Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
Number 43, October 2002

Contents

[1] Innovative College Algebra and Precalculus Courses

(This article consists of excerpts of a position paper that Sheldon Gordon wrote for the MAA's Committee on the Undergraduate Program in Mathematics.)

Over the last year, considerable attention has been directed to the courses before calculus and their relationship to a movement for quantitative literacy. Four special invited conferences (including the Conference to Improve College Algebra, sponsored by the HBCU Consortium for College Algebra Reform) looked at different aspects of these courses and the participants independently came to almost identical sets of conclusions and recommendations. For example most of the innovative projects in this area have introduced the theme of fitting functions to data to take advantage of the capabilities of graphing calculators and spreadsheets such as Excel. There are huge advantages to doing this - it far better connects the mathematical ideas to the kinds of applications that students will see in their other quantitative courses; it gives the students a much better sense for the usefulness of the mathematics; it allows the instructor to return to and reinforce the properties (both behavioral and manipulative) of the different families of functions; and it serves as a unifying theme in the course (something which is sadly lacking in traditional courses at this level).

In some of the innovative projects at this level, difference equations (recursive sequences) have been introduced as a major theme. This topic also serves to provide a feel for the power of mathematics in modeling the real world; it serves to reinforce the behavioral characteristics of various families of functions; it links the mathematics to what is done in many of the other disciplines; and it provides the students with the knowledge and understanding of recursion - the mathematical language of the spreadsheet, which is the primary technological tool of almost every

* Supported by the National Science Foundation and the U.S. Military Academy.

other quantitative discipline.

However neither of these topics is a traditional topic in college algebra or precalculus; in fact, neither is a traditional topic anywhere in the usual undergraduate curriculum. This means that the resulting courses are no longer instantly recognizable as college algebra or precalculus.

In summary, there was total agreement that college algebra and precalculus courses, as presently constituted with a primary emphasis on the development of algebraic skills, are not working for a variety of reasons, including:

1. At most schools, these courses have unacceptably high DFW rates.

2. These courses do not motivate large numbers of students to go on to further mathematics courses.

3. These courses do not adequately prepare most of the relatively few students who do go on to subsequent mathematics courses.

4. These courses do not serve the present-day mathematical needs of most other quantitative disciplines, where a deep level of conceptual understanding of the mathematics is deemed more valuable than a very high level of facility in manipulating symbols.

These courses do not provide the students with the type of intellectual skills and understanding that are needed in the workplace or that would enable them to be effective citizens.

Yet, according to the data such as the most recent Conference Board of the Mathematical Sciences study, several million students take these courses each year. The overwhelming majority of them take these courses only to fulfil some general education requirements that are imposed (and often prescribed in extreme detail) by people and groups outside the mathematics department.

Following the four conferences, a steering group formed to guide improvement in the courses before calculus. The group includes leaders of the four conferences, members of curriculum committees of the MAA, AMATYC, and NCTM, Presidents of AMATYC and NCTM and the Director of the Mathematical Sciences Education Board. At a meeting last spring,

* All of the participants believe that these courses should have a solid algebraic spine, but that algebraic techniques should not be the focus of the courses.
* All participants believe that these courses should have a strong emphasis on conceptual understanding and be deep intellectual experiences for the students.
* All participants believe that it is at least as important to prepare students conceptually for succeeding mathematics courses as it is to prepare them algebraically.
* Most participants believe that these courses should focus heavily on mathematical modeling and realistic problem solving, and that interpretation of results should be a vital component of any applied problem.
* Most participants believe that data analysis should be an integral part of all of these courses and should be used to connect the mathematics to its use in most other quanti-

tative disciplines.

* Most participants believe that technology has an important and meaningful role to play in both the teaching and learning of mathematics. However, in most other disciplines, the technology of choice is the spreadsheet rather than the graphing calculator.

* Most participants believe that the development of writing and communication skills should be an important and significant aspect of these courses.

* Many participants believe that college algebra courses should become vehicles for quantitative literacy;

* All participants believe that the quantitative literacy theme should permeate all of these courses.

[2] Fun Project: Is Improving Gas Mileage Worth the Cost?

The ongoing debates swirling around gas mileage for cars and trucks are multifaceted and far-reaching for oil is a major influencing factor in both foreign and domestic policy. For example: Should the federal government allow drilling in Alaska (Anwar national reserve)? Are car emissions major contributing factors to global warming? How many years will the world's oil reserves last? Should oil reserves be conserved for future generations? Is oil too valuable a resource to be used for inefficient cars and trucks? (Approximately only 15% of the energy in gasoline is used to move a car. See the article Energy Technology and Fuel Economy, http://www.fueleconomy.gov/feq/atv.shtml.)

In this project, we shall look at just one aspect of the fuel debate, the cost to the consumer. In particular, we consider the question: Does the financial savings from increased gas mileage cover the increase in the vehicle's sale price resulting from the cost of building a more fuel efficient vehicle? We make some assumptions in order to make the question tractable.

a. We use Jerry Taylor's (Cato Institute) statement that it will cost $1,466 to increase the average mileage on full-size pickup trucks from 18.1 MPG to 26.7 MPG.

b. The average driver of a full-size pickup drives 15,000 miles per year.

c. The average price of gasoline is $1.50 per gallon.

d. The bank interest rate is 4% APR.

Questions to be answered:

1. How many gallons of gasoline will an owner of a full-size pickup save in a year if the mileage is increased from 18.1 MPG to 26.7 MPG?

2. How much money will the owner of a full-size pickup save on gasoline in a year if the mileage is increased from 18.1 MPG to 26.7 MPG?

3. Assume a person intends to buy a full-size pickup and keep it for 4 years. Is the person better off financially paying the additional $1,446 to buy a truck

that gets 26.7 MPG or investing the \$1,446 in a savings account and buying a truck that gets 18.1 MPG? Assume the savings account offers 4% APR compounded monthly?

4. Assume a person finances the purchase of a full-size pickup with a loan at 6% APR, payable monthly for five years. Assume that the person pays the additional \$1,446 for a truck that gets 26.7 MPG. How long would the person have to keep the truck for the savings in the cost of gasoline to equal the additional purchase cost including the interest on the loan?

[3] Class Activity: Reading Times

Students in an English class were assigned to conduct a survey to determine if there was a relationship between the age of a person and the number of hours the person spent reading per week. Assume a friend in the English class asks for your help in analyzing the following data that was collected outside Bert's supermarket on a Saturday morning. In particular, your friend asks:

a. How do you model the relationship between a person's age and their reading time per week (assuming there is one)?

b. Based on your model, what do you predict the reading time is for a 28 year old? For a 30 year old?

c. How reliable are your predictions? Explain.

Age	Hours	Age	Hours
13	10	16	11.5
14	11	32	11.5
55	4	18	12
38	10.5	42	9
45	8	20	12
22	12.2	35	12
38	11	24	13
50	6	29	12
35	14	44	8.6
40	10	40	11

[4] Notices

1. The 7^{th} annual Retreat of the HBCU Consortium for College Algebra Reform will be held at Huston-Tillotson College, Austin, TX, Oct.10-12, 2002.

2. Laurette Foster, Russ Lundgren, and Don Small will participate in the 28th Annual Conference of the American Mathematical Association of Two-Year Colleges that will be held in Phoenix, AZ, November 14-17, 2002.

3. Deadline for contributions to the November Newsletter is Monday, November 4, 2002. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

4. To subscribe to this Newsletter, write to Dr. Della Bell, Chair, Department of Mathematics, Texas Southern University, 3100 Cleburne St., Houston, TX 77004.