

Vision - Potential

Vision Within Every Instructor - Potential Within Every Student
Newsletter of the HBCU College Algebra Reform Consortium*
Number 84, September 2008
www.ContemporaryCollegeAlgebra.org

Contents

- [1] Crisis → Opportunity
- [2] Age Dependency
- [3] Oil Heating Costs
- [4] Queries
- [5] Take a Good Look, using Mathematics
- [6] Notices

[1] Crisis → Opportunity

“Within a crisis there are opportunities,” is a cliché that clearly rings true with respect to college algebra. Traditional college algebra is the crisis for several reasons including

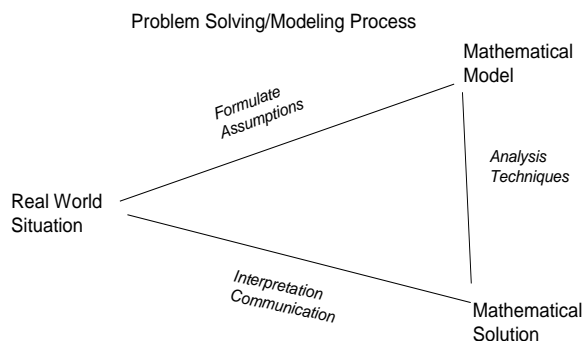
- a. A morally unacceptable low pass rate.
- b. Failure to meet its objective of inspiring and preparing students to enter a calculus tract.
- c. Failure to serve as a general education course.
- d. Generates a culture of negativity with respect to mathematics.

This crisis is enhanced by the fact that college algebra is a college *gateway* course—a gateway that the traditional course closes, as a result of its high failure rate, to over half a million students per year.

The opportunity is to refocus the traditional course to form a bridge linking what Lynn

* Supported by the U.S. Military Academy.

Steen and Bernie Madison call the *two mathematics*, formal mathematics and quantitative literacy (QL). The refocused course is a modeling course that emphasizes problem solving in the modeling sense rather than in the traditional exercise sense. This means that problems are set in a real world context and solutions are interpreted in light of the real world setting as illustrated in the following diagram.



Problems are presented in story form for as Scott Hunt, a retired engineer from Scott Paper Company, said “In the real world, there are only story problems.” Formal techniques are introduced when needed. The philosophy is to leverage the power of human reasoning to analyze and interpret while using the power of technology to aid in computation.

The primary pedagogical goal of the refocused course is to develop students to be exploratory learners who take responsibility for their own learning and extend their efforts

beyond the confines of the course. Developing an inquisitive approach and a habit of mind that seeks quantitative evidence to make an argument are essential ingredients of exploratory learning.

The emphasis on developing communication skills—reading, writing, presenting—is another aspect that contrasts a refocused college algebra course from a traditional course. Students learn how to transform a written description (story problem) into mathematical form, solve the “mathematical” problem, and then interpret the results in light of the original context. In addition to studying the text (reading) and preparing written reports, students make frequent class presentations.

Small group work is also central to the refocused program. Students are engaged in small group, in-class activities on a daily basis in addition to working at least two out-of-class projects.

[2] Age Dependency

Age dependency ratios are used in marketing, developing social security legislation, housing projections, etc. Using the 2000 population data in the following table, compute the following dependency ratios for the United States and Haiti.

- The age dependency ratio is derived by dividing the sum of the 0-to-19 and 65-and-over populations by the 20-to-65 population and multiplying by 100.

- The old-age dependency ratio is derived by dividing the population of 65 and over by the 20-to-64 population and multiplying by 100.

- The child dependency ratio is derived by dividing the population under 0-to-19 by the 20-to-64 population and multiplying by 100.

Estimates of the 2000 population distributions in the three age categories: 0-to-19, 20-to-64, 65 and older for the United States

and Haiti. Source: U.S. Census Bureau www.census.gov.

Age	United States	Haiti
0-to-19	80,473,265	13,358,000
20-to-64	180,451,957	107,920,000
65-	20,532,684	12,250,000

Recognizing that the United States is the richest country in the world and Haiti is one of the poorest countries, what conjectures can be drawn by comparing their age dependency ratios? What implications for the future can you conjecture based on your dependency ratios?

[3] Oil Heating Costs

The price of heating oil has increased almost five-fold since 2002 with the largest increase occurring this year (58%). This recent increase is threatening millions of people with an impending home heating crisis this coming winter. The Bangor (Maine) Daily News, August 8, 2008, published the following table

Winter	Price	Annual Increase
2008-09	\$5.04	
2007-08	\$3.20	
2006-07	\$2.22	
2005-06	\$2.28	
2004-05	\$1.79	
2003-04	\$1.25	
2002-03	\$1.06	

Display the year/price data in a bar chart. Fill in the third column and then display the Winter/Annual Increase in a bar chart.

[4] Queries

a. Pick a number, add 3 to it, double the result, subtract 4 from the answer, and then triple what you get. If the answer is 39, what was the original number?

b. How far out of your way would you drive to save six cents per gallon on the price of

gasoline? Clearly state your assumptions and explain your reasoning.

c. If inflation over a given year was 300 percent and if a shovel cost \$25 at the start of the year, how much would it cost at the end of the year?

d. If prices double in one year, is the inflation rate 100 percent or 200 percent? Explain your reasoning.

