Vision - Potential

Vision Within Every Instructor – Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
Number 38, January 2002

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[1] College Algebra Reform at the 2002 Joint Mathematics Meetings

College Algebra reform was an important topic at the Joint Mathematics Meetings that were held in San Diego, CA, January 6-9, 2002. Several members of the HBCU Consortium for College Algebra Reform participated in the Meetings. Della Bell moderated a panel on modeling in college algebra. Alex Fluellen was one of the panelists. Laurette Foster and Don Small spoke at the MER session on Revitalizing College Algebra: Why? And How?

* Supported by the National Science Foundation and the U.S. Military Academy.
Don Small moderated a panel and Open Discussion on College Algebra Reform. Laurette Foster and Don Small participated in the two CRAFTY committee meetings. The sixth Annual Local Coordinators Meeting was attended by Della Bell, Victor Obot, and Carrington Stewart all of Texas Southern University, Laurette Foster of Prairie View A&M University, Joel Williams of Houston Community College Central Campus, Dorothy Hunter of Huston-Tillotson College, Sarah Bush of Wiley College, Alex Fluellen of Clark Atlanta University, Bill Echols (evaluator) of Houston Community College Northwest Campus, and Don Small of the U.S. Military Academy.

In addition to the prceding there were two contributed paper sessions on Redefining What a Modern "College Algebra" Experience Means. There was also a panel discussion on Rethinking the Preparation for Calculus that focused on college algebra and precalculus courses. The panel on the West Point Summary Conference for the CRAFTY Curriculum Workshops addressed reforming college algebra from the standpoint of technical colleges.

[2] National Forum, "Quantitative Literacy: Why Numeracy Matters for Schools and Colleges"

The Forum was sponsored by the National Council

on Education and the Disciplines, and was hosted by the National Research Council in cooperation with the Mathematical Association of America. The quotations in this article are taken from "Achieving Quantitative Literacy," a background paper for the Forum.

"In the 1920s the United States crossed the threshold into universal secondary education" and "now, a century later, we are crossing a similar threshold into universal postsecondary education." The questions concerning the "role of education for employment, for engaged citizenship and personal welfare, and for democratic well-being" are now being posed in a different context as the base of society has changed from industrial to information and the base of economics from national to global.

"As access to postsecondary education increased, especially during the last half-century, the gap between experts and average citizens widened." In mathematics and science, educational programs focus on developing specialists even though the large majority of students enrolled in mathematics and science courses have no intention of majoring in those fields. This growing gap calls into question how well educational programs are addressing the basic roles of education for employment, for engaged citizenship and personal welfare, and for democratic well-being.This questioning, in turn, has fueled the concerns about the quantitative literacy (QL) of our graduates. Although no formal definition has emerged for QL or numeracy, as it is often called, there is general agreement that it involves the ability to reason effectively, accurately, and creatively from numerical data given in diverse forms such as tables or graphs. A few examples of the need for QL in the three basic roles will help clarify the situation.

> Employment: QL is an important element in "the poliferation of computer-generated data, especially in the fields of growing employment opportunity such as health care, technology, and information services." Ordering for a pizza business, determining selections and quantities for a canteen service, clerking in a yard goods department, and understanding assembly diagrams all require a facility for understanding and working with numbers.
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> Citizenship and personal welfare: Choosing health plans, making safety decisions, computing taxes, forming budgets, managing credit, and financial planning all call for "the ability to reason effectively, accurately, and creatively from numerical data." This ability is also required to sort through the myriad of choices for telephone service, for refinancing a home or business, or being able to analyze the charts and graphs in newspapers and magazines.
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> Democratic well-being: QL is an essential element in many duties of citizenship such as the ability to disect political arguments, understand media presentation, serve on juries, understand national and international trade agreements, and comprehend voting trends.

"The most recent International Adult Literacy Survey indicated that the literacy rate in the United States is the second lowest of 18 European/North American countries (only Poland is lower)." A central reason for this among college graduates is the absence of QL type thinking in the primary general education courses taken to satisfy mathematics/ QL requirements, the traditional college algebra and precalculus courses. These courses emphasize abstraction and algorithmic processes and contain almost no data analysis or contextual focus. Because discipline major courses do not incorporate a QL focus, students often leave college with no more numeracy skills than when they entered. A

counter to this situation is emerging in the movement to reform college algebra, placing emphasis on elementary data analysis and realistic contexts.

[3] "Quickies"

a. In a club of 86 members, there are 14 more women than men. What percentage of the club membership is male?

b. What is the largest rectangular area that can be fenced in with 100 feet of fencing?

c. What is the largest circular region that can be fenced in with 100 feet of fencing?

d. A standard step has a run of 10 inches (the step part) and a rise of 8 inches. How many steps are there in a flight of stairs from the first to the second floor that is ten feet above the first floor? What is the slope of the railing for the flight of stairs?

e. The diameter of the large wheel on a wheel chair is two feet. How many times does the wheel rotate when the wheel chair is pushed up a ramp that rises three feet in height that has a government mandated slope of 1:12?

