

Quantitative Reasoning Assessment at the University of Massachusetts Boston

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The University of Massachusetts Boston

- Urban mission: to provide a low-cost education to the people of the greater Boston area.
- Many students are low-income and the first in their family to attend college.
- The majority of students are older: mean age is 27; median age is 24.
- One-third of students are from minority groups.
- Many transfer students.
- There are no dorms - it is truly a commuter campus.



General Education at UMass Boston

In 2002, a new general education program was put in place with the following principles as its foundation

- critical analysis and logical thought
- Verbal and quantitative reasoning
- Human diversity
- Principal approaches to knowledge

A radical idea: Build in a comprehensive first-year experience consisting of a first-year seminar and a mathematics/quantitative reasoning course

Why does UMass Boston need a Quantitative Reasoning course?

- Until a few years ago, students could graduate without taking a course emphasizing quantitative reasoning or mathematics.
- Those who did take a math course often took “Basic Algebra” (actually, high school algebra!).
- Basic Algebra was a traditional, usually terminal, course with an unacceptably high failure rate.
- Were students really prepared for higher-level courses and the workplace? Feedback indicated they were not.

The Math/QR requirement

- Part of our new general education program.
- **All** students must “demonstrate competence in mathematics/quantitative reasoning. “
 - B.S. students must take Calculus I (a traditional Calculus course)
 - B.A. students have several choices:
 - Test into PreCalculus or Calculus
 - Take College Algebra or Statistics
 - Take a Quantitative Reasoning course
 - Nursing and Health Science students take Statistics
 - Management students take Calculus

Each semester, approximately 200 - 250 students choose to take a QR course.

The QR course at UMass Boston

- Taken by liberal arts & nursing students to meet their QR requirement.
- Taught out of the math department (by mathematicians, computer scientists, philosophers, etc.).
- Taught in a computer classroom; course size limited to 23 students.
- Each section has a peer tutor in the classroom to help with the work and with the technology.
- Course topics: numbers in context; descriptive statistics; models of dependence; probability and chance.
- Subversive course topics: citizen literacy; learning to read, write and think quantitatively and critically.

Other aspects of QR

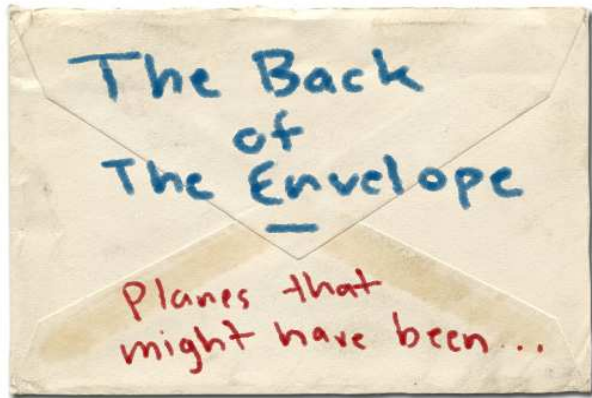
It is horizontal and purposefully multi-disciplinary

Typically encourages collaboration

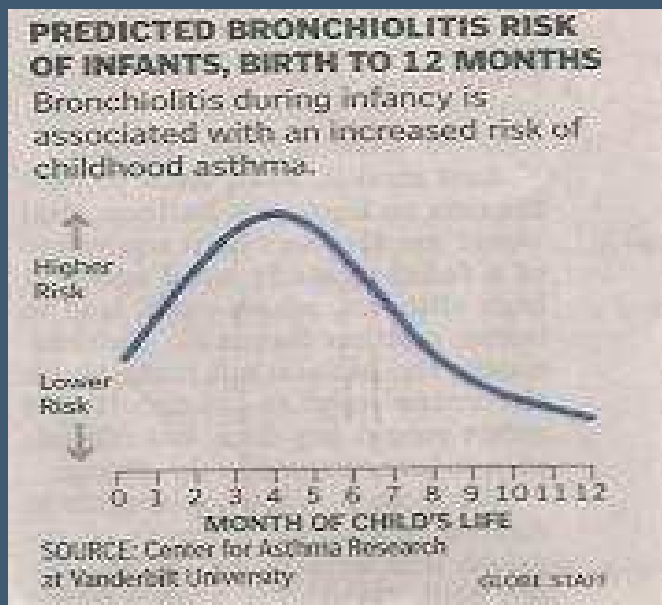
Not just mathematics, but mathematics in new and surprising contexts

Not just calculation, but interpretation, analysis, description

Can we use technology (the web, spreadsheets) as a tool for exploration (“what-if” questions), calculation, and information? These are tools that will endure long after the course is over.



