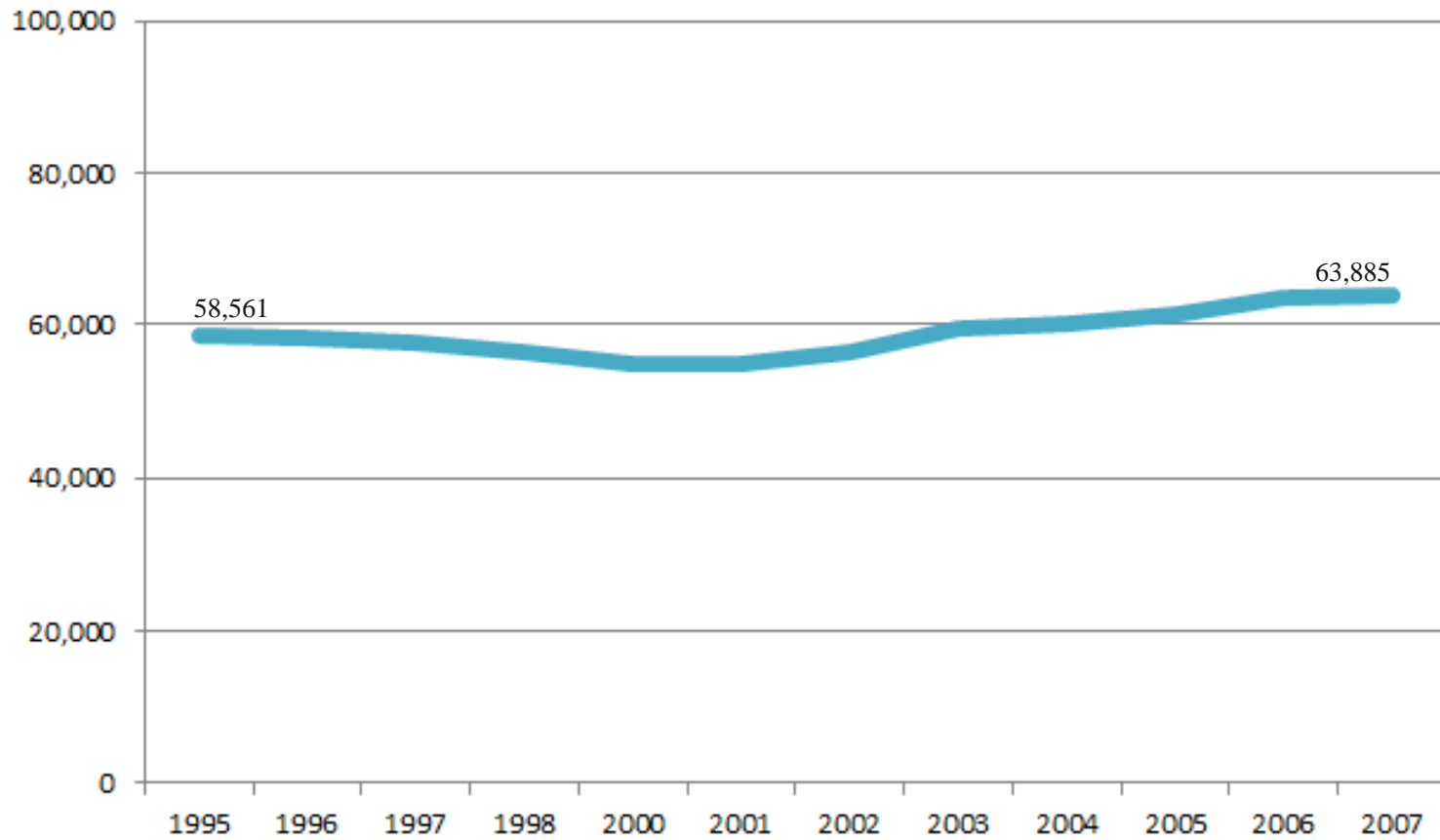
Undergraduate Engineering Enrollment



Source: American Association of Engineering Societies - Engineering Workforce Commission, Engineering & Technology Enrollments as cited in National Science Board *Science and Engineering Indicators 2010* Appendix Table 2-9