[4] Writing Assignment: "Who is Correct?"

Juan and Percy were discussing the change in their college tuition. Last year, tuition plus room and board cost \$6,000. This year it costs \$6,200. Juan said that the cost had increased \$200, but Percy claimed that the cost had actually decreased because last year's inflation rate was 4.2%. Who is correct, Juan or Percy? Or, are they both correct.

Write a one page essay defending your answer.

[5] Numbers, Data, Variability

Is the number 5.5 data or is it just a number? More generally, when are numbers data? The answer is that numbers are data when they provide information about a variable. Numbers that do not provide such information are just numbers. Thus, for example, if the number 5.5 represented the average height of women in a college algebra class, then the number 5.5 is data that provides information about the height variable of women in the college algebra class. The importance of understanding the context within which numbers arise cannot be over emphasized. It is the context that distinguishes data from numbers.

List the heights of the women in a group, say the women in a college algebra class. Order this data, listing the heights from smallest to largest. This list displays the variability in the height variable. (Look up the definition of variable in Section 2.4 of the *Contemporary College Algebra* text.) As the name implies, a variable has variability. That is, a variable represents a quantity that can take on two or more different values. The set of different values that a variable can have is called the range of the variable. Understanding the variability (range) of a variable is an important objective in data analysis. Analyze the range of data on women's heights using the average, median, and mode(s) measures. What information about the heights of women in the group can you gain from your analysis?

[6] Running Average

The average value of a data set is often used as a summary value to represent the data set. Statisticians speak of the average, as well as the median and mode, as a measure of central tendency. Another use of average is to lessen errors due to uncounted factors or measuring mistakes. We often repeat experiments and average the results in order to obtain more accurate results. The awareness of possible measuring mistakes is reflected in the old adage for carpenters to "measure twice and cut once."

There are different types of averages. A weighted average is an average in which the elements are assigned different weights. For example, grade point

averages are weighted averages with the grade in a four credit course carrying more weight than the same grade in a two credit course. Another type of average is a running average, which is used to reduce the volatility of the data in order to better portray trends. Examples of running averages can be found in business sections of newspapers and magazines. A running average applies to data that is ordered, usually by the time of occurance. A running average of an ordered data set is a sequence of averages computed as follows: The first average is the average of the first three elements, the second average is the average of the second through fourth elements, the third average is the average of the third through fifth elements, etc. Each new average is computed by deleting the first element of the previous set and adding the next element. One could average over sets of four elements, or five elements, or some other number. The size of the set is determined by the context of the problem. For example, a five day running average of the stock market changes might provide a more useful measure to investors than the daily averages.

Example: Roll a die twelve times and record the results in a three-column table. Let the first column be the "roll number," one through twelve, and the second column be the value of the die for each roll. Let the third column, beginning with the third row, represent the three element running average. For example, the number in the third column, third row is the average of the first three rolls. The number in the third column, fourth row is the average of the second, third, and fourth rolls of the die. Form a multiplot with one plot being that of the data set formed from the first and second columns of your table. The second plot is that of the data set formed from the first and third columns of your table and the third plot is the horizontal line representing the average of the elements in the second column.

Write a paragraph interpreting your multiplot (that is, compare the three plots) and suggesting two situations that would be suitable to summarize with a running average. Defend your suggestions.

The twelve rolls of the die can be simulated by using the random integer program in your graphing calculator. For the TI-83, this program is found by pressing the Math key, shifting twice to the right to PRB, and then selecting number 5. The lowerbound, upperbound, and number of trials is entered into the program as: randInt(lowerbound, upperbound, number of trials).

[7] Notices

1. The fourth edition of *Contemporary College Algebra* by Don Small is now available (ISBN: 0-07-256439-3). Examination copies may be obtained by contacting the McGraw-Hill Publishing Co (1-800-338-3987).

2. The HBCU Consortium for College Algebra Reform will host a national conference on Reforming College Algebra. The conference will be held at the U.S. Military Academy, February 7-10, 2002.

3. Persons interested in hosting or attending a dissemination workshop for the Contemporary College Algebra program should contact Don Small, Dept. of Math. Sciences, U.S. Military Academy, West Point, NY 10996 [donsmall@usma.edu]

4. The next issue of the *Vision - Potential* Newsletter will appear in February 2002. The Deadline for contributions to the February Newsletter is Monday, February 4, 2002.

   Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, CBL activites, announcements, and so on are welcomed. Please send material to Dr. Della Bell, Chair, Department of Mathematics, Texas Southern University, 3100 Cleburne St., Houston, TX 77004.

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