**[5] Take a Good Look, using Math
“Wells’ career short, but robust”**

Jacqueline Brannon Giles
Texas Southern University

Forty-six years ago a young man greeted me in the hallway of the Nabrit Science Building at Texas Southern University, Houston, Texas. He was on his way to Mrs. Corinne Newell’s mathematics class and I was taking a break, walking down the hallway. That moment began an adventure in collaboration and I am taking a good look at the people and experiences of the past.

The man, an elementary education major, who spoke to me in the hallway at Texas Southern is Warren Wells. He became a professional football player, a wide receiver, while I became a mathematics professor. After re-encountering him in February 2007, I began to search for some way to measure the impact of his career. Unfortunately, I did not archive statistics on the National Football League (NFL) or on his career. On May 18, 2008, however, a sports enthusiast and researcher published a quantitative analysis of thirty-three of the NFL wide receivers, starting with Don Hutson (January 31, 1913 – June 24, 1997). Warren Wells, a veteran who is now 65 years old, was included. I scanned the data and saw that Wells ranked No. 1 in two categories, and it looks like he has held that rank for about 38 years.

I decided to compare Warren Wells with Jerry Rice by analyzing the plot of the data for the two wide receivers. Letting the left most, lower corner of the chart be (0,0), I let the vertical axis represent ranking and the horizontal axis categories (spaced at 5 point intervals). So, if Jerry Rice, an NFL wide receiver, ranked 5 in the fifth subcategory, there was a point in his data set of (5, 5). Data points were plotted and a line graph was drawn for both Jerry Rice and Warren Wells. The next step was to turn the problem over to my calculus class and ask the students to calculate the area under each of the line graphs. One of my students who received his law degree from Harvard University questioned the arbitrariness of the spacing on the horizontal axis. The students finally concluded that the spacing could be arbitrary as long as it was uniform and consistent for both players. The students became excited because they were using calculus to analyze historic NFL data, and they were totally surprised that the mathematics professor was talking about great wide receivers. The students began to take a good look at the NFL data, using mathematics.

What were the results of the study? Well, the students concluded that overall Jerry Rice ranked higher than Warren Wells, although Warren Wells ranked higher in two subcategories. His rank is No. 1 in “Yards/Reception” and in “Yards/Attempt”. He has held the top rank for 38 years, which is longer than Jerry Rice’s career of 20 years. Using calculus, the total area under Rice’s curve was found to be greater than the area under Wells’ curve. The difference in the areas was not that large. Also, although Jerry Rice’s overall average rank is greater than Warren Well’s, Rice is ranked No. 1 in only one category, “TDs/Game.” In the three categories for “Rushing” Warren Wells, Don Hutson and Jerry Rice all rank No. 1.

Hutson, the first NFL wide receiver, dominates “Yards/Game” while Rice dominates “TDs/Game” and Wells dominates “Yards/Attempt”. The alumnus from Texas Southern University has career statistics that are shining bright in 2008.

My students and I encourage you to take a good look at the data on www.behindthesteelcurtain.com/2008/5/18/520032/quantitative-analysis-of-t and decide whose career statistics stands out over a long time period. You may be surprised at your results. Here is a short report based on student input:

Calculus students analyzed a quantitative analysis comparing the career statistics of Jerry Rice and Warren Wells. They created a model for each player by graphing a piecewise defined function connecting ranks and then used integration to find the area under the piecewise linear curves. The students asked, "Why hasn't Wells been considered as a nominee to the NFL Hall of Fame since he ranks No. 1 in two of the seven categories in the quantitative study?" They noted that the statistics indicate that Wells has ranked No. 1 in two categories for about 38 years. Source: WolfpackSteelersFan on May 18, 2008 7:42 PM EDT

The students in the project group were: Shannon Harrison, Jeff Sickorez, Ashely Tish, and Teyshia Waters. Shannon Harrison, an electrical engineering major and math minor, was the group leader.

[6] Notices

1. The sixth edition of *Contemporary College Algebra: Data, Functions, Modeling* is now available. Contact Kathy Kilburg (563-584-6322, Kathhj_Kilburg@mcgraw-hill.com) for an examination copy.
2. Past issues of the *Vision - Potential* Newsletter are available on our website: www/ContemporaryCollegeAlgebra.org.
3. A Contemporary College Algebra workshop will be held at Husson University in Bangor, Maine on October 13 & 14, 2008. The contact person is Ken Lane, LaneK@husson.edu.
4. A National Math Panel Forum organized by CBMS and the U.S. Department of Education will be held October 6 & 7 at the Marriott Wardman Park Hotel in Washington DC. Information about the Forum and how to participate may be accessed online via the CBMS website www.cbmsweb.org.
5. Deadline for contributions to the October Newsletter is October 1, 2005. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.
6. To subscribe to this Newsletter, write to Don Small, Department of Mathematics, U.S. Military Academy, West Point, NY 10996 or contact him via e-mail at don-small@usma.edu.