Can we help them become critical consumers of data and information?



This means evaluating data, going beyond the data to get more information, asking questions, realizing when you're in too deep, and using appropriate mathematical tools to get answers.

boston.com

Benefits take hit in Patrick budget State staff to pay higher premiums

By Matt Viser, Globe Staff | January 13, 2008

Looking for ways to trim a looming \$1.3 billion budget gap, Governor Deval Patrick will propose shifting more of the cost of health insurance to premiums onto tens of thousands of state employees.

Under his plan, about 37,000 employees would see their monthly premiums increase by 10 percent...

Right now, most employees pay 15 percent and the state covers 85 percent. But under the governor's proposal ... those making more than \$50,000 would pay 25 percent.

Can we change the way students understand coincidence, chance, probability, risk?



Should I stock up on Antibiotic soap, hand sanitizer, face masks?

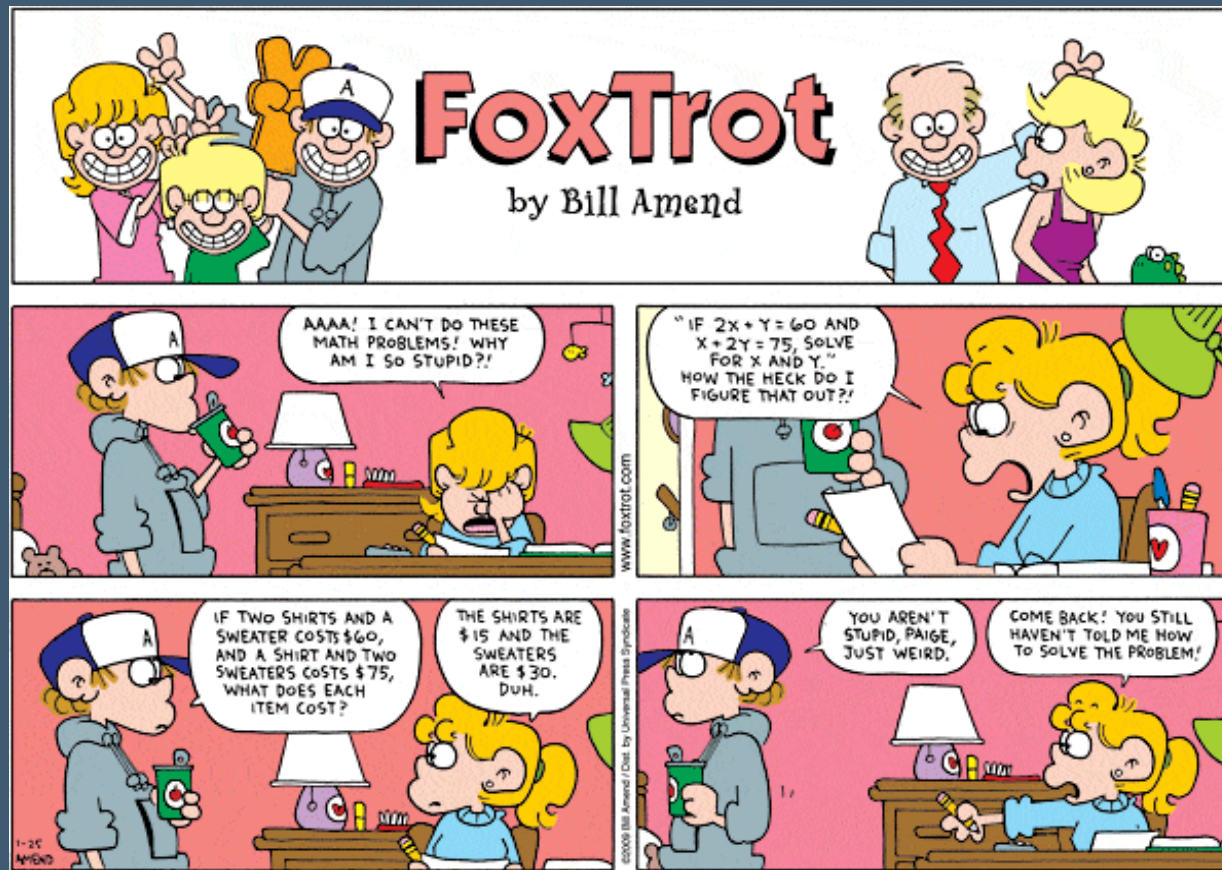
NY Times Offline column, March 8, 2008:

New managers often have this quandary: Do you hire the candidate you know is competent, but ordinary, or someone who has potential to be great, but has an equal chance of being awful?