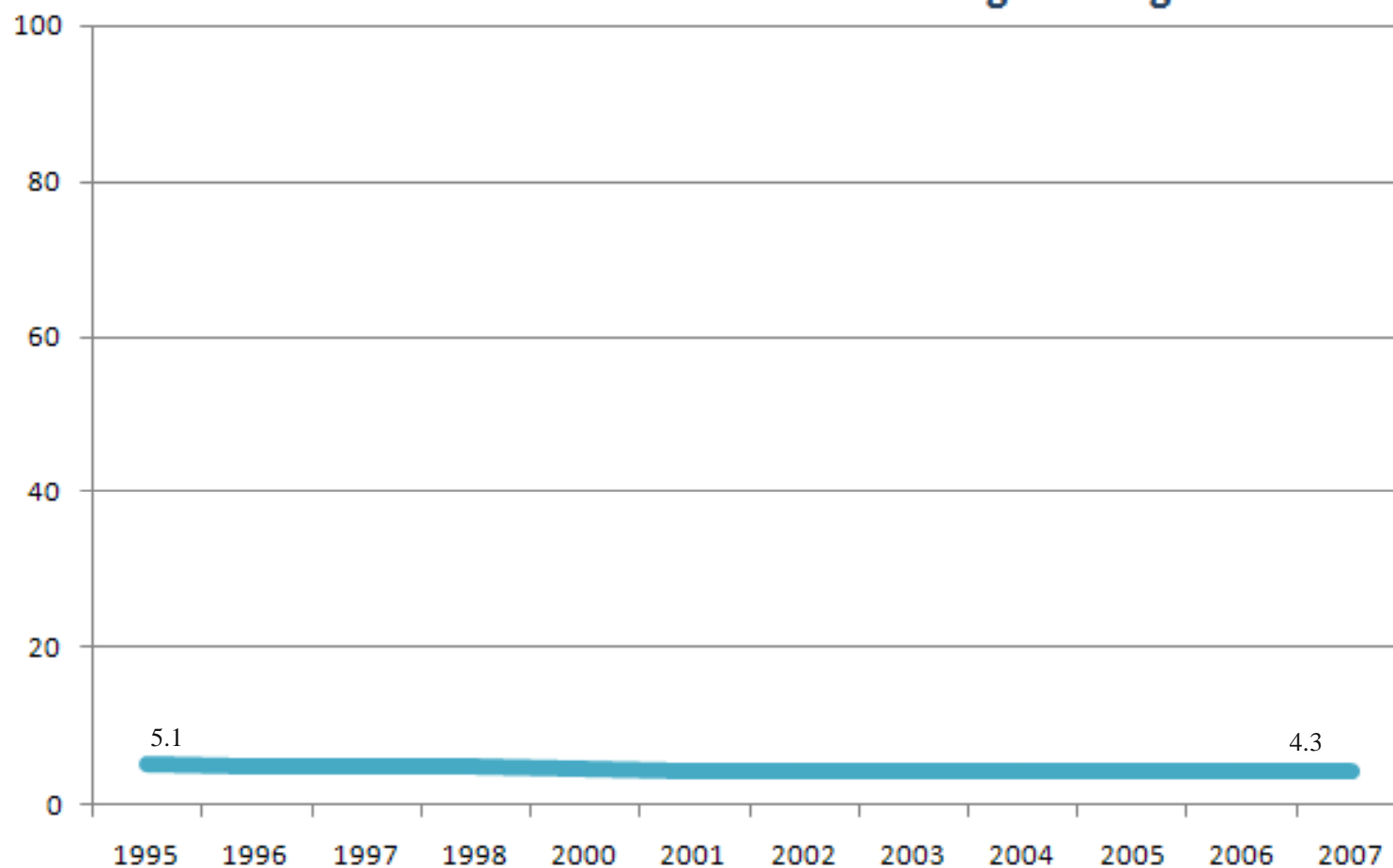
Post-Secondary Pipeline

Bachelor's Degrees Awarded in Engineering



Post-Secondary Pipeline

Percent of Bachelor's Awarded in Engineering



Source: National Science Foundation/National Center for Education Statistics as cited in National Science Board *Science and Engineering Indicators 2010* Appendix Table 2-13

Shifting Perspective



Previous
Research

Current
Study

What do we know?

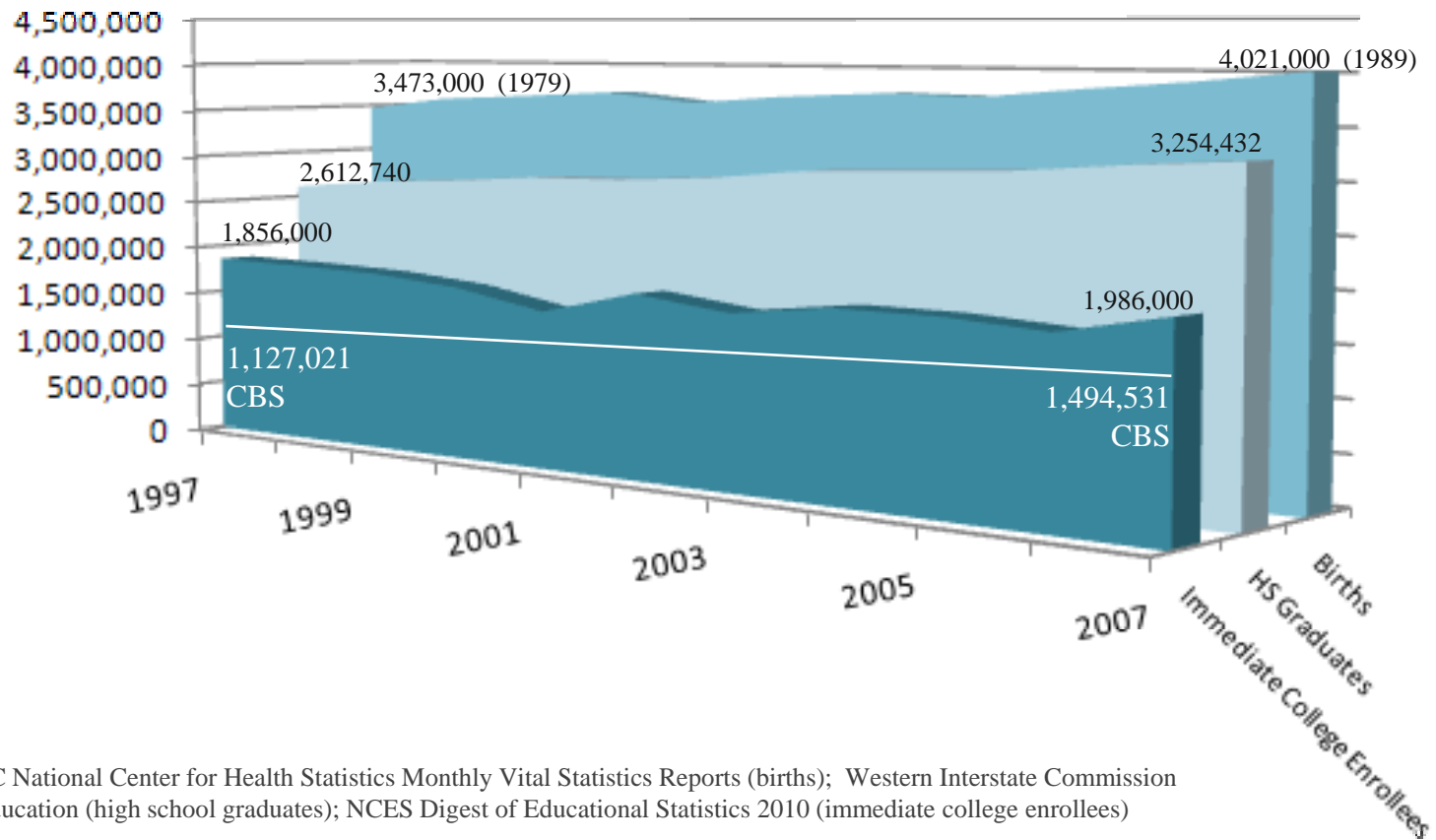
- Previous pre-college engineering research
 - Efficacy of interest-building interventions
 - Improving quality of K-12 math and science teachers
 - Position papers about engineering in K-12 curriculum
- Challenges:
 - Finding a national, representative sample of high school students
 - Tracking these students over time

