The Right Stuff: Module Overview

Background

The Right Stuff: Appropriate Mathematics for All Students is an American Mathematical Association of Two-Year Colleges (AMATYC) project funded by the National Science Foundation. Project participants created educational materials designed to promote changes in the way we teach the courses below calculus.

The Problem

The mathematics taught in many college algebra courses fails to provide learners with the quantitative understanding and practical skills they will need to solve real world problems. In response to this problem, the Mathematical Association of America (MAA), AMATYC, the US Department of Labor (DOL) and others have called on educators everywhere to change what they teach and the way they teach.

MAA Curriculum Foundations Project

"Replace traditional college algebra courses with courses stressing problem solving, mathematical modeling, descriptive statistics, and applications in the appropriate technical areas. Deemphasize intricate algebraic manipulation."

Source: MAA Curriculum Foundations Project: Voices of the Partner Disciplines (p. 6)

http://www.maa.org/cupm/crafty/Chapt1.pdf

MAA Curriculum Renewal Across the First Two Years (CRAFTY) Committee

Students should be able to

- [solve] problems presented in the context of real world situations with emphasis on model creation and interpretation
- effectively [use] multiple perspectives (symbolic, numeric, graphic, and verbal) to explore elementary functions
- [fit] an appropriate curve to a scatter plot and use the resulting function for prediction and analysis;

Source: MAA CRAFTY Guidelines for College Algebra (p. 2)

http://www.maa.org/cupm/crafty/CRAFTY-Coll-Alg-Guidelines.pdf

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AMATYC *Beyond Crossroads*

"Mathematics departments will develop, implement, evaluate, assess, and revise courses, course sequences, and programs to help students attain a higher level of quantitative literacy and achieve their academic and career goals."

Source: Beyond Crossroads (p. 14)

http://www.beyondcrossroads.com/doc/CH3.html

DOL Secretary's Commission on Achieving Necessary Skills (SCANS)

The commission identified the several skills and personal qualities as needed for solid job performance including

- acquiring and evaluating data
- solving problems
- using computers to process information
- interpreting and communicating
- thinking creatively

Source: http://wdr.doleta.gov/SCANS/whatwork/whatwork.pdf

In summary, an effective college algebra course should engage students in data modeling, promote the effective use of technology, equip students with strong problems solving skills, increase critical thinking skills, and enhance quantitative literacy.

College Algebra Course Design: A New Way of Thinking

Many of the topics and solution techniques included in existing College Algebra courses are not relevant to today's learners. A redesigned course should emphasize creating models and interpreting solutions instead of focusing exclusively on solution techniques. For example, knowing how to solve a linear equation algebraically is of little value if the learner can't interpret the meaning of the solution or is unable to create the linear model in the first place. In contrast, if a learner knows how to create a linear model and knows how to apply problem solutions, the technique of solving the equation becomes a meaningful part of the problem solving process. The problem solving / modeling process is depicted in the following figure.

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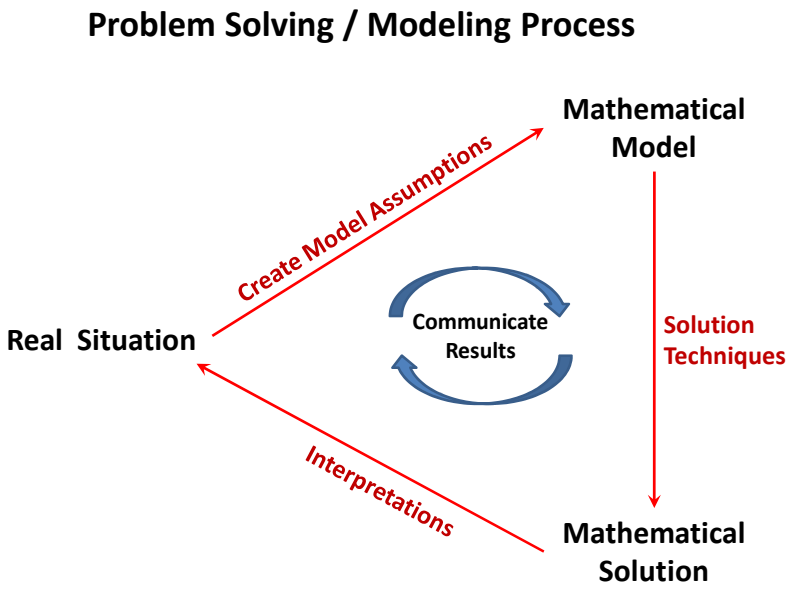

