Challenges for the Undergraduate Curriculum

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CBMS, MAA Carriage House
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This PowerPoint will be available at
www.macalester.edu/~bressoud/talks
1. Overlapping Programs
80% precalculus and precollege
53% introductory and precollege, 72% if you count Calculus I as high school math.
2. Transition Testing
3. Communicating College Expectations
Initiatives to clarify expectations:

• NCTM *Focal Points*

• College Board *Standards for College Success: Mathematics and Statistics*

• Achieve, Inc. (National Governor’s Association), *American Diploma Project: Secondary Mathematics Expectations*

• ASA *Guidelines for Assessment and Instruction in Statistics Education*
4. Transfer of Credit
Dual enrollment

In spring, fall 2005 (combined), 33,436 students studied Calculus I under dual enrollment programs: 14,030 in connection with 4-year colleges, 19,406 in connection with 2-year colleges.

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<tr>
<th>Control of</th>
<th>4-year colleges</th>
<th>2-year colleges</th>
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<tbody>
<tr>
<td>syllabus</td>
<td>92%</td>
<td>89%</td>
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<tr>
<td>textbook</td>
<td>44%</td>
<td>74%</td>
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<tr>
<td>instructor</td>
<td>48%</td>
<td>52%</td>
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<td>final exam</td>
<td>30%</td>
<td>37%</td>
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Phil Cheifetz, Nassau Community College

*The NCC Partnership Program in Mathematics*

- Training of high school teachers (one-week workshop plus regularly scheduled users’ group)
- Close supervision, college supervisor teaches the class once every two weeks
- College writes *and grades* the exams.
Welcome to NACEP, the National Alliance of Concurrent Enrollment Partnerships.

NACEP is a professional organization for high schools and colleges that fosters and supports rigorous concurrent enrollment. Established in 1999 in response to the dramatic increase in concurrent enrollment courses throughout the country, NACEP serves as a national accrediting body and supports all members by providing standards of excellence, research, communication, and advocacy.

Concurrent enrollment (also called dual enrollment or dual credit) programs provide a unique and sustainable way to deliver rigorous curriculum to a broad range of high school students. They simultaneously provide a mechanism for delivering ongoing professional development to America's most talented teachers. As concurrent enrollment programs continue to flourish across the country, an ever broader audience is taking note. Thus, members, this Web site is intended to serve students, parents, and others learning more about the innovative and proven concurrent enrollment model.
Articulation:
7. Across Curricula
8. Between Tracks
9. Technology
2005 NAEP data (all 12th graders):
84% use calculators at least once/week in math class
62% use calculators daily in math class
52% always use calculators on math tests,
41% sometimes use calculators on math tests
Of those who answered about type of calculator used:
   64% usually use graphing calculator
   17% sometimes use graphing calculator
10% use computers at least once/week in math class
5. Curricular and Pedagogical Alignment
NCES estimate of total HS calculus enrollment versus number of AP exams:

1990: 170,000  85,708
1995: 240,000  126,588
2000: 330,000  184,905
2005: 500,000  255,784

Growth rate has slowed, but still over 6% per year

College Calculus I enrollments have been flat for the past quarter century at about 500,000 per year (including business calculus)
~200,000 arrive with credit for calculus (includes AP, IB, dual enrollment, transfer credit)

~300,000 retake calculus taken in HS

Some start by retaking the calculus they studied in high school

Some are required to take precalculus first

~200,000 will take calculus for first time
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Increasingly, these are students who neither need nor want more than a basic introduction to calculus (i.e. Biology majors). Challenge is to give them a one-semester course that

• Acknowledges that they may not be our strongest students, but
• Builds their mathematical skills,
• Gives them an understanding of calculus, and
• Does not cut them off from continuing the study of calculus
Some are required to take precalculus first.

We need a better solution for these students. Again, the challenge is to give them a course that enables them to overcome their deficiencies while challenging and engaging them.
Some start by retaking the calculus they studied in high school.

We need a better solution than having these students retread familiar territory, but at a much faster pace, in larger classes, and with an instructor who is unable to give them the individual attention that they experienced when they struggled with these ideas the previous year.
~200,000 arrive with credit for calculus (includes AP, IB, dual enrollment, transfer credit)

These are our success stories but:

• We need to worry about articulation with their high school experience.

• We need to work at both challenging and enticing these students.
Mainstream Calculus II Enrollments
(fall only for 2- & 4- year colleges and

students (thousands)

academic year

4-yr colleges &
universities

2-yr colleges

AP Calculus BC only
6. Competing Pressures
Calculus Before Grade 12

- AB Calculus
- BC Calculus
BC exam,
8818 in 2002
13,809 in 2006
57% increase
We need a much better grasp of the extent of the problem:

How many receive college credit for calculus in high school but never take math in college?

How many retake the class they could have skipped?

How many encounter insurmountable difficulties in the transition to college?

If they retake the course they studied in high school, how many now succeed?

How many study calculus in high school but are directed to precalculus when they get to college?

How does what we do and how we do it affect their perception of mathematics and ability to complete the mathematical training they need?

What are the successful strategies for meeting the needs of these various groups of students?
We need to communicate our findings to high school students, their parents, their teachers and counselors:

We need a clear set of expectations of the preparation needed before beginning the study of calculus.

We need collaborative ventures between high school and college teachers that articulate and disseminate these expectations and assist K-12 teachers in preparing students to meet these expectations.
Most colleges still teach a calculus sequence predicated on the assumption that students taking the first course in the sequence have never seen calculus before, and students in subsequent courses have come through the previous courses at that college. This is not the reality on most campuses.

We need to use our findings to re-evaluate the way we teach calculus in college.