Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
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[1] Some Reflections on the Value of Group Projects in College Algebra

Paul Dirks
Miami-Dade Community College

I teach at Miami-Dade Community College, where 78% of our incoming students must begin their study of mathematics in non-college level courses. The most poorly prepared among them take three courses before entering College Algebra: Basic Mathematics (arithmetic), Beginning Algebra, and a second basic algebra course that we call Intermediate Algebra. In June 2001, I attended a workshop on Contemporary College Algebra, a program incorporating group activities and a heavy use of technology into the classroom work; and group projects developed by the students outside of class time. With many reservations and some trepidation, I decided to try the program at MDCC. A major concern for me was with regard to the group projects. Would our students, generally weak not only in mathematics but also in writing and other communication skills, be able to rise to this challenge? Having taught the program now for three semesters, I can say that the results have exceeded my expectations by at least one order of magnitude.

Of the many aspects of the students' work in producing the group projects, there are three that seem particularly important to me and on which I would like to focus our attention here: 1) engagement in critical thinking; 2) the exercise of creativity and autodidactic activity; and 3) a phenomenon best expressed by the statement, "The whole is more than the sum of its parts."

If structured appropriately, the projects lead students through critical thinking processes and contribute to their skills in this area. The issues they must address have to be clearly outlined and non-trivial questions posed. In developing their projects, the students have to seek further information, preferably from multiple sources, decide what best fits the de-

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scribed situation, and make decisions about what is relevant and what is not. More, they must organize what they have discovered, and decide how and in what order to present it. They must include graphic representations of their data, seek to identify a pattern in it, and finally determine their conclusions and present them concisely and cogently. If all that is not engagement in critical thinking, then I don't know what is.

If structured appropriately, the projects elicit from the students some level of creativity, including both an intellectual stretch and self-learning activity. Most of the projects involve at least some mathematics that is accessible to the students but new to them. They have to learn something new on their own and incorporate it into what they already know. In developing their projects, many students will have to learn and use for the first time some technological skills, whether on computers or graphing calculators. Preparing an attractive presentation of their projects (and appearance is an element in the evaluation of the projects) brings artistic creativity to the fore.

What I mean by the assertion, "The whole is more than the sum of its parts," is that when students work together as a group on a project, what they turn into me is often far better than what all of their individual talents, even considered collectively, would seem capable of producing. One of my best experiences in this regard was one I had just last semester. In my Contemporary College Algebra class, I had four students who had been with me the previous term in our second basic algebra course. They were reasonably good students, but very definitely not future mathematicians. They chose to work together in the same group, perhaps because they already knew one another, and were joined by two others. None of them by him/herself would have been able to produce the two projects they did. Somehow, the interaction among them helped generate more careful analysis (critical thinking), more mathematical insight (creativity), and more surprising conclusions than any of them could have produced single-handedly. One of their projects dealt with the cumulative number of stamps issued by the U. S. Post Office since its inception. On a scatter plot representing the number of stamps as a function of time, most people would have been content to view the data as following approximately a quadratic or exponential pattern (as did most of the other groups working on this same project). This group, however, discovered that the curve of best fit was, in fact, a quartic function. Admittedly, they did not come to this conclusion by using the least-squares method and reams of pencil-and-paper calculations, but by using a calculator with regression functions. My amazement came from this: that this group of students who had just been in a basic algebra course the previous term would even think to explore this unusual alternative. That says to me, in no uncertain terms, that working together as a group, they reached a whole new level of mathematical insight. I was impressed and very pleased with how they grew through this process and how they reached a level of development that, I believe, they would never have reached working as individuals in a more traditional class setting.

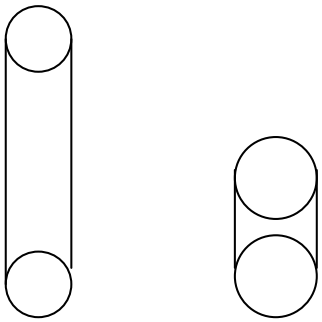
As I reflect on my experiences since August 2001, when I began using this different approach, I have no doubts that even if this is not the "final answer," we are definitely mov-

ing in the right direction. There is one thing I am sure of: what we were doing in 1959 and what many of us have continued to do in the same way since then no longer works for a significant portion of our student population. Like it or not, we must choose to change or to become increasingly ineffective.