Study I:

ENGINEERING INTEREST AND ACADEMIC PREPARATION IN THE CLASS OF 1997-2007

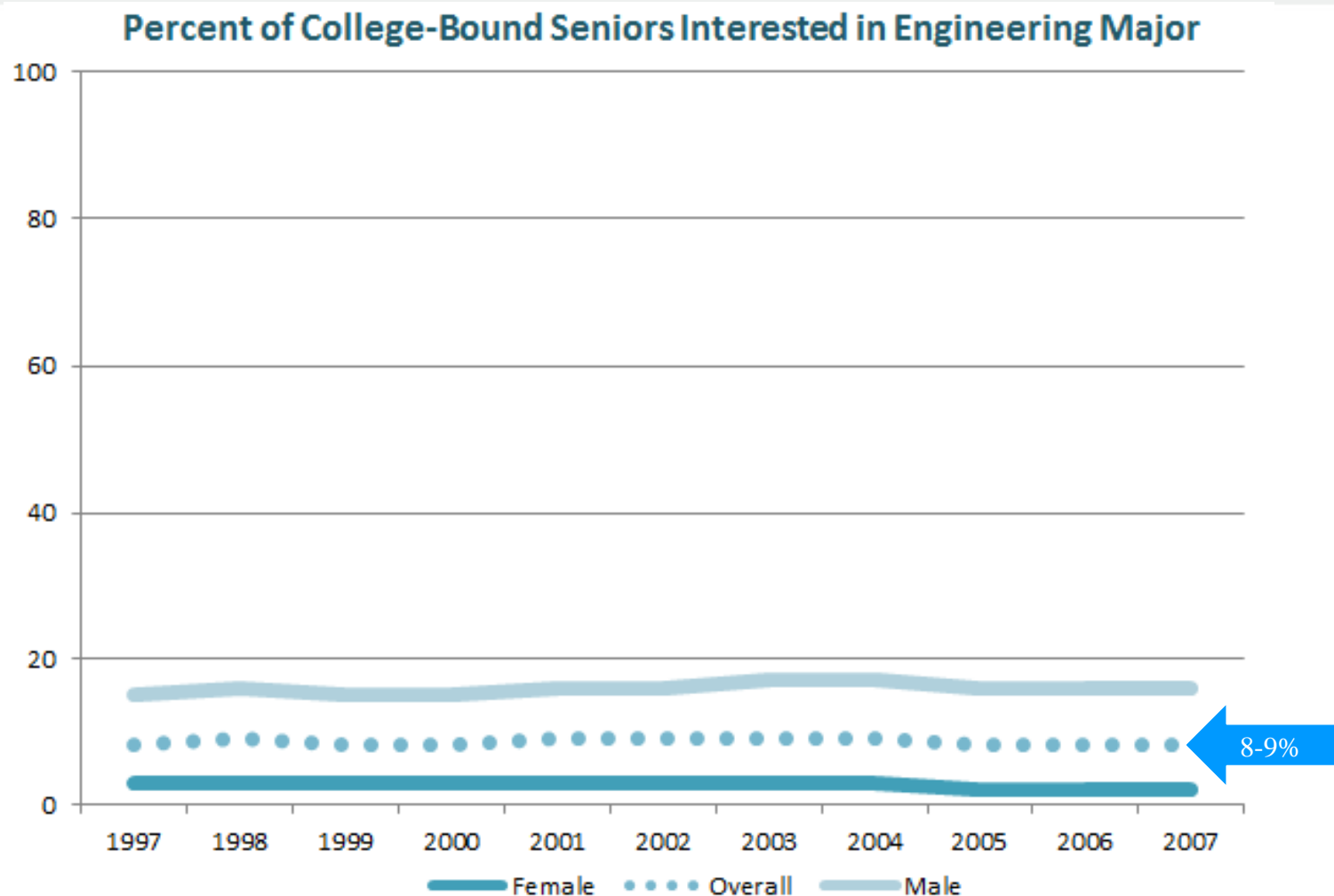
The Pool of Potential Engineers

Number of Births, High School Graduates, and Immediate College Enrollees: 1997-2007 Cohorts

