

# The National Teaching & Learning FORUM

Volume 18

Number 1

December

2008

## CONTENTS

- **EDITOR'S NOTE**, p. 3.
- **Teaching with Numbers**, James Rhem, Executive Editor, p. 1. Michael Burke of the College of San Mateo wants numbers to be more than parlor games for his students. He wants them to become part of how students grapple with the world.
- **PROGRAMS: Reading Apprenticeship**, James Rhem, p. 4. Nancy Ybarra of Los Medanos College explains how a program she helps lead helps students form reader identities and move from novices to adept college readers of texts.
- **DEVELOPER'S DIARY: The Feeling of Learning: Intellectual Development and the Affective Domain: Educating in Fractal Patterns XXVI**, Ed Nuhfer, California State University—Channel Islands, p. 7. How do Perry levels and stages of affective development match up?
- **AD REM . . . : How Many Pages?**, Marilla Svinicki, University of Texas—Austin, p. 12. The question exasperates many faculty, but perhaps students have a good reason for asking that has nothing to do with being lazy louts who don't appreciate the wonderful educational opportunity we are giving them.

## Teaching With Numbers

*James Rhem, Executive Editor*

When he was a graduate student in the 1970s, the abstract nature of mathematics didn't bother Michael Burke. He liked it. When he became a college teacher of mathematics, he began to feel differently: "I wanted to interest [students] in mathematics on the one hand, and on the other — even in a math class — I wanted to talk about important, compelling issues, because I think there's too little of that anywhere on campus, frankly."

Burke, a 2005-2006 Carnegie Scholar, wrote in a "Perspectives" piece last year: "I would propose . . . redesigning our freshman and sophomore writing programs in order to place a significant emphasis on working with quantitative data, and on the visual representation of that data. We write, after all, to figure out what we think. And we ask our students to write so that they will learn how to think."

"Since the ability to think quantitatively is, in fact, essential to understanding today's world and to acting effectively and wisely as a citizen," Burke continued, "we have an obligation to ask: are we teaching

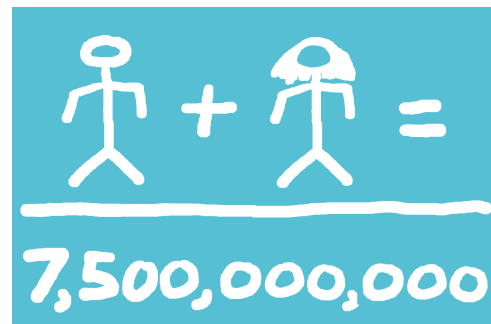
these skills? Do we routinely require students to build their arguments on an analysis of the data relevant to an issue? Do we require them to create their own tables and graphs to support their arguments? Are we teaching our students how to get beyond the rhetoric surrounding important issues, how to see the underlying trends at work, and how to cut through the distractions of the often loud, heated debate?"

Math may have been a fun

challenge in grad school, but when Burke, a faculty member at the College of San Mateo in California, came to teach it, he also came to see its real importance as a quality of

mind and a means of grappling with the world. That realization underscored his sense of the importance of mathematics for his students. "I realized that my mathematical training gives me a view of the world that is different from most people's. I mean, I think I know things that other people don't, not because I'm smarter but just because I look at things differently (and the mathematics I use here is not . . . especially hard)."

In his courses — intermediate algebra — Burke gives students data



sets, poses questions based on the sets, has students think through the implications of the numbers in responding to the questions, and then write papers. He describes one example this way:

“You can take an issue like population growth, and people sort of discuss that, and people say ‘Well, we’ve got six billion people and it’s growing, but we’ve always handled it in the past, and so we’ll handle it,’ and that’s sort of the end of the discussion. Whereas, when I look at it (because I’m a mathematician), I say ‘Well, in the last 35 years the population doubled, and in the next 35 years, unless something happens, it will double again. Do you think we can handle that? If you do, then in 35 years, it will double again. Can we handle that?’ So it’s pretty clear to me that we’re headed for a major problem. My natural approach to the problem is to look at the numbers. But if you look at the political discourse in this country, nobody does look at the numbers. And the political discourse is impoverished as a result, and it leads to really bad decisions on important issues. So I feel really strongly about this. What I want to do is share the way I look at the world — and you don’t have to be a professional mathematician to do this — college students are capable of doing this.”

“Seeing” figures as importantly in what Burke wants to accomplish as “counting” or “calculating.” Something happens when numbers, trends, data are confronted visually in a graph or chart. In this he echoes Paul Krugman, who wrote of graphs as he began his blog for the New York Times: “charts and tables . . . are crucial **to the way I think** about most of the issues I write about.” Indeed, Burke includes

Krugman’s graph illustrating the history of middle-class wealth from 1950-1970 in his “A Mathematician’s Proposal” for the Carnegie Perspectives series. Somehow, “seeing” the data differs in significant ways from reading it or hearing it. Says Burke: “If you look at it [data], literally, you can see the trends. And the trend is the important thing. It’s not where are we today, it’s where are we likely to be tomorrow.”