Don Small, USMA

The following list details recommended course content for College Algebra based on the MAA CRAFTY Guidelines for College Algebra.

- use symbolic, numeric, graphic, and verbal perspectives to explore elementary functions
- investigate linear, exponential, power, polynomial, logarithmic, and periodic functions
- use standard transformations with graphs of elementary functions
- use systems of equations to model real world situations
- solve systems of equations using a variety of methods
- master algebraic techniques necessary for problem-solving and modeling
- collect, display, summarize, and interpret data
- fit an appropriate curve to a scatter plot
- use a function model for prediction and analysis
- determine the accuracy of function model results

Best Practices in College Algebra Teaching

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Admittedly, teaching a course like the one described above requires different teaching strategies and techniques. As you make the change, keep in mind the following priorities.

- Understanding over memorization
- Integration over isolation
- Depth over breadth
- Application over recognition

The following teaching strategies will help you keep these priorities in proper perspective: rule of four, real world data, Right Stuff Modules.

Rule of Four

Provide opportunities for learning to interact with data graphically, symbolically, numerically, and verbally. For example, the interactive spreadsheet depicted below shows a data table and scatter plot relating fuel usage and running time of a generator. The spreadsheet allows the student to adjust the red line by using the two scroll bars that determine the slope and the vertical intercept in order to find a reasonable algebraic model for the data. As the scroll bars are moved, the line moves and the equation changes (see Module 2.0). The technology empowers the student to graphically analyze the situation and find a solution to the modeling problem. The verbal description of the situation and the task of describing the accuracy of the model allow the learner to verbally interpret the data and the results. The symbolic equation for the data model is shown immediately below the graph of the model.