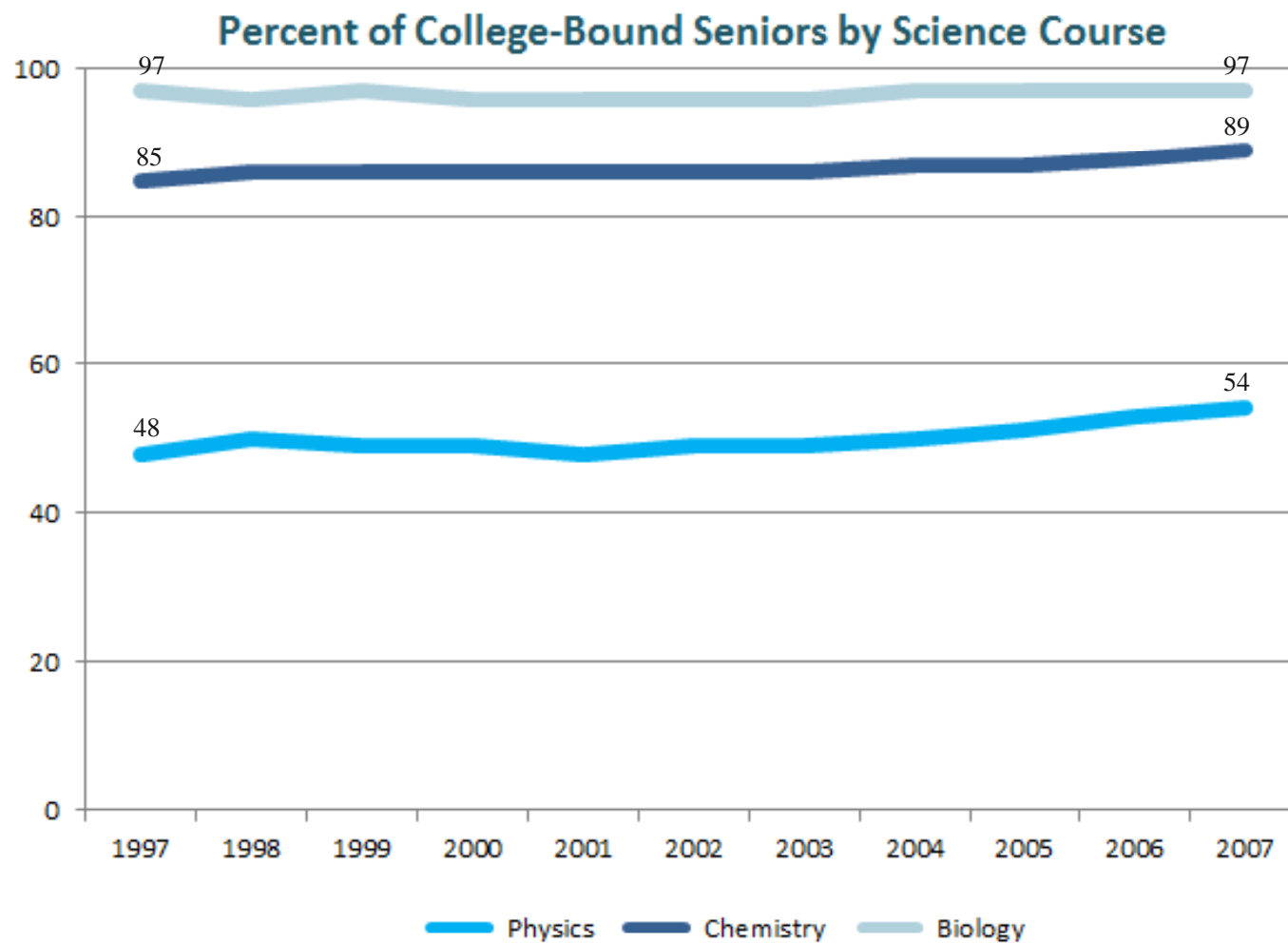


Sources: CDC National Center for Health Statistics Monthly Vital Statistics Reports (births); Western Interstate Commission for Higher Education (high school graduates); NCES Digest of Educational Statistics 2010 (immediate college enrollees)