The advice, from the “Cubicle Coach” Marie Claire, is to go with the wild card.

“You have a 66.7 percent chance of a positive result,” the coach writes. “Yes, the unknown could flop, but she could also a) do as well as the known, or b) actually be a star.”

Can we give students a transformative experience that changes their attitudes and their confidence about working with quantitative information?



Assessment

- An interdisciplinary committee (QuAC) evaluates new QR course proposals and existing QR courses
- 2 - 3 course sections are assessed each semester, using student portfolios - are instructors covering the syllabus and following the General Education guidelines; are students demonstrating mastery?
- All students are asked to complete a QuAC evaluation form (separate from the Math Department's evaluation)
- A set of common final exam questions are graded holistically, to assess specific student learning outcomes
- QR faculty meet at least once each semester to discuss the course and related issues.

Assessment: several approaches

- Assessment of the course as a whole
- Student self-assessment
- Assessment of student learning objectives

Portfolio reading

- Each semester, new faculty and selected veteran faculty submit a sample of portfolios of student work.
- Portfolios include student “automathography” and end of semester reflection; evidence of data analysis; written work; final exam
- The QR Assessment Committee reads the portfolios and gives feedback to the individual faculty.
- Results are used to enhance faculty training and development.

Student self-assessment

Self-reflection:

- Students complete an “automathography” at the beginning of the semester and a reflection at the end of the semester – this is viewed only by the instructor

Course assessment and evaluation:

- Student questionnaire given to all students
 - Demographic data
 - Self-assessment of technical skills and QR skills
 - Attempts to measure attitudinal change
- Administered online with support from the mathematics department
- Faculty log in to view their students’ responses and course-wide responses.

Student questionnaire

12. As a result of the course my ability to:

	Is about the same	Is Improved	Is much improved
a. Attach documents to email.....	_____	_____	_____
b. Use Excel to analyze data.....	_____	_____	_____
c. Use a word processor.....	_____	_____	_____
d. Use the Internet to obtain information.....	_____	_____	_____
e. Cut/paste and download data from the Internet.....	_____	_____	_____
f. Read and understand graphs.....	_____	_____	_____
g. Draw conclusions from datasets.....	_____	_____	_____
h. Work with formulas.....	_____	_____	_____
i. Work with very large and very small numbers.....	_____	_____	_____
j. Use data to construct a convincing argument.....	_____	_____	_____

13. Do you find that you now read newspaper or magazine articles that contain data, charts or graphs more critically? Yes _____ No _____

14. Check any of the boxes below that apply to you:

	I would be comfortable applying this in another course or in my employment	I have already applied this in another course or on-the-job (if so, specify the course or the kind of job)
a. Evaluating quantitative claims and the evidence presented in their support	_____	_____
b. Using Excel to organize and analyze data.....	_____	_____
c. Producing reports that use data, charts or graphs to support conclusions or arguments.....	_____	_____
d. Using technology learned in this class.....	_____	_____

Holistic grading of common final exam problems

- QR faculty agree on a set of problems that will appear on all finals across the sections.
- Generally 5 – 6 problems, covering the main student learning objectives
- A sample of finals from each section is graded holistically
- New approach: ask QR faculty to participate in holistic grading.

Examples of holistic grading for common final exam problems

Exhibited understanding of relative frequency	Found mean for grouped data	Understood distinction between mean and median	Made a coherent, logical argument
<i>0=no understanding</i> <i>1=full understanding</i>	<i>0=no understanding;</i> <i>1= partial;</i> <i>2 = full</i>	<i>0=no understanding;</i> <i>1= partial; 2 = full</i>	<i>0=no understanding;</i> <i>1= partial; 2 = full</i>

Faculty self-assessment

- QR faculty meet each semester to “de-brief”
- Discussions include
 - What worked
 - What didn’t work
 - Issues of support and training
 - Student learning outcomes and course objectives
 - Assessment information
 - Resources and information

For more information

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See also:

“Quantitative Reasoning at the University of Massachusetts Boston,” M. Mast and M. Pawlak, in *Current Practices in Quantitative Literacy*, edited by R. Gillman, MAA publications, 2006