It’s the things that good numbers can say that Burke wants his students to understand and thus value math for being able to frame, and he knows well the moral perils arguing with numbers always encounters. “Skillful people use numbers to lie, and the result of that is that a lot of our population doesn’t believe any numbers,” Burke admits. “What I want to say is that it’s not that hard [to get good numbers], and we don’t have to listen to other people’s numbers. We as citizens can look at the original data and draw our own conclusions.”

To date, Burke has used data sets framing issues like gun control, the death penalty, and global warming.

“It’s certainly true that numbers don’t tell the whole story,” Burke continues, “and when I teach today, I spend more of my time talking with my class about how you interpret what you’ve done than about the mathematics necessary to do it. That’s really the difficult question and the important question. So you make a graph that shows an increasing trend. What does that mean? What can you conclude from that? You have to think about the implications of that graph. What the graph is showing you is what will happen if the present trends continue. But the important question is ‘Will that

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2203 Regent Street, Suite B  
Madison, WI 53726

**The National Teaching & Learning Forum**  
(ISSN 1057-2880) is published six times during the academic year by James Rhem & Associates, LLC — December, February, March, May, September, October.  
One-year individual subscription: \$59.

Periodicals postage paid at Madison, WI

Postmaster: Send change of address to:

**The National Teaching & Learning Forum**  
2203 Regent Street, Suite B  
Madison, WI 53726

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<http://www.ntlf.com>  
December

## Editor's Note:

For as long as I have been writing about higher education, I have been impressed with the innovative vigor of the two-year college world. It seemed to me that two-year colleges were creating their own video discs, and using e-mail and distance learning when most faculty elsewhere either hadn't heard of such innovations or were grudgingly acknowledging that "these things" were around, but that they saw little use for them in their teaching. And I well remember faculty at major state universities telling me at conferences that, "yes, the university has set up an e-mail account for me, but I never use it."

How times have changed. An old friend of mine (now sadly deceased) once said to me that in life you either grow up or you're "grewed up." The gallop of technological change and the near collapse of the American economy seem to be about to converge on higher education in a way that surely will intensify the focus on what has been the central enterprise of higher education all along — teaching and learning. Research won't stop and the search for prestige and status will never end, but as the new year approaches I predict that those who may not have consciously focused on their teaching as an intellectual, social, and moral adventure will begin to do so. And they will more and more begin to take just pride in it. With the cost of higher education becoming an acute social and moral problem and with more and more students beginning their careers at two-year schools as a result, the stage is set for the peculiar prestige boundary that has separated two from four-year schools for too long to fade.

As the two lead stories in this issue of the *Forum* illustrate, important and very thoughtful innovation in teaching is going on in two-year schools, spearheaded by passionate and committed faculty. All faculty have much to learn from these examples. Would that **Michael Burke** had been around to teach me math. For me algebra was all parlor games, and I never saw the point. I never liked games. I don't play chess. If a fly begins flying back and forth between the handles of a handlebar on a train leaving Philadelphia at 30 miles an hour and a sister fly begins the same journey on a train leaving Chicago at 20 miles an hour, I just don't care where they will meet or how many miles they will have traveled. In Burke's classes where numbers engage important modes of thinking and reasoning (as well as significant social issues), I think I would have gotten the beauty and importance of thinking with numbers and gotten better in math as a result.

Though I was always a good reader of texts, I'm sure I could have honed my skills under **Nancy Ybarra's** guidance so that some of the lazy B's I made would have become easy A's. Apprenticeship of all kinds is undervalued as a means of learning and yet we are almost all of us apprenticed to experts at some time or another and usually these experiences remain among the most important of our lives. Learning to read, *really read*, seems a treasured thing in Ybarra's class.

And what of **Ed Nuhfer's** important DEVELOPER'S DIARY comparing stages of intellectual and affective development? Would that more teachers had supped at the cup of the awareness of these interactions: they might have stopped writing on my report cards "if Jimmy just weren't so sensitive." Something similar goes for **Marilla Svinicki's** AD REM . . . There are good reasons for prioritizing work, even when it's homework. More understanding and acceptance of the whole student can only lead to better teaching and learning. The growing and valuing of that awareness is what I see and pray for in our future, my hope for the new year.