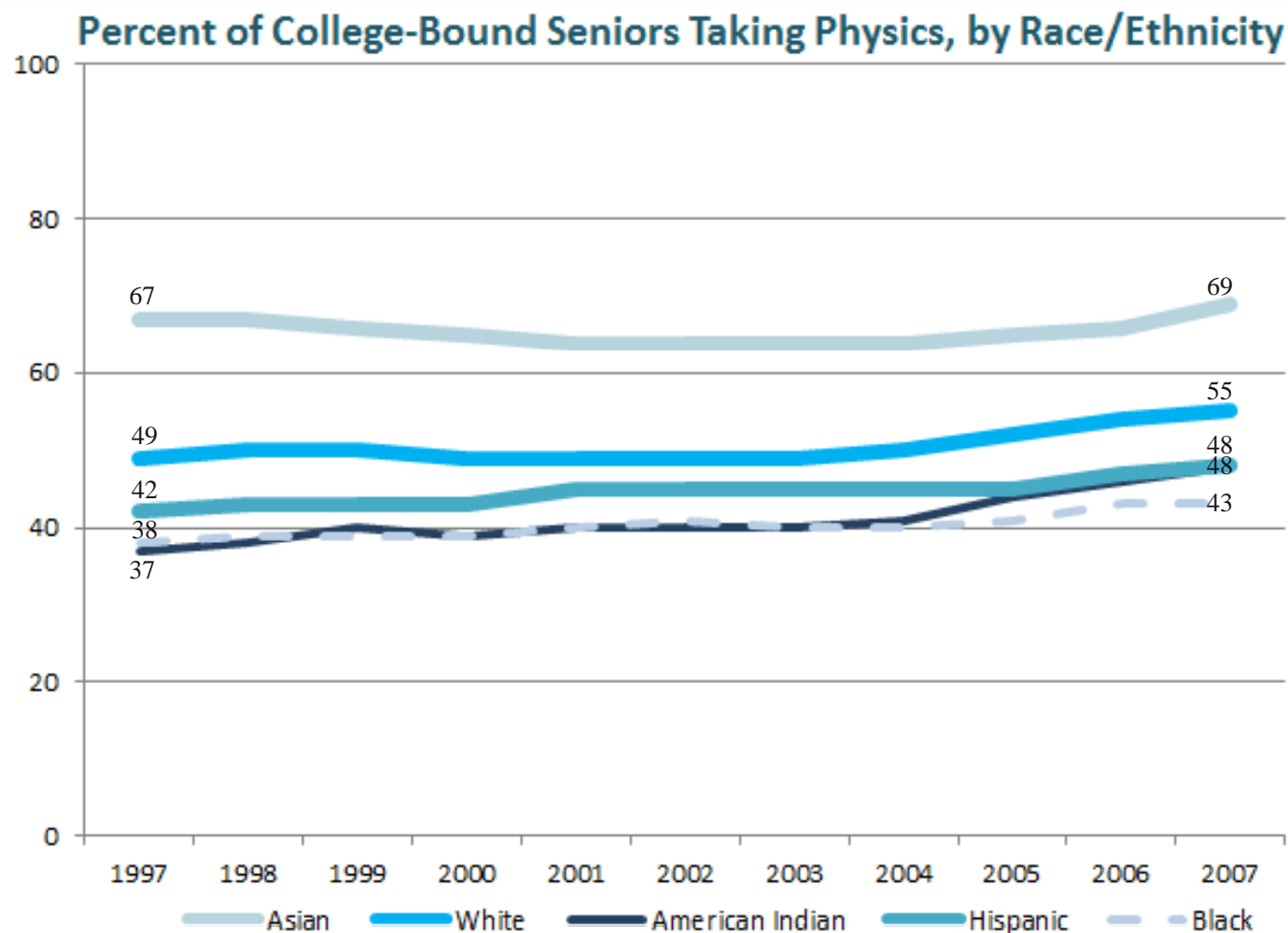
Secondary Pipeline - Interest



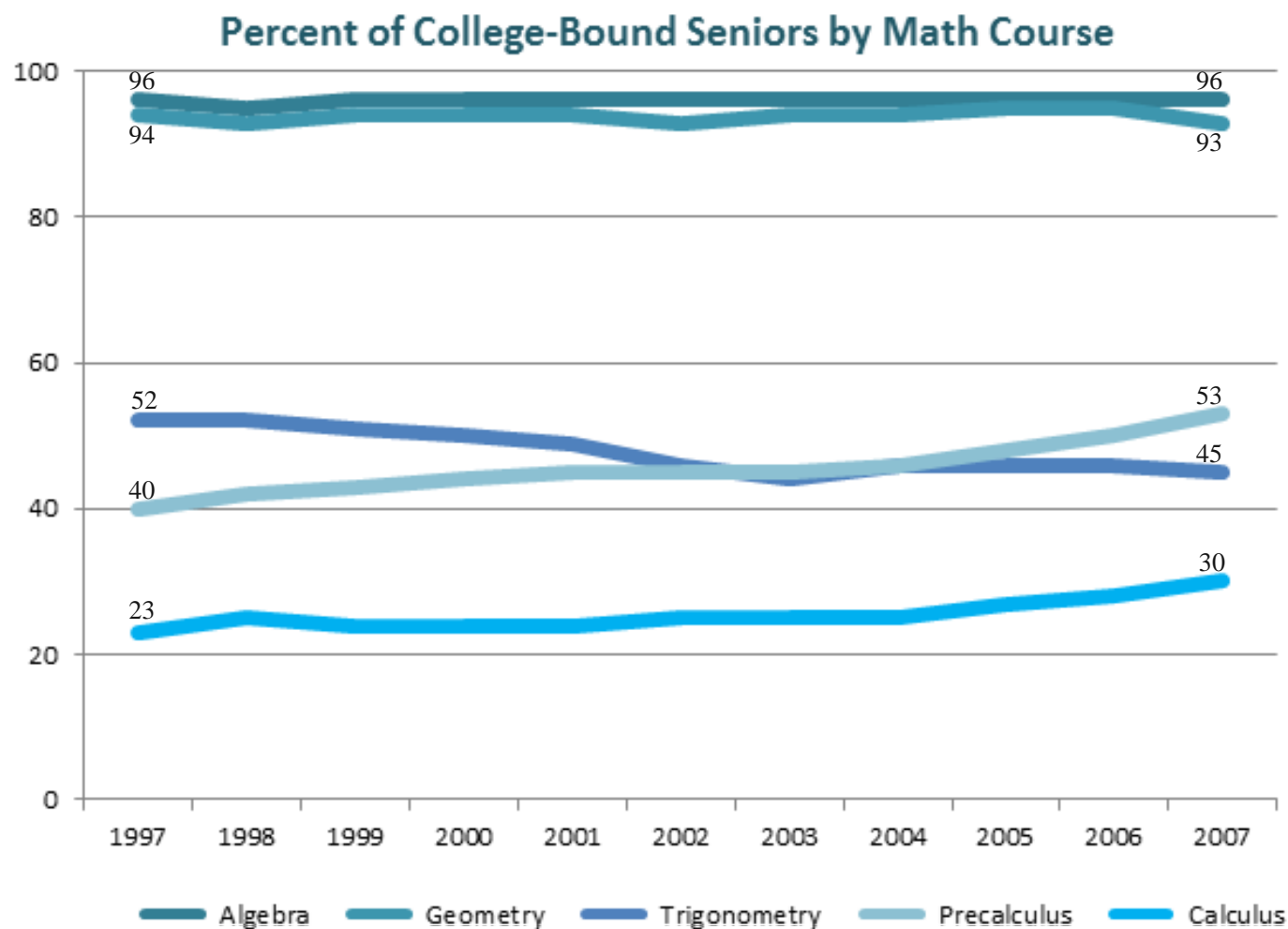
Secondary Pipeline - Preparation



