Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
Number 66, January 2006

Contents

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***NOTICE*!!!**

Starting with the April issue, the *Vision-Potential* Newsletter will be distributed electronically. In order to continue receiving the Newsletter, send your e-mail address to Don Small, <don-small@usma.edu>.

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[1] VCU's Instructor's Guide

Yvette Stepanian
Virginia Commonwealth University

(This Instructor's Guide is given to the instructors of the Contemporary College Algebra course at Virginia Commonwealth University at the beginning of the semester.)

This course is very different from a traditional course both in content, pedagogy, and student expectations. Students as well as instructors need to frequently review and discuss the course goals.

The primary goal of this text is to empower students to become **exploratory learners, not to master a list of algebraic rules**.

* Supported by the U.S. Military Academy.

The structure of the course and text is designed with this goal in mind. We want our students to be fully participating in their learning process, each time they come to class. As an instructor, here is some guidance to always have in mind.

1. Frequently review and discuss the goals of the course. The students are not used to this teaching approach; constantly remind them, particularly during the first two weeks, on the importance of this approach:

- Why is it that we are not "just" giving the right answer?
- Why is it that students have to think as a group about different ways to solve a problem?
- How is it possible that there is no answer, or that there are many possible answers, or that the answer we found does not make sense?

. . .

Students need to learn that the mathematics used in real life is not a magic trick; it cannot give one perfect, unique solutions to all problems. The student remains the one who will have to make the best decision.

2. Repeatedly remind and encourage the students to read and study the text with a pencil: the text was written for it to be personalized. This is something the students do not do naturally. It might be useful to personalize your own copy before class and show it to your students.

3. Practically, you should not lecture for more than 15 minutes; the course is about learning through problem solving and critical thinking, not about mimicking repeatedly the instructor's examples. This can feel uncomfortable at first for you as well as for your students who are usually never asked to think by themselves and who expect you "to do all the work."

4. The course is designed so that students work in small groups regularly and hand in graded worksheets (or graded Class Activities) weekly. They learn to manage a group, they learn to make compromises, they learn to rely on each other's knowledge, and they learn to be responsible while working in a group with people of different motivation.

5. Rather than just giving students an answer when they feel stuck, you should encourage them to talk to each other to try to explain the problem to each other. Stronger students could be paired with weaker ones. Students need to be reminded of the benefits of such an approach; as they talk to each other they stimulate their communication skills, they are more likely to feel comfortable expressing their misunderstandings, . . .

6. Spending a whole session on one exercise is fine; always remember that your goal is not to give an answer, but is to make students think, talk, write about the problem. The schedules you are given are designed with this in mind. If you are too much ahead of the schedule, then it means that either you are lecturing too much or you are not letting your students be stuck enough!

7. As the semester goes on, the students learn about different approaches for solving a problem (algebraic, graphic, . . .). They need to be reminded of these possibilities; your goal is to make them feel comfortable, to develop their personal confidence as problem solvers, to let them know that there is not only one way to do it.

8. In this course the calculator is used expansively/daily so students learn the process of analyzing a real situation: (1) collecting data, (2) plotting data, (3) fitting an appropriate curve to the plotted data, (4) making predictions, (5) obtaining insights into the situation.

9. Expect your students to show some resistance to this teaching approach; after all:

- They have rarely been left stuck on a problem,
- they have been asked to think critically about an answer to a math problem,
- They have rarely been asked to think and discuss new situations without mimicking a model exercise,
- They have rarely been asked to use technology as an important part of their problem solving,
- And more importantly, they have rarely been asked to rely on their own knowledge as much as on their peers to discuss a problem and solve it.

[2] Joint Mathematics Meeting San Antonio, TX, Jan. 12-15, 2006

The Joint Mathematics Meetings includes the American Mathematical Society (AMS), the Mathematical Association of America (MAA), the Association of Women in Mathematics (AWM), the National Association of Mathematicians (NAM), the Association of Symbolic Logic (ASL), and sessions by the Society for Industrial and Applied Mathematics (SIAM). A rich spectrum of talks, minicourses, panel sessions, poster sessions, contributed papers, committee meetings, and, of course, numerous hallway discussions will make the Meetings memorable to several thousand mathematicians.

Interest in refocusing college algebra will be high at the Meetings. The following sessions will be of particular interest to those interested in college algebra:

Friday, 8:00 - 9:55 am (Room 217B, Convention Center) *MAA Session on Courses Below Calculus: A Continuing Focus* (Aimee Ellington, who conducted a research study of the effect of a modeling-based college algebra on student achievement will speak at 8:00 am.)

Friday 2:30 - 3:50 pm (Room 205, Convention Center) *What Business Looks For in New Hires.* A panel session of four business speakers discussing what business related skills/experiences are important in college algebra level courses.

