What can colleges and Universities do to Improve student success In Calculus?

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PowerPoint available at
www.macalester.edu/~bressoud/talks

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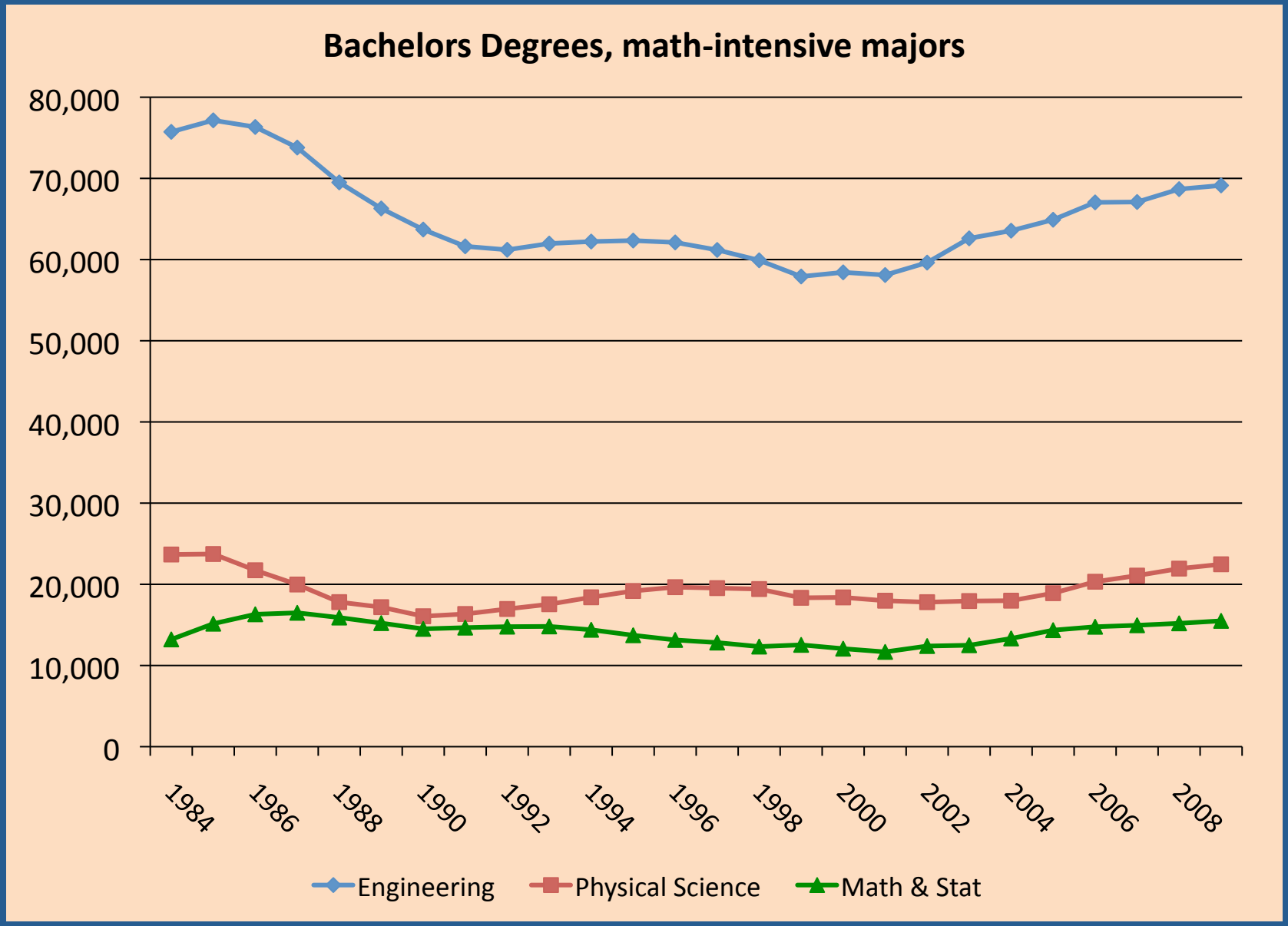
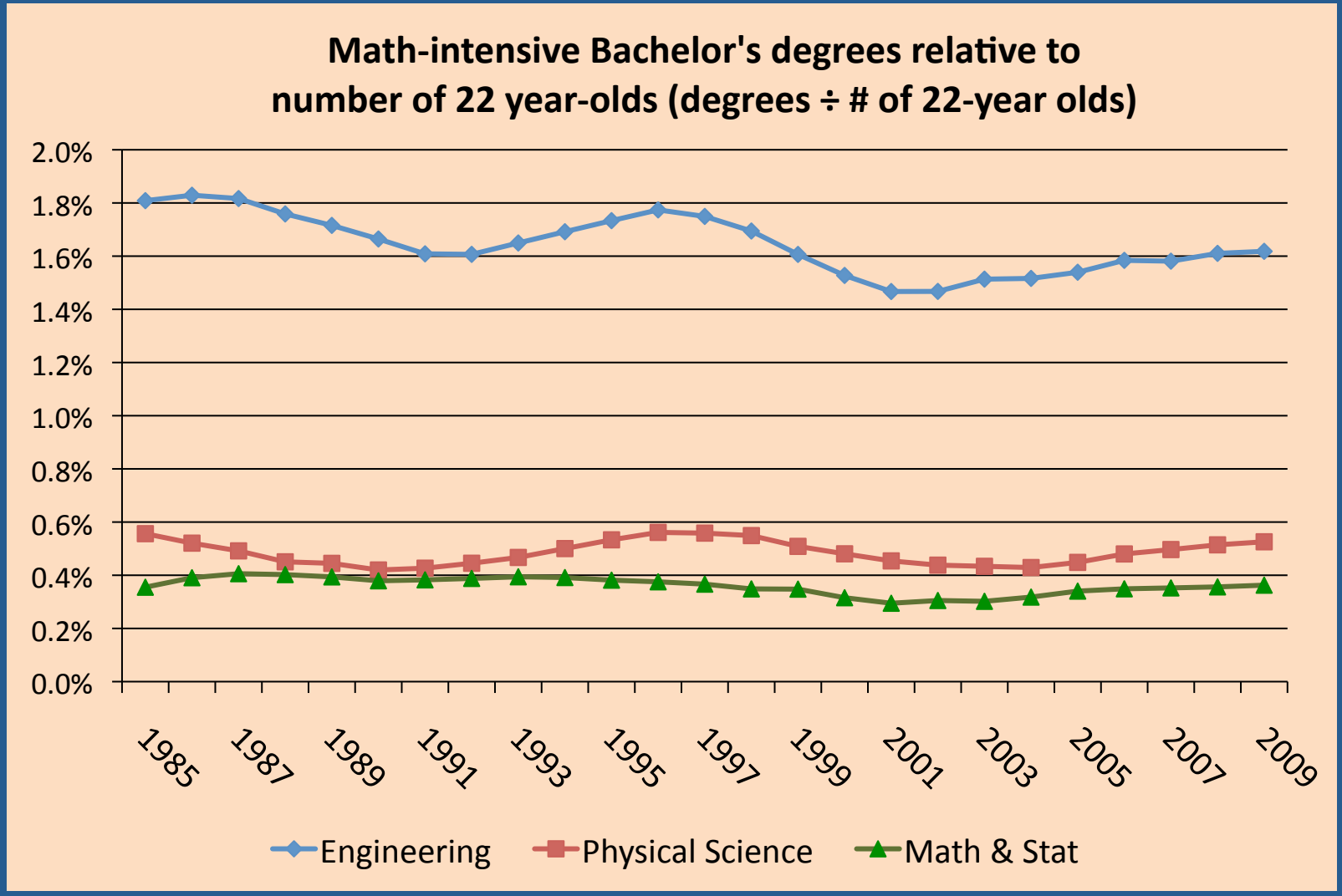
210,000 students per year enter four-year undergraduate programs intending to major in engineering, a physical science, mathematics, or statistics.