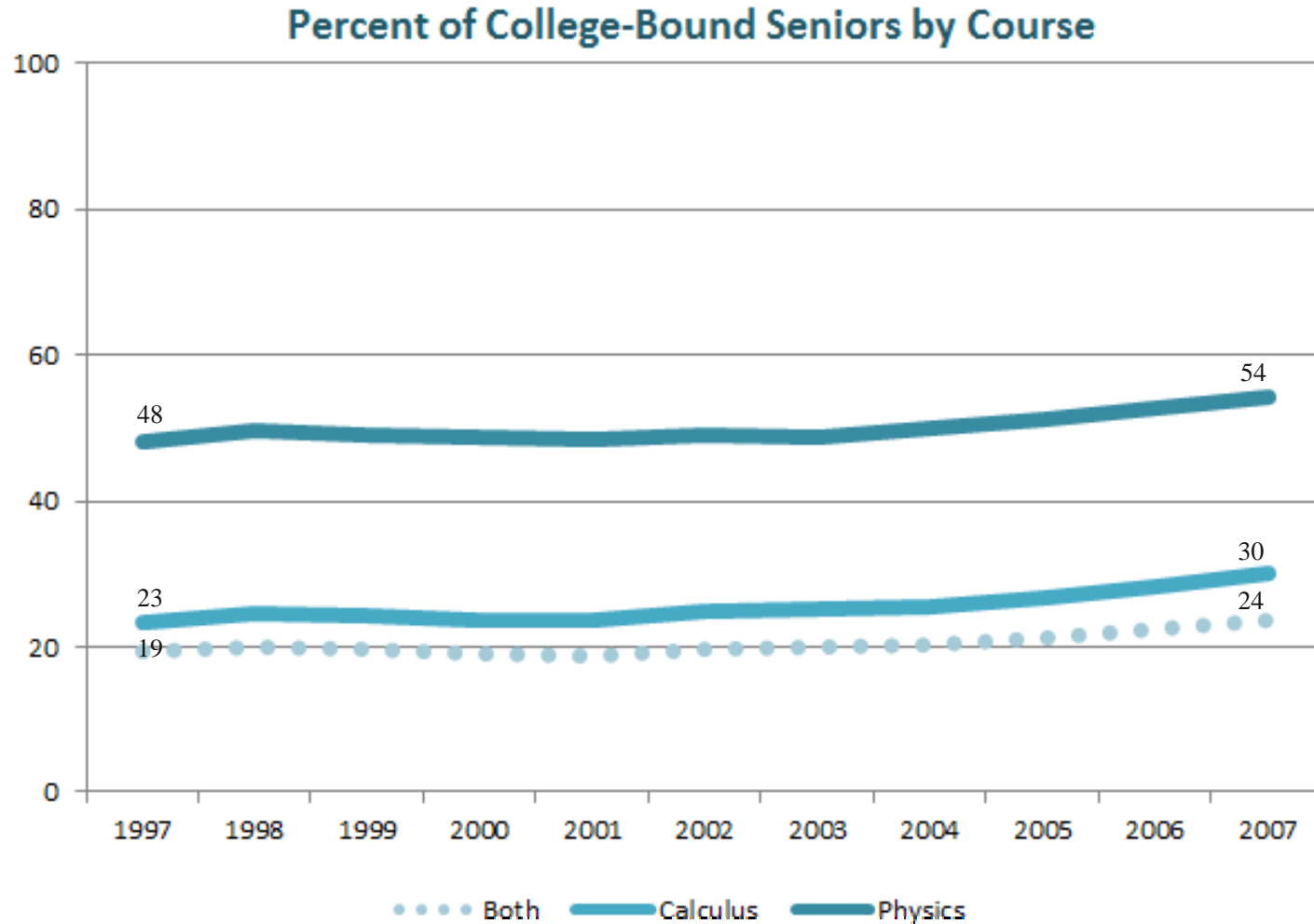
Secondary Pipeline - Preparation



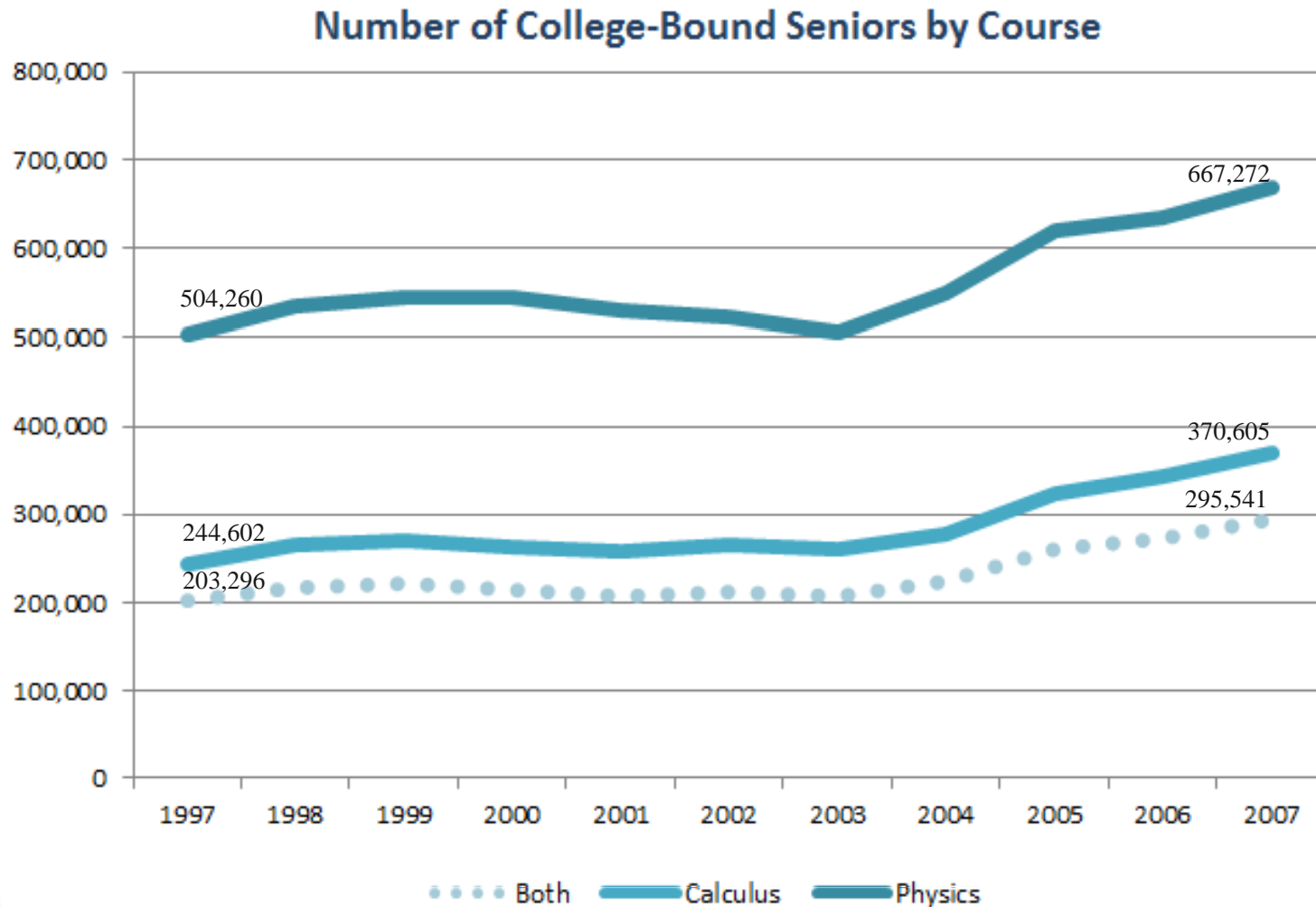
Secondary Pipeline - Preparation



Secondary Pipeline – Admission Expectations



Secondary Pipeline – Admission Expectations



Study II:

