Quantitative Reasoning: Alternatives to Traditional College Algebra

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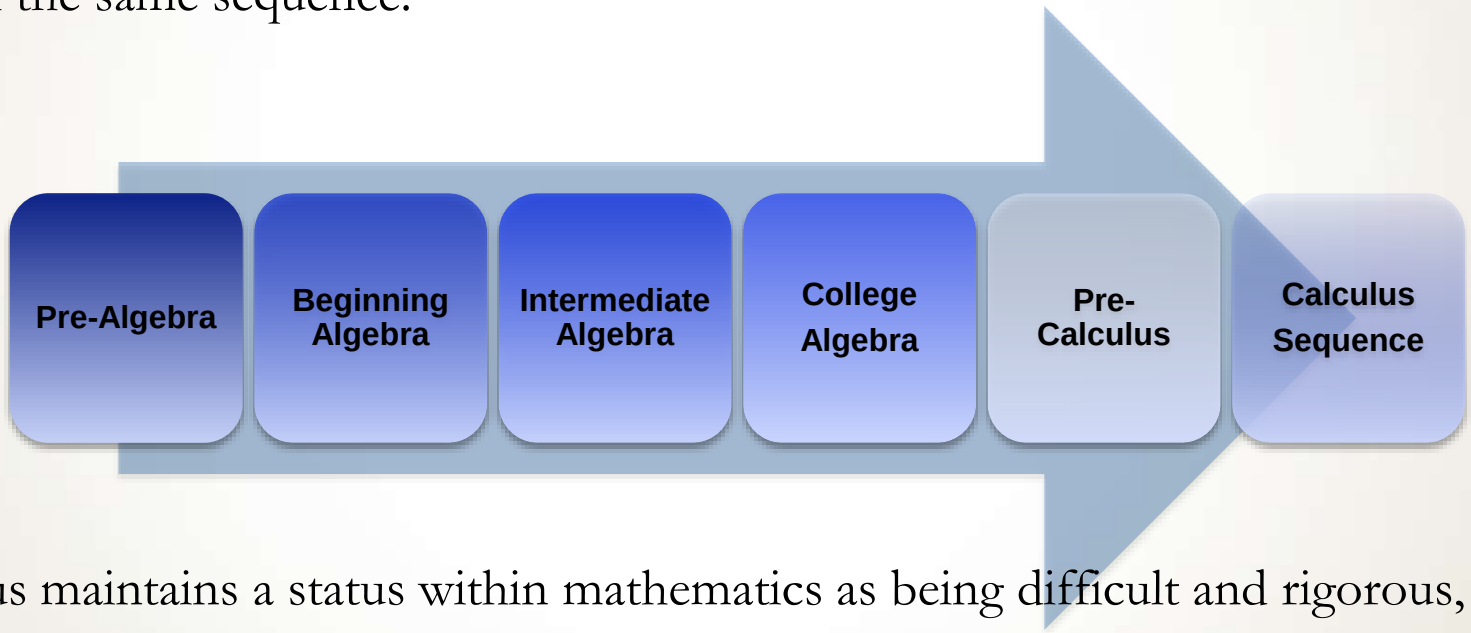
What Mathematics?

What mathematics should "everyone" know and be able to do? Various educational groups and professional organizations have been attempting to answer this question for decades.

Post-Secondary Mathematics

Higher education has created more and more courses built to support a sequence based on skills needed for Calculus. Every student who needs "math" is forced through the same sequence.



Calculus maintains a status within mathematics as being difficult and rigorous, offering preparation for future mathematicians and engineers. However, the mathematics required for Calculus may not fit the demands of all student career paths.

Undergraduate Mathematics Enrollment

Type of course	1995	2000	2005	2010
Precollege level				
Arithmetic & Basic Mathematics	134	122	104	146
Pre-algebra	91	87	137	226
Elementary Algebra (high school level)	304	292	380	428
Intermediate Algebra (high school level)	263	255	336	344
Geometry (high school level)	7	7	7	6
Precalculus level				
College Algebra	186	173	206	230
Trigonometry	43	30	36	45
College Algebra & Trigonometry	17	16	14	11
Intro to Mathematical Modeling	NA	7	7	18
Precalculus/Elem Functions/Analytic Geometry	50	48	58	64

Undergraduate Mathematics Enrollment

Type of course	1995	2000	2005	2010
Calculus level				
Mainstream Calculus I	58	53	51	65
Mainstream Calculus II	23	20	19	29
Mainstream Calculus III	14	11	11	15
Other mathematics courses				
Elementary Statistics (with or w/o probability)	69	71	111	134
Probability (with or w/o statistics)	3	3	7	3
Mathematics for Liberal Arts	38	43	59	91
Business Mathematics (not transferable)	28	14	22	16
Business Mathematics (transferable)	11	19	17	4
Technical Mathematics (non-calculus based)	17	13	16	17
Technical Mathematics (calculus based)	2	2	1	1

Undergraduate Mathematics Enrollment

More than half of all four-year enrollment and more than 90% percent of all two-year enrollment is in courses that cover the content typically addressed in middle and high school– level mathematics courses.

Less than 10% of higher education math enrollment is at the upper division level.

What Mathematics?

Uri Treisman (University of Texas at Austin) remarked recently that mathematics should not be a barrier to our citizen's upward social and economic mobility. The need to modernize the American undergraduate mathematics curriculum is upon us. Without real change we will see myriads of students trapped into college algebra courses learning skills that are irrelevant to their intended careers and their futures.

Our Mathematical Mismatch

There is a mismatch between the core general education mathematics curriculum and our growing need for students to understand how to analyze data and to quantify uncertainty. It no longer makes sense for making college algebra to be the general education mathematics requirement.

Quantitative Reasoning

Success in the new information economy appears to require a new set of problem-solving and behavioral skills. These skills, especially problem-solving skills, emphasize the flexible application of both mathematical and verbal reasoning abilities in multifaceted work contexts across the full array of occupations and industries. Such skills most often require the versatile use of relatively basic mathematical procedures such as "numeracy" and "quantitative literacy" than to higher knowledge of advanced mathematical procedures.

Questions to Consider

- What are the enduring QR understandings, concepts, and processes in STEM disciplines that students should carry from high school to college?
- What is the appropriate development of expertise in QR over the high school and college continuum?
- How should college science and mathematics courses change to build on and extend high school QR?
- How can we improve QR?
- What is the impact of QR on increasing students' engagement in science and mathematics so they are motivated to study and remain in STEM disciplines?

Parallel Pathways

How can institutions remove barriers and open pathways into and through the mathematical sciences curriculum?

- The New Mathways Project
- Transforming Post-Secondary Education in Mathematics (TPSE Math)
- Big Picture Learning – QR Quest
- Statway & Mathway

Questions?

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