An additional 300,000 are enrolled in one of these programs in a two-year college.

We graduate 107,000 with a Bachelor's degree in one of these disciplines.


Bachelors Degrees, math-intensive majors
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Engineering
Physical Science
Math & Stat

NCES data



NCES & US Census data

Students in college or university Calculus I:

mean score on SAT Math: 652, SD: 76

75% earned 610 or higher (top 23%)

mean score on ACT Math: 28.5, SD: 4.3

75% earned 26 or higher (top 16%)

MAA survey of 700 instructors, over 14,000 students, all types of colleges and universities across US, Fall, 2010

Students in college or university Calculus I:

61% studied calculus in high school

69% of them studied AP Calculus

60% of them took the AP Calculus exam and earned 3 or higher

(20% of all students in college Calculus I)

MAA survey of 700 instructors, over 14,000 students, all types of colleges and universities across US, Fall, 2010

Grade for college Calculus I:

22% A

28% B

23% C

27% D, F, or Withdrew

Part of the Solution: Place students in appropriate courses and ensure that remediation (when called for) is effective.

- Measure developed mathematical reasoning skills
- Emphasize realistic and current expectations
- Avoid singular focus on computational skills
- Incorporate appropriate technology
- Use appropriate testing methods

College Placement Testing in Mathematics

Educational accomplishments in mathematics often exert a strong influence on career accomplishments. College-level mathematics study must build on and extend prior experiences. Students entering higher education have diverse preparations for college mathematics due to many factors including academic background, time since high school graduation, age, and work experience. As a result, mathematics departments in colleges and universities have difficulty in placing students in their first college mathematics courses by using only data such as high school rank-in-class, grade point average, or record of high school mathematics courses.

Placement tests can be an effective component of a comprehensive placement process. However, it is important to recognize that the development of testing instruments is a nontrivial process. The Mathematical Association of America recommends that college placement tests in mathematics should:

MEASURE DEVELOPED MATHEMATICAL REASONING SKILLS. College admission tests such as the SAT or ACT measure students' general readiness for college, whereas placement tests seek to measure students' knowledge and skills that are prerequisite for specific entry-level college mathematics courses. Nationally administered tests such as SAT and ACT measure a broad range of quantitative skills, and this measure is often too general to distinguish between readiness for entry-level mathematics courses such as college algebra, trigonometry, pre-calculus and calculus. Therefore, very often, high school record and admission test scores need to be supplemented to make decisions about placing entering students into their initial mathematics courses.

EMPHASIZE REALISTIC AND CURRENT EXPECTATIONS. Placement tests should not reflect obsolescent expectations in mathematics preparation in the secondary schools. Placement tests must be carefully reviewed as more is learned about what contributes to success in post secondary education and in light of changes in content and effectiveness of pre-collegiate mathematics programs.

AVOID SINGULAR FOCUS ON COMPUTATIONAL SKILLS. Good placement tests assess computational skills in unexpected contexts and a balance of procedural fluency, conceptual understanding, and strategic reasoning.

INCORPORATE APPROPRIATE TECHNOLOGY. Calculators and computers are an integral part of most pre-collegiate mathematics instruction. Even though prerequisite skills for a college mathematics course can be assessed without computers or calculators, students may be more comfortable working on a placement test in the familiar environment that includes use of technology. Therefore, calculators and computers should be considered for use in placement testing programs.

USE APPROPRIATE TESTING METHODS. Great care should be used in the design and administration of placement test programs. Informed consultants and helpful literature should be utilized in the design of placement test programs.

Further information on design of effective college placement programs for mathematics can be obtained from the Mathematical Association of America, 1529 Eighteenth Street, NW, Washington, DC 20036.

— MAA Board of Governors
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