PATTERNS OF ENGINEERING INTEREST IN THE CLASS OF 2009

Sample - Class of 2009

3,320,163

High School
Graduates

2,272,912

Seniors w/ Major on
PSAT/NMSQT and/or SAT

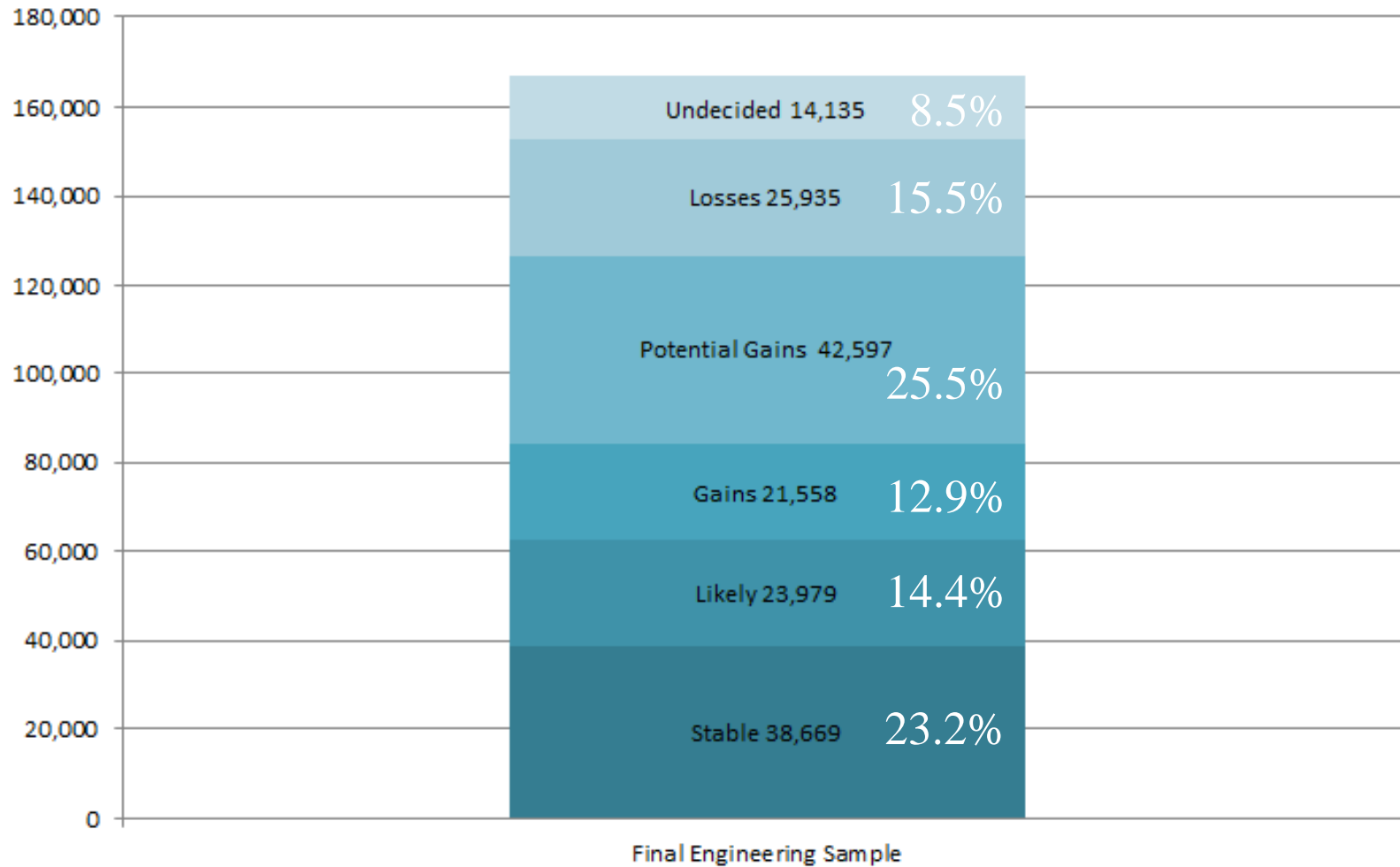
251,309

Seniors w/ Engineering Interest
at some point during high school

166,873

Seniors w/ Engineering Interest who
Indicated Major at Two Points

Engineering Pathways



Stable – Select Characteristics

Race/Ethnicity	College-Bound Seniors	Final Engineering Sample	Stable
American Indian	0.8	0.6	0.6
Asian	7.0	10.6	8.4
Black	15.0	11.7	9.1
Hispanic	16.3	14.5	13.2
White	56.6	59.5	65.9
Other/No Response	4.4	3.1	2.9

Gender	College-Bound Seniors	Final Engineering Sample	Stable
Female	53.3	18.0	10.8
Male	46.6	82.0	89.2

First Language Learned	College-Bound Seniors	Final Engineering Sample	Stable
English	77.5	76.6	80.1
English and Another	13.9	13.9	12.0
Another Language	8.6	9.5	7.8

Highest Level of Parent Education	College-Bound Seniors	Final Engineering Sample	Stable
No High School Diploma	5.0	4.2	3.2
High School Diploma	31.2	25.1	22.7
Associate Degree	9.0	8.2	8.2
Bachelor's Degree	29.8	33.2	35.0
Graduate Degree	25.0	29.3	30.9

Degree Goal	College-Bound Seniors	Final Engineering Sample	Stable
Certificate Program	0.8	0.8	0.6
Associate	1.1	0.6	0.4
Bachelor's	26.5	24.4	26.7
Master's	31.0	37.5	41.0
Doctoral/Related	20.6	18.9	13.1

Stable – Select Characteristics

Math Ability	College-Bound Seniors	Final Engineering Sample	Stable
Highest 10%	20.9	41.6	47.9
Above Average	38.2	39.9	39.2
Average	37.4	17.7	12.5
Below Average	3.5	0.8	0.4

Science Ability	College-Bound Seniors	Final Engineering Sample	Stable
Highest 10%	17.0	33.7	39.4
Above Average	40.2	43.5	43.2
Average	41.3	22.3	17.0
Below Average	1.6	0.5	0.3

Percent Scoring 3 or Higher on AP Exam*	College-Bound Seniors	Final Engineering Sample	Stable
Calculus AB	60.0	66.5	67.8
Calculus BC	80.4	84.2	84.7
Chemistry	56.6	67.6	69.4
Physics B	59.8	66.7	68.4
Physics EM	71.3	72.4	71.2
Physics M	70.7	72.8	73.5

Mean SAT Scores*	College-Bound Seniors	Final Engineering Sample	Stable
Critical Reading	506	531	534
Mathematics	516	575	588
Writing	497	516	516

*Based on most recent test date of those who completed the SAT

High School Rank	College-Bound Seniors	Final Engineering Sample	Stable
Top Tenth	32.6	43.5	46.9
Second Tenth	27.5	26.7	27.5
Second Fifth	19.5	16.3	14.8
Final Three Fifths	20.4	13.4	10.8

Certainty of Major*	College-Bound Seniors	Final Engineering Sample	Stable
Very Certain	27.4	26.7	32.5
Fairly Certain	51.7	52.0	51.4
Not Certain	20.9	21.4	16.1

*if indicated that Engineering was first choice on SAT

Losses – Select Characteristics

Race/Ethnicity	College-Bound Seniors	Final Engineering Sample	Losses
American Indian	0.8	0.6	0.6
Asian	7.0	10.6	9.4
Black	15.0	11.7	14.1
Hispanic	16.3	14.5	16.3
White	56.6	59.5	56.3
Other/No Response	4.4	3.1	3.3

Highest Level of Parent Education	College-Bound Seniors	Final Engineering Sample	Losses
No High School Diploma	5.0	4.2	4.5
High School Diploma	31.2	25.1	28.8
Associate Degree	9.0	8.2	9.0
Bachelor's Degree	29.8	33.2	31.9
Graduate Degree	25.0	29.3	25.9

Mean SAT Scores*	College-Bound Seniors	Final Engineering Sample	Losses
Critical Reading	506	531	509
Mathematics	516	575	537
Writing	497	516	493

*Based on most recent test date of those who completed the SAT

Percent Scoring 3 or Higher on AP Exam*	College-Bound Seniors	Final Engineering Sample	Losses
Calculus AB	60.0	66.5	60.6
Calculus BC	80.4	84.2	82.3
Chemistry	56.6	67.6	60.7
Physics B	59.8	66.7	59.8
Physics EM	71.3	72.4	71.4
Physics M	70.7	72.8	72.0

Math Ability	College-Bound Seniors	Final Engineering Sample	Losses
Highest 10%	20.9	41.6	26.5
Above Average	38.2	39.9	41.2
Average	37.4	17.7	30.4
Below Average	3.5	0.8	1.9

Science Ability	College-Bound Seniors	Final Engineering Sample	Losses
Highest 10%	17.0	33.7	22.6
Above Average	40.2	43.5	43.2
Average	41.3	22.3	33.2
Below Average	1.6	0.5	1.0

Limitations

- Students from locales where the SAT and PSAT are less common may be underrepresented
- Report major two or more times
 - inherently biased the sample toward students who take multiple tests
- Only the most recent SAT data could be obtained
 - a portion of students' history is missing from the analysis (many students take it twice)

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