Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

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[1] Transforming Leaders

(Background information for this article includes reflections on twelve years of refocusing college algebra, conversations with Scot Snook of the Harvard Business School, and the January 2009 issue of the Harvard Business Review (HBR).)

Success in refocusing college algebra at a particular school can usually be traced to a transformational leader who develops, with a team of colleagues, a shared vision of what college algebra could be and then effectively communicates it to his or her Dean and Department faculty. The vision must be broad enough to address the concerns of the Dean (ABC pass rate), the Department (percentage of students taking follow-on courses), and the instructors teaching the course (growth of the *whole* student - e.g., responsibility, communication, teamwork). The vision needs to be forward looking and focused on the quantitative issues that students will face in their academic career, the work place, and as contributing members of society.

* Supported by the U.S. Military Academy.

> James Kouzes and Barry Posner write in HBR "Being forward looking - envisioning exciting possibilities and enlisting others in a shared view of the future - is the attribute that most distinguishes leaders from nonleaders." The data tell us that what leaders struggle with most is communicating an image of the future that draws others in - that speaks to what others see and feel. ... They go on to say "the best way to lead people into the future is to connect with them deeply in the present."

Forming this connection requires a vision that is grounded in the present particularities of the school. Like shoes, schools are different and also like shoes, no one-size-fits-all.

A crucial task of the leader is to create a sense of urgency for making a change in the traditional college algebra course. Also crucial is the development of a team to help shape a *shared* vision, create a refocused course, and then guide the implementation of the new course. The on-going collaboration within the team while managing the refocusing efforts is vital to the ultimate success of the program. There is ample evidence that ongoing faculty development is a critical component in successfully refocusing college algebra. In particular, involving *all* the instructors in a one or two-day workshop at the start

of a semester followed by weekly or bi-weekly meetings helps keep the instructor group focused and everyone "on-board" with the program. The importance of having all the instructors understand the vision, the reasons for it, and be involved in the process of implementing it can not be over-stated.

> Speaking of General Electric's Leadership, Innovation, and Growth (LIG) leadership development program, CEO Jeffrey Immelt said "The program's aim was to embed growth into the DNA of our company."

Scott Snook offers a road map for refocusing college algebra when he speaks about "Eight Steps to Transforming Your Organization" (printed in the HBR, March-Apriil 1995):

1. Establishing a Sense of Urgency,
2. Forming a Powerful Guiding Coalition,
3. Creating a Vision,
4. Communicating the Vision,
5. Empowering Others to Act on Your Vision,
6. Planning for and Creating Short-Term Wins,
7. Consolidating Improvements and Producing Still More Change,
8. Institutionalizing New Approaches.

Honesty and candor are important ingredients in discussing the refocusing efforts. Mistakes will be made and there will be unintended consequences as is the case whenever change is made. Dealing with these issues and reassessing on a team basis will lead to a stronger and healthier program. Refocusing college algebra requires more time and effort for both students and instructors. These, however, are more than offset by the rewards.

> "I have never seen students so involved in their own learning, so confident, so fluent with communication of their knowledge."
>
> Bernadette Turner,
> Lincoln University

[2] Sugaring

Sugaring, the term used to describe the process of creating maple syrup, predates recorded history. According to tradition, the Algonquin Indians in Eastern North America were the first to recognize maple sap as a source of energy and nutrition. During the spring, when the sap of maple trees moved from the roots to the branches, the Indians made "V" shaped cuts in the bark of maple trees. The sap dribbled out and was collected in birch bark buckets. Hot rocks were put into the bucket to heat the sap. This increased the rate of evaporation leaving a sweeter and richer drink. Although techniques and equipment have improved over the years, the basic process remains the same. Today holes are drilled into the trees and a small spout is inserted. The sap is collected either in metal buckets and transported to a "sugar house" or a system of plastic tubing is used to connect the spouts directly to a sugar house. At the sugar house, evaporators are used to withdraw water from the sap. Evaporators are long and narrowed ridged pans that are heated to boil the sap. The pans are usually divided into parts. The sugar density increases as water is evaporated from the boiling sap as it flows through the upper part into the lower part. The sap is boiled until the sugar density reaches 1333 kg/m^3.

Although several varieties of maples can be tapped, the sugar maple is the best known. The sucrose concentration in the sap varies from 1% to 4%. In contrast, the sucrose concentration in maple syrup is 79%.