Sunday 2:30 - 3:50 pm (Room 217A, Convention Center) *Reunion of Participants in Refocused College Algebra Programs.* Bill Haver (Virginia Commonwealth University) and Laurette Foster (Prairie View A&M University) will lead the session. All persons who are interested or involved in renewing college algebra courses are encouraged to participate by sharing their experiences, plans, and dreams.

[3] Soda Preference

(This activity is designed for the first week of classes, possibly over the first weekend. It would serve well as a guided discovery for Section 2.5 (Circle Properties and Pie Charts). The purpose is to initiate group work and to emphasize working with data.)

Campus vending machines are usually limited to dispensing fewer than six varieties of soda. How does a vending company decide which varieties to offer? This activity provides an insight into how such decisions may be made. The activity consists of three stages.

Stage 1. (in class) Divide the class into groups (e.g., 3-person groups). The groups are then given 10 minutes of class time to organize themselves. In particular, each group determines a procedure for determining the soda preference for thirty people, including themselves. Each group member is to be involved in collecting the data and the procedure adopted should avoid having any person surveyed by more than one group.

Stage 2. (out of class) Each group

a. Collects data

b. Consolidates the data collected and displays it in both a bar graph and a pie chart.

c. Prepares a class presentation, including a discussion of which display (bar graph or the pie chart) is better at conveying the information on soda preference and a discussion of how reliable the results are for making predictions.

Stage 3. (in class) Group presentations.

[4] Proportional Reasoning

Proportional reasoning occurs throughout mathematics and is an important aspect of problem-solving. We are all familiar with the statement "corresponding sides of similar triangles are proportional" and use it in solving problems of ladders sliding down the side of a barn or determining the length of a shadow when walking away from a lamp post. Formulas in Section 2.5 for circle properties such as measures of central angles, areas of sectors, and length of arc are the result of proportionality reasoning. For example, the length of a subtended arc of a circle is proportional to the corresponding subtended central angle (arc length $= r \cdot \emptyset$).

Two quantities, A and B are proportional to one another if one is a constant multiple of the other, $A = kB$. That is if the ratio of the two quantities is a constant, $\frac{A}{B} = k$. Geometrically the graph of a proportionality relation is a straight line that passes through the origin with slope equal to the proportionality constant. Let y be proportional to x. Then $y = kx$ and its graph is the straight line passing through the origin with slope k.

Another important category of problems involving proportionality reasoning are those involving inflation, change in prices over time. For example in 1975, a gallon of gasoline cost 56.7 cents. How does that price when *adjusted for inflation* compare to the price in 2005 when the price was $1.60 per gallon? In order to obtain the inflation adjusted price, one assumes that the proportional increase in gas prices is the same as the proportional increase in the Consumer Price Index (CPI) over the same time span. That is

$$\frac{\text{2005 Jan. } Gas\ Price}{\text{1975 Jan. } Gas\ Price} = \frac{CPI(Jan.,2005)}{CPI(Jan.,1975)}$$

or

$$(\text{2005 Jan. Gas Price}) = \frac{CPI(Jan.,2005)}{CPI(Jan.,1975)}(\text{1975 Jan. Gas Price}).$$

Consulting the CPI table in www.bls.gov gives

$$(\text{2005 Jan. Gas Price}) = \frac{190.7}{52.1}(\$0.567) = \$2.075$$

In Cornwall, NY, the price of gasoline in January 2005 was approximately $1.75 per gallon. Thus gasoline was a "better buy" in 2005 than it was in 1975 as its rate of increase over this 30 year period was less than the inflation rate.

The proportionality constant

$$\frac{CPI(Jan.,2005)}{CPI(Jan.,1975} = \frac{190.7}{52.1} = 3.66$$

indicates that the rate of inflation over this 30 year period was 366%.

Another way to make a comparison on gas prices over the period 1975-2005 would be to compute the 1975 price in "2005 dollars." That is, solve the equation

$$\frac{\text{2005 Jan. } Gas\ Price}{\text{1975 Jan. } Gas\ Price} = \frac{CPI(Jan.,2005)}{CPI(Jan.,1975)}$$

for the 1975 Jan. Gas Price (in 2005 dollars)

$$(\text{1975 Jan. Gas Price}) = \frac{CPI(Jan.,1975)}{CPI(Jan.,2005)}(\$1.75) = \$0.478 \text{ (in 2005 dollars)}$$

[5] Notices

1. Whew! Last November 13, I.B.M. announced its Blue Gene/L super computer can perform 280.6 trillion calculations a second (teraflops) making it the fastest computer in the world. This was an increase from the 136.8 teraflops that was the previous record (set in June 2005). The Blue Gene/L computer operates at the Livermore National Laboratory in California. Scientists claim that the computer could be further enhanced for speed if the Labs were interested in making it bigger.

2. Deadline for contributions to the February Newsletter is February 1, 2006. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

3. 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.