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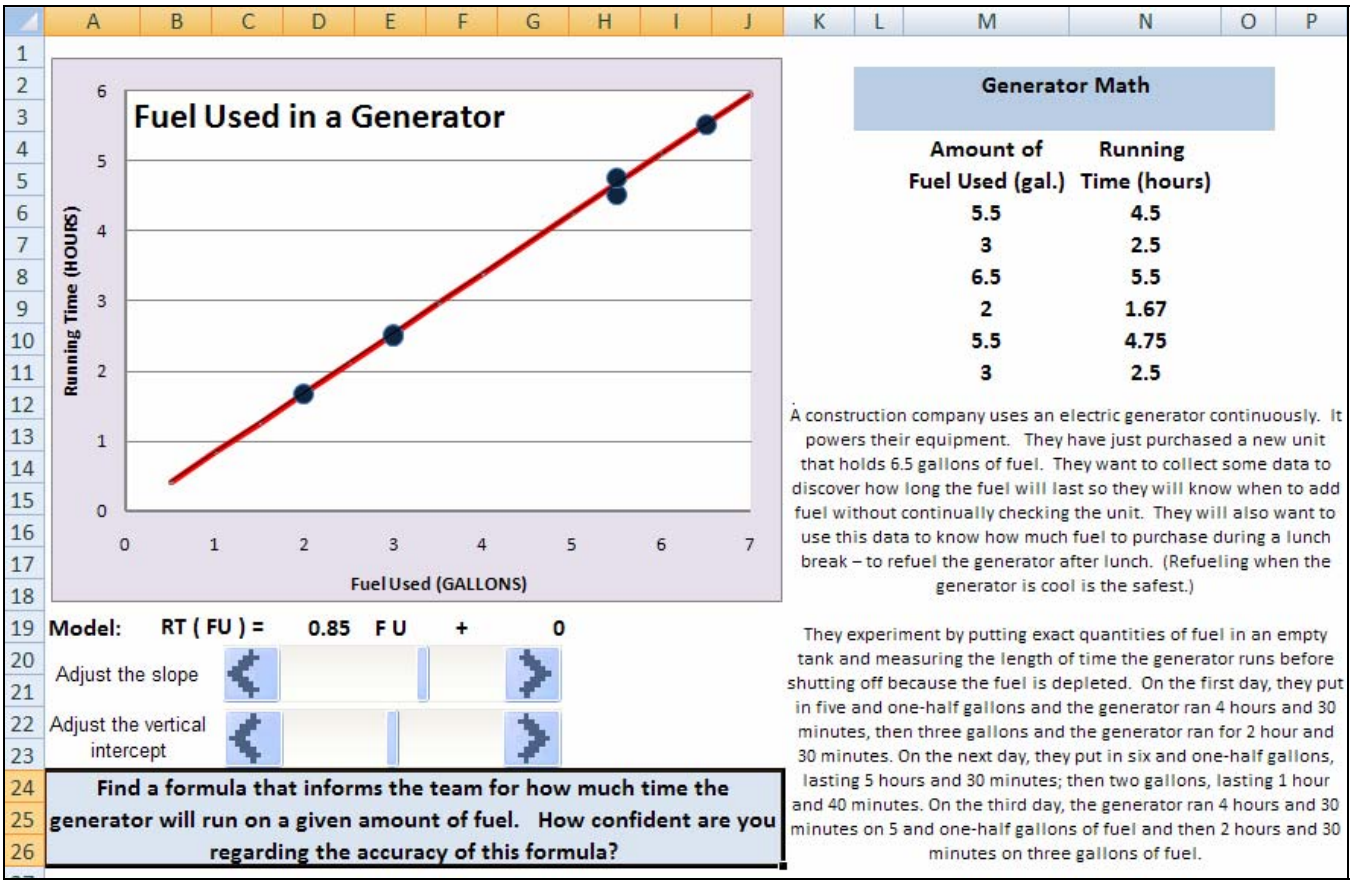

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Use of Real World Data

Integrating real world data into exams, projects, and lectures in meaningful ways is one of the best ways to help learners make the connection between mathematics and the problems they will be required to solve in their professional and personal lives. Numerous data sources are readily available. To help you know where to start, we have identified a few of them below.

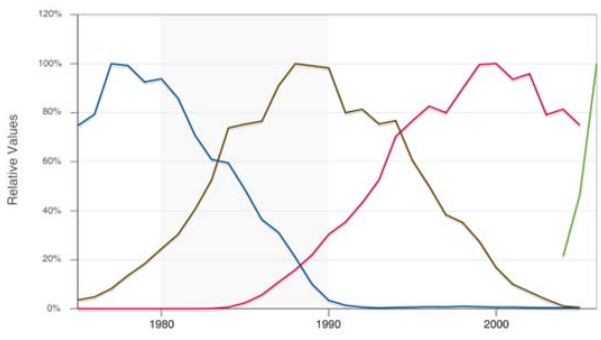
USA Today

The USA Today "snapshots" often contain information that can be used in a mathematics class. Newspapers, in general, use a great deal of statistics.