[2] Which is Larger - Or Are They The Same?

Laurette Foster
Prairie View A & M University

Form two paper cylinders. One by rolling the long side of an eight and one-half by eleven inch sheet of paper onto the other long side and the other by rolling the short side of an eight and one-half by eleven inch sheet of paper onto the other short side.



Without measuring or computing, answer the following questions and include a written explanation of your reasoning.

a. Are the volumes of the two cylinders the same?

b. If the volumes of the two cylinders are different, which one has the larger volume?

c. Are the lateral surface areas of the two cylinders the same? (The lateral surface area does not include the areas of the top and bottom of the cylinder.)

d. If the two cylinders have different lateral surface areas, which one has the larger lateral surface area?

Compute the volumes of the two cylinders. Do your computations agree with your original insight?

Compute the lateral surface area of the two cylinders. Do your computations agree with your original insight?

Reflect on the relationships between the volume of a cylinder and the radius and height of the cylinder. For example, would a tall thin cylinder have the same volume as a short fat cylinder when both have the same lateral surface area?

Suppose the lateral surface area of a cylinder is 93.5 square inches (the area of an eight and one-half by eleven inch sheet of paper). Express the height of the cylinder as a function of the radius of the cylinder. Express the volume of the cylinder as a function of the radius by substituting for the height in the volume equation of a cylinder. Considering your function of volume in terms of the radius, what can you say about maximizing the volume?

[3] Distribution of Wealth

How should the wealth of a nation be distributed among its population is an on-going debate among politicians, economists, and the general public. The extreme case for equality would have x% of the population controlling x% of the country's wealth. A reflection on the salaries of professional baseball players or CEOs would strongly suggest that the extreme case for equality does not hold in the United States. What is the distribution of wealth in the United States?

Develop a graphical model for the distribution of wealth in the United States by plotting and fitting a curve to the following data: (% of Pop refers to the percentage of the United States population and % of Wealth refers to the percentage of the United States wealth controlled by the corresponding percentage of the population.)

% of Pop.	% of Wealth
0	0
50	5
70	10
80	20
90	40
96	60
100	100

Write a one page essay on how you think your model of the distribution of wealth should impact the Federal Income Tax policy.

[4] Picking Apples

(This problem was taken from the *Mathematics Teacher*, 1997.) A man enters an orchard through a series of five gates. At each gate stands a guard. Inside the orchard, he picks some apples and leaves through the same five gates. At each gate, he gives the guard one-half of his apples plus one more apple. After the last gate, he noted that he had only one apple left to take home. How many apples did the man pick?

Model this scenario by defining variables and forming a five element recursive sequence.

[5] Dissemination Workshop

A three day Dissemination Workshop for the Contemporary College Algebra program will be held May 29-31, 2003 at Cy-Fair College Fairbanks Center, 14955 NW Freeway, Houston, TX. (Cy-Fair College is part of the North Harris Montgomery Community College District.) Laurette Foster and Don Small will be the facilitators. Activities will feature:

(a) Hands-on, small group activities and projects
(b) Use of the graphing calculator in teaching and learning college algebra
(c) Inclusion of elementary data analysis in college algebra
(d) Problem solving in the modeling sense
(e) Modeling using recursive sequences

Several discussions are planned for the workshop. A sampling of topics include the roll of college algebra in a student's academic program; formulation of goals for a college algebra course; the national movement to refocus college algebra, and the use of technology.

All participant expenses will be paid by a grant to support the Contemporary College Algebra program. Further information can be obtained by contacting Laurette Foster at Prairie View A&M University <Laurette_Foster@pvamu.edu>.

[6] Notices

1. Deadline for contributions to the April Newsletter is Tuesday, April 1, 2003. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

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