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President's Desk

How We Can Avert A National Crisis

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The call came in on my wife's cell phone as we were driving back to Chicago from northern Wisconsin. Our then newly minted high school graduate was calling to tell us that she had just received her calculus AP scores and that she did "well enough so that I no longer have to take math again in my life." While I was pleased she had done well, I was disappointed in her decision about future math courses.

Why does our K-12 math and science curriculum turn off our children to these exciting fields? In the case of calculus, perhaps it is because we teach the subject today the same way we taught it 35 years ago when I took the course. Yes, today's books are in color and encourage students to graph functions on their calculators; my black-and-white text required me to plot functions by hand. My younger daughter's calculus book includes a 14-page section on "modeling and optimization" with problems on fabricating a box and designing a can. My favorite problem from this section begins, "A rectangle is to be inscribed under one arch ..." Clearly this is critical for all of us who want to build our next home under the St. Louis arch!

The pedagogy is the same today as it was 35 years ago: have students do countless hours of exercises, learning tricks to integrate or differentiate obscure functions. Frankly, I have had to integrate functions like $\sec^7(3x)$ exactly twice in my life: once when I took calculus myself and again three years ago when my older daughter was taking calculus.

There is a name for this sort of pedagogy: hazing.

Most college campuses have banned the practice when it comes to fraternity and sorority recruiting, but we perpetuate its use in identifying those students who are "good enough" to make it into math, science and engineering programs. Is it any wonder that U.S. students ranked 24th out of 40 countries in 2003 in a test of a student's ability to apply math to real-world problems? Should we be surprised that only 15 percent of U.S. undergraduates receive a degree in science or engineering while the corresponding numbers in South Korea, France, China and Singapore range from 38 percent to 67 percent? With only a third of the 8th grade math teachers holding a degree in mathematics, is it any wonder that students fail to see the exciting facets of math? Should

we be shocked when students leave high school vowing never to take math again in their lives?

The National Academies recently published a report entitled, "Rising Above the Gathering Storm." The study notes that up to 85 percent of the growth in per capita income in the United States can be attributed to technological change. Globalization is eroding this country's competitive advantage as other countries significantly improve their technological bases. The first recommendation of the report is to "increase America's talent pool by vastly improving K-12 science and mathematics education."

This is where we at INFORMS can play a role. We understand that mathematics can be used for exciting projects that significantly impact the world around us. We know that there is more to calculus than finding the largest rectangle that can be inscribed under an arch.

There are at least four actions we can take to help mitigate this crisis:

- Buy Ken Chelst and Thomas Edwards' book entitled, "Does This Line Ever Move? Everyday Applications of Operations Research." Built around 10 case studies on network routing, linear programming, queuing, simulation and decision theory, the book illustrates key concepts in contexts relevant to high school students (e.g., choosing a college). Give the book to the chair of your local high school math department and encourage him or her to incorporate the material in the school's curriculum. Visit www.hsor.org for outstanding supplements to the text.

- Give a talk about O.R. applications at your high school or middle school. If your work does not lend itself to such a talk, borrow from Chelst and Edwards' book, use an example from an Interfaces paper, or a topic from a case study on the Science of Better Web site (www.scienceofbetter.org).

- Plan a one- to two-day workshop to introduce high school math teachers to O.R. Any school can request a workshop from HSOR.ORG. Ken will go anywhere in the United States to assist with the first workshop, provided a local O.R. person (you) will pick up the ball from there. INFORMS has a small budget to support Ken's travels if the local school cannot afford to pay for his expenses.

- Support legislative efforts to implement the recommendations of the National Academies' report.

There are undoubtedly other actions we can take to help improve K-12 math education. I welcome your ideas. The crisis in K-12 math education endangers our country and our profession. We owe it to ourselves to contribute in whatever ways we can to the resolution of this problem.