Publisher's Editorial

The Good Fight

Solomon A. Garfunkel
Executive Director
COMAP, Inc.
57 Bedford St., Suite 210
Lexington, MA 02420
s.garfunkel@mail.comap.com

The MCM issue of *The UMAP Journal* has historically been an opportunity for me to reflect on the year at COMAP and discuss with you many of the new projects underway. I am, with your indulgence, going to diverge from that tradition this year. Perhaps it is the coming (as I write this) election, but this has been an extremely political year. And that politics is having its effect on all of us involved in mathematics education. I have found myself as a consequence writing pieces that are more "polemical" in nature—defending our beliefs and our work within our community and without. So, with no apologies, here are two short essays that reflect my thoughts on the "good fight."

Mathematical Breadth for All

The discussion (debate, war) about differentiating the curriculum for students with the perceived ability to go on in mathematics vs. the rest usually misses the crucial point of breadth. It is in many ways ironic that the "mathematics for all" movement has succeeded in infusing the secondary school mathematics curriculum with many important ideas and concepts that the "better" students simply do not see. A great deal of effort has gone into the creation of materials intended to show all students the usefulness of mathematics, through the use of contemporary applications and the processes of mathematical modeling. In many cases, this means teaching more discrete mathematics such as graph theory, game theory, social choice theory, and operations research.

Henry Pollak is fond of saying that there are four reasons for students to learn mathematics—to help them as they enter the world of work, to make them more knowledgeable citizens, to help them in their daily lives, and to

The UMAP Journal 24 (3) (2003) 185–188.

have them appreciate the beauty and power of the discipline. Clearly, for the mathematically talented, we focus on the last, while for more average or less motivated students, we (hopefully) stress the first three. I believe that this is a terrible mistake and that we are paying a terrible price.

It is no secret that there has been a worldwide decline in mathematics majors. In the U.S., the half-life of students in mathematics courses, from 10th grade to the Ph.D., remains one year. In other words, if we look at the students enrolled in 11th-grade math courses, there are approximately half as many as were enrolled the previous year in 10th-grade math courses, and so on to the Ph.D. I argue that while we are doing a much better job in showing average students the importance and relevance of mathematics in their lives, we are simultaneously discouraging our brightest students from continuing their mathematical studies.

I believe that the reasons for this are clear. We assiduously avoid showing the mathematical elite the utility of our subject and its relevance to their daily lives, career choices, and role in society. There is some mythical linear sequence of courses from birth to the Ph.D., which we feel that they must take. Many of theses courses are highly technical, providing practice in skills necessary only for the next course. But we have ample proof that this delayed gratification simply does not work. Our best students are leaving mathematics for what they perceive as more relevant and rewarding fields, such as biology and finance.

Even if one accepts the notion that we should have a differentiated curriculum, based on ability, it is patently absurd to avoid showing our best and brightest students the power and utility of our subject. It isn't a horse race. Students don't have to take advanced calculus or point set topology by the age of 17, no matter how talented they might be. We need to show our students, at every ability level, the breadth of our discipline and the breadth of its applications. By not doing so, we only invite the disaffection we see.

Now It's Personal

I should preface my comments by saying that I am first and foremost a curriculum developer. For the past 30 years, I have worked to produce curriculum materials that attempt to teach mathematics through contemporary applications and modeling. COMAP has produced literally thousands of modules from primary school through university-level mathematics, as well as several high school and tertiary texts, television and Web-based courses.

There is, however, in many countries, a feeling that we have created sufficient new curricula over the past several years and that before we create more, we need to look hard at what we have done and whether we have made a difference in student achievement. At first blush this makes perfectly good sense, but the devil is truly in the details. Everyone is aware that student achievement is affected by several factors, not the least of which is teacher preparation and performance. And with the new curricula, teacher training and staff development consistently lag woefully behind. In part, this is due to the enormity of the task, and in large part, to the enormity of the expense involved in doing staff development "right."

But most of this discussion is beside the point. What we have today is a call for research. We have politicians and colleagues saying that before we develop new materials we must learn what works. We must experiment (almost in the medical sense) in order to be certain that what we teach from now on has a sound body of research behind it. While I realize that this analysis sounds extreme, I assure you that at least in U.S. educational circles it is a reality. Moreover, this reality is being played out by real politicians who decide where educational funds will be spent. Sadly, this dichotomy can also be seen within the discipline of mathematics education. Most of us, of a certain age, came to mathematics education through other pathways—as mathematical researchers, or as university or secondary-school mathematics faculty. There was not yet a discipline of mathematics education, few Ph.D.s, no direct career path, and few journals to publish our work. We were in the truest sense self-taught. We learned what works by working.

I would argue that there are examples / models / problems that are beneficial on their face. These problems illustrate key aspects of the modeling process, can be set in contemporary and inherently interesting contexts, and permit us to teach and/or reinforce important mathematical concepts and skills. I believe that their introduction into the curriculum should not wait for double-blind experiments with control groups, based on a theoretical framework, evaluated through statistical techniques valid in a 95% confidence interval.

That mathematics education is now a respected discipline is, of course, a good thing. More and more talented young people are entering the field and more and more journals and international meetings give them respected outlets for their work. But, I fear that we are losing the best part of our past. Much of that past does not rest in journals, but in ourselves. Anyone who was fortunate enough to view the tape that Henry Pollak made for the ICMI study conference in Dortmund [2004], or to listen to the stirring words of Ubi D'Ambrosio at ICME-10 [2004], or go to any talk by Claudi Alsina (see [2001a; 2001b] will understand what I mean.

These giants may or may not describe their work in the vernacular of the day. They may or may not explicate a theoretical framework, or reference a standards document for content or an educational statistics journal for a methodology. But the quality of their ideas is a thing to be treasured. Yes, we must describe our work in ways that can be replicated. Yes, we must conduct real research to establish whether our ideas as implemented make a positive difference in student performance. Yes, we must publish our work in respectable journals, reviewed by our peers. But in the same way that we understand analogous truths about mathematics research, we must not lose sight of the art of mathematics education. Just as with mathematics, there is beauty and elegance here. We must continue to make room for those who would strike out in new ways—try new content, new applications, new technologies.

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About the Author

Sol Garfunkel received his Ph.D. in mathematical logic from the University of Wisconsin in 1967. He was at Cornell University and at the University of Connecticut at Storrs for 11 years and has dedicated the last 25 years to research and development efforts in mathematics education. He has been the Executive Director of COMAP since its inception in 1980.

He has directed a wide variety of projects, including UMAP (Undergraduate Mathematics and Its Applications Project), which led to the founding of this *Journal*, and HiMAP (High School Mathematics and Its Applications Project), both funded by the NSF. For Annenberg/CPB, he directed three telecourse projects: *For All Practical Purposes* (in which he also appeared as the on-camera host), *Against All Odds: Inside Statistics* (still showing on late-night TV in New York!), and *In Simplest Terms: College Algebra*. He is currently co-director of the Applications Reform in Secondary Education (ARISE) project, a comprehensive curriculum development project for secondary school mathematics.