The production of maple syrup (and thus its price) is dependent on the weather, namely snow fall and temperature. The heavy snow winter of 2008 curtailed sugaring in northern Maine and Vermont as miles of tubing lines lay under snow and ice, and transporting sap to the sugar houses was made more difficult. Freezing temperatures at night and above freezing temperatures during the day create a pumping" action that increases the sap flow.
Sugaring is an important financial component of the economy of Eastern North America. Canada (primarily Quebec Providence) is the world's leading producer of maple syrup, marketing approximately five million gallons of syrup in 2008. In the United States, Vermont is the leader with a production of approximately 500,000 gallons followed by Maine and New York with productions of approximately 225,000 gallons each. A few other states have productions of approximately 100,000 gallons or less. The predictive price for a gallon of maple syrup in 2009 ranges from $40.00 to $60.00.

a. Assuming that maple sap has a sugar concentration of approximately 2%, maple syrup has a sugar concentration of 79%. How many gallons of sap does it take to make one gallon of syrup?

b. Determine the predicted market value of maple syrup in Vermont.

c. Create a bar chart showing the 2008 production (gallons) of maple syrup by state for Vermont, Maine, New Hampshire, Massachusetts, Connecticut, New York, Ohio, Pennsylvania, Michigan, and Wisconsin.
Sources: www.vermontmaple.og/maplestory; www.Maple Syrup 2008.

(The maple syrup industry offers opportunities for numerous projects, writing assignments, and research activities.)

[3] Queries

a. On March 1, 2009, the price of a share of Bank of America was $3.95 and its price to earnings ratio was 6.34. How much were its earnings?

b. (This Query resulted from correcting a mistake in Exercise 10 in Section 2.6 of the text identified by Ann Podleski's class at Harris-Stowe Univ.)
For each of the following equations, explain why the equation could or could not model the age relationship between Dottie and her father. Let f denote the father's age and let d denote Dottie's age.

i. $f(d) = 2d + 30$
ii. $f(d) = d - 20$
iii. $f(d) = d + 25$
iv. $f(d) = -d + 15$

[4] Formula Verification

Many dynamic situations can be modeled using the paradigm: New Situation = Old Situation + Change (See Chapter 4 in *Contemporary College Algebra: Data, Functions, Modeling*). In particular, financial problems involving credit cards, car loans, savings accounts, and buying on time are modeled using this paradigm. Applying this paradigm to a car loan where

n = number of months.
$b(n)$ = balance due after n months
$b(0) = 15{,}000$
$r = 0.01$, monthly interest rate
(i.e., 12% APR)
$p = 400$, monthly payment

gives the model

$$a(n) = (1 + r)a(n - 1) - p.$$

A conjectured solution based on iteration and an application of the geometric series is

$$a(n) = (1 + r)^n c + \frac{p}{r} \text{ where } c = a(0) - \frac{p}{r.}$$

Verify that the conjectured solution satisfies the model. That is, show that an identity is obtained when the conjectures solution is substituted into the model.

[5] Final Exam Question

(Taken from the Fall 2008 Final Exam in Contemporary College Algebra at Virginia Commonwealth University.)

You make a purchase at a hardware store. The Sales Tax is 4.5%. The before tax purchase price plus the sales tax can be modeled by the function $t(x) = 1.045x$ where x is the purchase price (before tax).

You decide to use the store's delivery service for $20 extra. The before tax purchase price plus the delivery fee can be modeled by the function $d(x) = x + 20$, where x is the price of your purchase (before tax).

a. Find the expression $t(d(x))$ and explain whether or not you are paying taxes on the delivery fee.

b. Find the expression $d(t(x))$ and explain whether or not you are paying taxes on the delivery fee.

c. Which composite function will result in the lowest cost to you? In a sentence, explain why this is true.

d. Suppose laws in your state say you cannot apply the sales tax to the delivery fee. Find the **Total** cost (that is purchase price, sales tax, and delivery fee) if your purchase price was $50.

[6] Notices

1. The sixth edition of *Contemporary College Algebra: Data, Functions, Modeling* by Don Small is now available. Contact Kathy Kilburg (563-584-6322, Kathyj_Kilburg@mcgraw-hill.com) for an examination copy.

2. http://usmasvdzdeanext/departments/math/HBCU/ is a resource website for the seventeen HBCUs in the U.S. Military Academy's program to assist HBCUs in refocusing their college algebra courses, as well as for anyone else interested in refocusing college algebra.

3. MAA PREP Workshop: REFOCUSING AND REMODELING COLLEGE ALGEBRA, will be held June 1-5, 2009 at the University of Wisconsin-River Falls. Facilitators are: Don Small, Erick Hofacker, Kathy Ernie. To register or learn more, visit www.maa.org/PREP.

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

5. Deadline for contributions to the April Newsletter is April 1, 2009. 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.