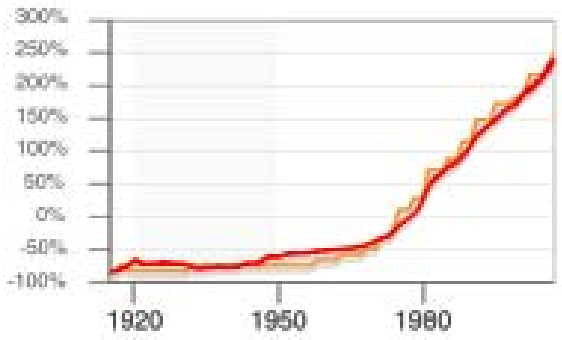
www.usatoday.com/snapshot/news/snapndex.htm

Swivel

Swivel contains nearly two million graphs of real world data sets that may be freely downloaded and pasted into exams, projects, or other course materials. Data sets range from the relative values of various forms of music media to the inflation rate and first class stamps (shown below).
www.swivel.com/graphs



Vinyl, Cassettes, CDs, and Digital



U.S. First Class Stamps vs. Inflation

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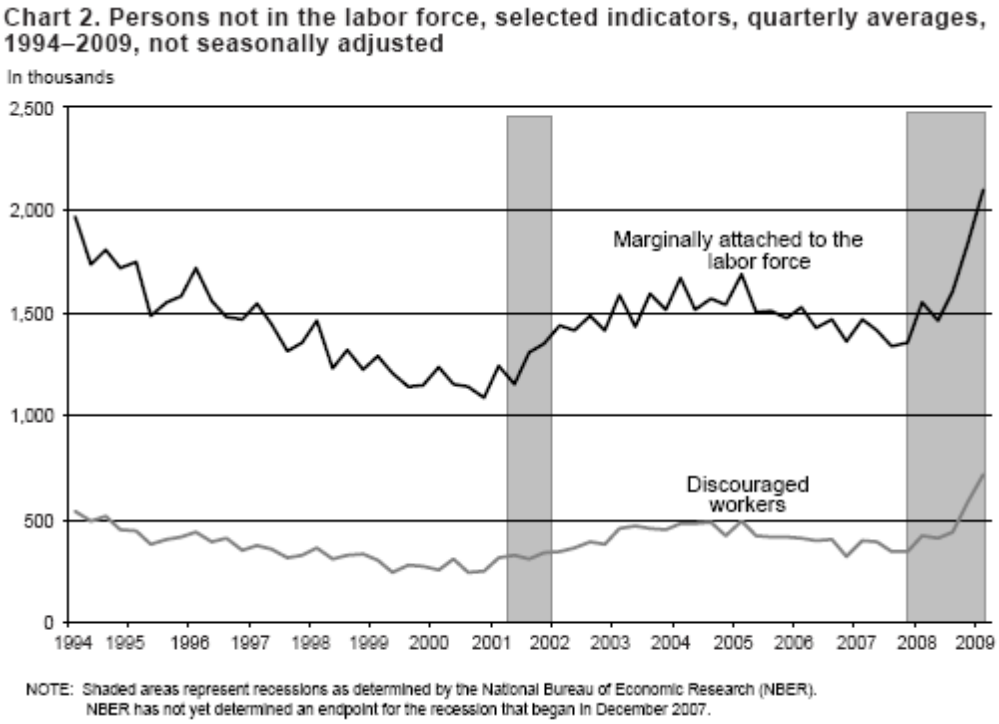
US Department of Labor and Statistics

Numerous data sets and graphs related to the US economy are available on the department's website.

www.bls.gov



Persons not in the labor force

US Census Bureau

This site contains thousands of data sets in editable Excel spreadsheets of data. www.census.gov

State Median Income

- **State Median Family Income by Family Size** (Excel File)
- **State Median Family Income by Numbers of Earners In Family** (Excel File)
- **Income of Households by State** Using 2-Year-Average Medians (Excel File)
- **Income of Households by State** Using 3-Year-Average Medians (Excel File)

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Right Stuff Modules

The Right Stuff Modules are classroom activities that reinforce the concepts and skills needed in a redesigned College Algebra course focused on the MAA CRAFTY recommendations for College Algebra. See the Table of Contents for a complete list of the modules.

Summary

By integrating the rule of four, real world data, and the Right Stuff modules into your course design and instruction, you will be able to help students acquire the personal qualities and skills necessary to succeed in today's workplace. It is a change worth making.

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