Vision - *Potential*

Vision Within Every Instructor - Potential Within Every Student

Newsletter of the HBCU College Algebra Reform Consortium*
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[1] Exploratory Learners

Exploratory learning is a style of learning that seeks a depth of understanding through critical reasoning, questioning, recognizing implications, forming and testing conjectures, and challenging paradigms. An exploratory learner is sometimes described as a person who "thinks outside the box." The exploratory learning style is contrasted with the surface learning style, where the emphasis is on memorization, gaming test questions, regurgitation, and is generally a "plug and chug" approach. Exploratory learning is also contrasted with the strategic style of learning in which the student's goal is to obtain a certain grade irrespective of understanding.

A primary goal of the Contemporary College Algebra program is to develop students to become exploratory learners. Although there is no recipe for achieving this goal, an instructor can create an environment that is conducive for developing exploratory learning. A partial list of characteristics of such an environment include the following:

* Students know that their instructor cares deeply about them and their learning.
* Reflection is strongly emphasized, time and opportunities for both private and public reflection are provided. (Dewey spoke about learning through reflecting on experiences, not just experience alone.)
* Establish high, but meaningful standards for learning which extend beyond the course.
* Encouragement of the successive approximation approach: try (approximate), fail, analyze mistakes (gain feedback), try again, fail, analyze mistakes, try again, etc. all without a judgemental assessment. (Graphically fitting a curve to a scatter plot is an example.)
* Collaborative learning - small group activities and projects.
* Communication (reading, writing, speaking) is emphasized.
* Frequent use of questioning and small group activities to engage students.
* Students receive emotional as well as technical support when needed.
* Students see problems as relevant and important to themselves.
* Students believe their work will be respected and judged fairly.

* Supported by the U.S. Military Academy.

* Students are held responsible for their own learning.
* Students care about their learning.
* Students believe that hard work and perseverance will lead to success.

Creating and maintaining an exploratory environment involves the combined efforts of students and their instructor.

[2] A Free College Savings Account

Harold Alfond, a leading philanthropist in Maine, died in 2007. His Will posthumously created a program to provide each baby born in Maine with a tax-free college savings account endowed with an initial investment of $500. The Finance Authority of Maine, which will administer the program, estimates that each $500 account could grow to $2,000 eighteen years later. Mr. Alfond hoped that parents or friends would also contribute to the accounts. Foundation officials said that if an additional $50 were invested each month in an account, the total could grow to $25,000 eighteen years later.

(a) If the birthrate of 14,000 per year holds steady, how much would the Finance Authority of Maine pay out each year for the program?

(b) If the $500 grew to $2,000 without any additional investments over eighteen years, what interest rate was paid?

(c) Assuming the birthrate holds steady and using the interest rate from Part (b), determine the minimum amount of money that Mr. Alfond needed to invest in his program.

[3] Pennies

The New York Times February 15, 2008 article "We're Spending Too Much to Make a Little Money" noted that February 12, 2009 will be the 100 th anniversary of the Lincoln penny. In 2007, 8 billion pennies were made at a cost of 1.67 cents each. Thus it cost approximately $130 million to make about $80 million worth of pennies. (Nickels are even worse of a bargain as it cost the U. S. Mint 9.5 cents for each of the 13 million nickels that were minted last year.) A "surface" response might be to just eliminate the penny from our currency and there have been efforts to do just that. However, there are numerous groups who strongly support retaining the "beloved" penny. Here are a few comments taken from the web.

Americans for Common Cents
(www.commoncents.org):
The Penny's Impact: From the Grocery Store to the Gas Pump

The penny enjoys overwhelming support from the majority of Americans. Eliminating the penny is a losing proposition because it will result in rounding to the nearest nickel and higher prices for America's working families. This increased cost to consumers will be felt in everything from the grocery store to the gas pump. Pennies add up to millions of dollars every year for charities across the country. Simply put, the penny plays an important role in our everyday lives and in our nation's economy.

Our Mission: Americans for Common Cents aims to inform and educate policy makers, consumers, and the media about the penny's economic, cultural, and historical significance. Through coalition building, media outreach, and community partnerships, ACC attempts to ensure that accurate information about the penny is widely disseminated, and that the impact of any changes to the penny's role in our nation's monetary supply is adequately understood.

Penny Lovers of America (www.pennylovers.org)

A non-profit group, headed by Richard Barber, has helped send disadvantaged students to college with the pennies collected in its annual National Penny Recycling Campaign. Mr. Barber's goal is to raise one million pounds of pennies, or $ 1.64 million dur-

ing this campaign.