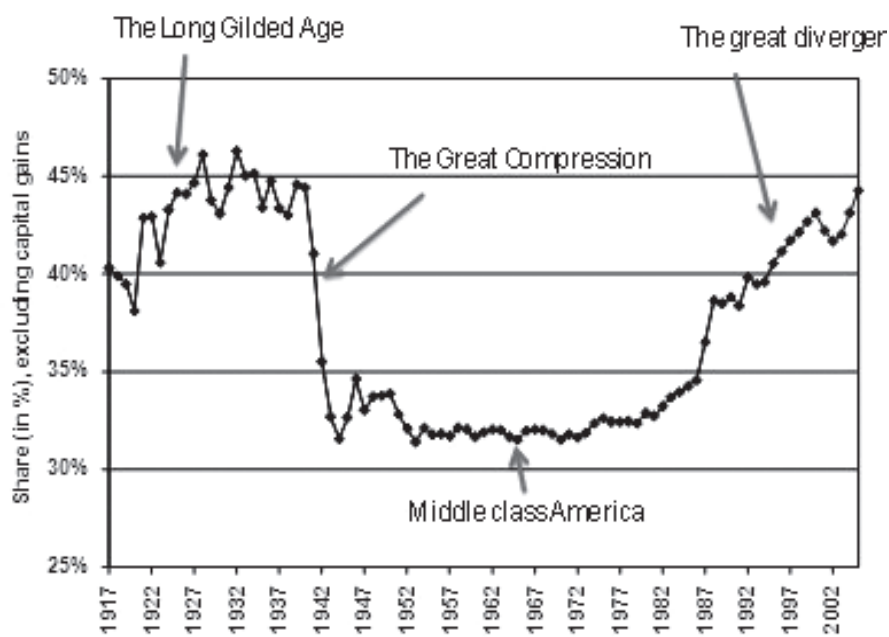
— James Rhem

trend continue? What conditions will prevent it? Support it?"

"The goal always is to get a model, right? But the most important question once you get a model is, when and how will the model break down because the point at which the model breaks down is the point at which we have a catastrophe. You had 10 billion people, and then suddenly you've got six or four. And that's not something that comes right out of the data. You've got to step back and ask, what is the model saying, what are the trends, what are the conditions that support those trends, and will those conditions continue to hold? And if they won't, what will happen?"

That model implies food and water or some other combination of life-supporting elements not keeping pace with population growth—a negative trend. But what about positive trends? "If the model is predicting good things, and the breakdown of the model is a bad thing, then that, once again, raises the question of human intervention. What can we do to prevent the breakdown of the model?"

Burke has been teaching for over 30 years, but his efforts to shift his teaching of math from the purely abstract toward something like informed, practical thinking has really taken off in working with writing teachers over the last ten years. For three years or so, he was able to work as part of a learning community with a few other faculty and a small cohort of students. When that became difficult to organize officially due to organizational structures, the effort continued somewhat fugitively but with more faculty involved, in something called "Confluence Model Learning Committees." The effort culminates in two sets of mini-lectures where the faculty from different disciplines gather with all the enrolled students to address the common theme they've been exploring from the perspectives of their various disciplines. In one of these, well-known ecological writer Paul Ehrlich wowed students as a guest speaker. In another, students



Paul Krugman's *New York Times* graph showing the recent history of American wealth

produced the event, offering a mock Supreme Court case presenting an “opinion” on the recent disavowal of responsibility by the Environmental Protection Agency. So, says Burke, while the learning community has changed shape, the effort now actually reaches more students.

In all cases, the implications of numbers engage the necessity of human judgment, human values, human actions, all of which may spring from qualitative spheres, but all of which benefit from quantitative clarity and accuracy, Burke believes; hence, his call for including more math in freshman composition courses. “Yes, I would like to see this kind of approach to numbers added to freshman composition,” says Burke. “I’d also like to see it added to freshman mathematics,” he laughs. ■■■

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### Submissions

What is the Scholarship of Teaching and Learning (SoTL), anyway? Like scholarship in general, SoTL takes many forms. One of the most useful begins when faculty step back and reflect critically on their own work. What they end up having to say about that is often the very thing other faculty need to hear. Scholarship that’s read, not filed, is what this publication is all about.

Therefore, the *Forum* encourages submissions on any aspect of college teaching and learning. The ideal article falls within a 1500 word limit and, following Thomas Sprat’s praise of the Royal Society, holds to a style of writing that reflects a “close, naked, natural way of speaking.”

Normally, articles come from faculty, but other voices, including student voices, are welcome.

Also, the symbiosis between our printed edition and our web site creates rich opportunities for posting ancillary materials to accompany submissions.

Submit manuscripts to James Rhem at 2203 Regent Street, Suite B, Madison, WI 53726 or via e-mail to [jrh@chorus.net](mailto:jrh@chorus.net).