Pennies offer numerous fascinating small-group activities. Here are two ideas:

a. Pennies are $\frac{1}{16}$ inch thick and weigh $\frac{1}{10}$ ounce in weight. Use these facts to develop a sense for large numbers (e.g., How high is a stack of one hundred pennies? one thousand pennies?, one million pennies?, How much does $100 dollars worth of pennies weigh? etc.) Reference: www.TheMegaPennyProject | Index Page by kokogiak media that is introduced by the statement:

Visualizing huge numbers can be very difficult. People regularly talk about millions of miles, billions of bytes, or trillions of dollars, yet it's still hard to grasp just how much a "billion" really is. The MegaPenny Project aims to help by taking one small everyday item, the U.S. penny, and building on that to answer the question: "What would a billion (or a trillion) pennies look like?"

b. Form two teams and hold a class debate. Resolved: The American penny should be eliminated. Each team is given a homework assignment to research their position and then given 15 minutes of class time to consolidate their position prior to a half hour debate.

[4] Query about Pennies

Which is more: being given one million dollars, or one penny the first day, double that penny the next day, then double the previous day's pennies and so on for a month?
Suggestion: Compute the number of pennies received for the first n days for $n = 1, 2, 3, 4, 5$, looking for a pattern. If a pattern is not discovered, continue computing for larger values of n. An alternative approach is to note that the number of pennies on day n is given by the geometric series: $1 + 2 + 2^2 + 2^3 + \ldots + 2^{n-1}$. How do you sum a geometric series?

[5] Query about Cookies

The Portion Control section of the August 2007 edition of "Heart Insight" magazine compared a standard cookie to a supersized cookie. Both cookies were flat and round and were made from the same ingredients. The standard cookie, which weighed one ounce, has a circumference of 8.5 inches and a thickness of 0.5 inch. The supersized cookie has a circumference of 16.75 inches and a thickness of 5/8 inch. Eating one supersized cookie is equivalent (by weight) to eating how many standard cookies?

[6] Query about Changing a Cereal Box

Consider the dimensions of a cereal box whose (width) < (length) < (height). Suppose you want to increase the volume of the box by changing just one of the three dimensions. A one unit change in which dimension would make the largest change in the volume? Explain your reasoning and give two examples illustrating your reasoning.

[7] Test Question

The following problem is offered as a way to test students' understanding of the function concept without using any numbers.
Problem: Water is poured into this initially empty pineapple garden urn at a constant rate. (Assume the urn is hollow down to the top of the base plate.) Let $d(t)$ denote the depth of the water as a function of the time that water has been poured into the urn. Sketch a graph of the function d assuming that water continues to be poured until a few minutes after the urn is full.

[8] Functions

(This problem was adapted from one given by Mr. Yarrish at Harrisburg Area Community College.) Fill in the blanks in Table 1 and Table 2. There may be more than one correct answer for the entries in the function columns.

Exponential Function	**Growth or Decay**	**Vertical Intercept**	**Growth or Decay Rate**	**Horizontal Asymptote**
$f(t) = 27)\,(2.31)^{\cdot 4t}$				
$f(t) =$	decay	50 gms	5%	t axis
$f(t) = 4(3)^{-.8t} + 2$				
$f(t) =$	growth	\$1,000	4%	None
$f(t) =$	growth	50 lbs	25%	None
$f(t) =$	decay	100	120%	4

Table 1

Function $\mathbf{y = f\,(x)}$	**Concave Up or Down**	**Zeros**	**Maximum Point**	**Minimum Point**	**Asymptotes**
$f(x) = (x+2)^2 - 3$					
$f(x) = \frac{1}{x}, x > 0$					
$f(x) =$	Down	1	None	None	Neg. y axis
$f(x) =$	Up	None	None	(2, 3)	None
$f(x) =$	Down	0, 4	(2, 4)	None	None
$f(x) =$	Up	2	None	None	$y = -4$

Table 2

[9] Notices

1. Don Small will conduct a workshop on Refocusing College Algebra at the University of Wisconsin, River Falls, April 3-5, 2008. Contact Erick Hofacker (erick.b.hofacker@uwrf.edu) for details.

2. Don Small will conduct a workshop on Refocusing College Algebra at the University of Oregon, April 17-20, 2008.

3. Past issues of the *Vision - Potential* Newsletter are available on our website: www//ContemporaryCollegeAlgebra.org.

4. Deadline for contributions to the April Newsletter is April 1, 2008. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

5. 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.

"Educate your sons and daughters, send them to school, and show that besides the cartridge box and ballot box and jury box, you also got the knowledge box."
Frederick Douglas, speaking at Newburgh, NY on August 11, 1890.