The 2001 James R. C. Leitzel Lecture: What I Have Learned from the Mathematics Community

Bob Witte

Good morning Association members and guests. It is a special privilege to have been asked to be your James R. C. Leitzel speaker. When I was offered this opportunity, I was first surprised, then enormously honored, and finally, more than a little concerned that I had bitten off more than I could properly chew. It was 1992 when I was first introduced to your Association and its leadership, and began to attend your meetings. Since then I have come to prize my acquaintances within the Association. Those friends in this audience know what many may not know: I am not a mathematician. Not only that, while I am honored by the title "Doctor" that some bestow upon me, I am not Dr. Witte. This is not the only time I have been mistaken for someone else. Some years ago I visited a class of first and second graders taught by a wonderful mathematics specialist elementary teacher in Albuquerque. That evening at dinner, the teacher confided that a first-grade boy approached her after I left and asked, "I saw his tummy and his white hair but where was his beard?" And I wasn't even wearing my red suit! Recalling this has assuaged some of my initial fears. Whether one is the fellow in the red suit or a foundation program officer, everyone is nice to you.

The Foundation, now the ExxonMobil Foundation, has a long and productive history of support for this Association. And I can assure you that the support has been based upon the Foundation's belief in your work and expectation of its success, and that Santa Claus had nothing to do with it. The Foundation is always aware that it is giving the shareholders' money, and we insist upon the prospect of generating important returns from this investment. The most persuasive evidence that you members and leaders have enabled the MAA to meet and exceed those Foundation expectations is three million dollars that has been granted to your Association since 1989.

Part of my job, representing the Foundation, was to convey the Foundation's deep respect for the work of its grantees, and that certainly is the case with the Mathematical Association of America. I recall well that, when I was the new program officer in 1992, I was welcomed with a genuine openness and a sense of partnership that characterizes the MAA's relationship with the Foundation.

To reiterate that profound institutional, as well as personal, regard for your work is surely a worthy purpose for this talk, and perhaps even an adequate content for the talk. But you will not get off that easily today. My position with the Foundation—and, indeed, with respect to your Association—afforded a vantage point and experiences that strongly influenced how I think about education. Thus, I have chosen to share some of my perspectives with you. In the end, I hope to suggest some opportunities or items of unfinished business that I believe you may be uniquely positioned to address, and I may try to persuade you that you might even have a responsibility to take on some of those challenges.

I retired from my employment with the Foundation in early 2000. My comments this morning are entirely my own and I do not speak for the ExxonMobil Foundation in any way.

Because my education and work background are different from those of most of you, I offer a little more history in the hope that it will help you to understand where

I picked up these ideas. I did not begin my career at Exxon with the Foundation. My undergraduate education was in mechanical engineering, and I worked in refinery engineering and operations supervision for about half of my almost forty years with Exxon. About the midpoint of my career, I joined the corporation's public affairs function. My first assignment in this new world introduced me to the work of managing corporate charitable contributions programs, along with other tasks. But this work was not as a part of the Foundation.

The Foundation was a separate organization, and it was active in supporting education at the national level. The corporation's philanthropy tended to be more closely related to communities in which it had substantial operations and, thus, significant numbers of employees. Some of those contributions were directed toward educational activities at the local, and sometimes state, levels.

In the early 1980s, publication of the report "A Nation At Risk" by the U.S. Department of Education had grabbed public and business attention for education and energized a growing wave of activities aimed at helping our schools. By the later years of that decade the company was receiving dozens, if not hundreds, of requests for contributions for every imaginable sort of aid for schools. I trace my involvement in education to a day when one of those requests arrived at my desk from the office of the company president. I don't remember what the request was about, but the president was clearly frustrated by the lack of a clear strategy for dealing with all those requests, and he had penciled a note in the margin of the letter: "Maybe we need to rethink what we are doing in education." That rethinking fell to me.

Well, I had been in schools for at least eighteen years, and I might have judged that my experience would qualify me to assess and redesign the company's programs. But I had a great deal of respect for the Exxon Education Foundation and a genuine interest in its work, so I phoned one of the program officers and asked for advice.

My mentor was Foundation Program Officer L. Scott Miller. Scott asked whether I was acquainted with the work of Dr. Theodore Sizer. I had, of course, never heard of Dr. Sizer. Scott told me to find a copy of Sizer's 1983 book *Horace's Compromise* [**1**], read it, and call him back.

Dr. Sizer had been headmaster at Phillips Exeter Academy and Dean of Education at Harvard when he became engaged in a major study of American high schools in the late 1970s. In addition to the scholarly work of the study, Sizer wrote *Horace's Compromise* to address its findings to a broader audience. The book's main character is Horace Smith, a high school teacher who knows how to meet the needs of his students. However, because of the structure, organization, and governance of the school he must compromise and accept what he knows is much less than what he could do and what his students deserve. I found Sizer's account compelling. At the end of the book, Dr. Sizer sets forth nine "common principles" he believes should guide the organization and the operation of high schools. Those principles are intended to guide an "Essential School," and Sizer organized the "Coalition of Essential Schools" to foster the realization of those ideas. The Coalition now numbers its member-schools in the hundreds. The Exxon Education Foundation was among the earliest supporters of the Coalition.

Beginning with the notion that the focus of the school should be to help adolescents learn to use their minds well—and calling for student mastery of a limited number of essential skills, limits on the number of students each teacher would be responsible for, and school costs no more than ten percent greater than current schools—the idea of the Coalition was extraordinarily ambitious. In an afterword to the book, Dr. Sizer addresses almost thirty questions and challenges and reasons why the Essential School would never work. The last of those challenges asserts that the effort will fail because

"no one cares." Sizer's answer has been an important motivation for me since my first reading; here is what he said [**1**, p. 237]:

> Yes, too many don't care, even parents. Few citizens really know what's going on in their schools. They settle for the familiar form and ignore the substance. The businessman who would neither copy any part of the high school's routines or structure for his own firm's training programs nor tolerate for his employees the work conditions that are standard in schools sanctimoniously takes part in pep rallies for the schools.
>
> The college professor who on principle would not stand for close state regulation of her classes of freshman blithely endorses tight control on twelfth-grade instruction, and even assists central authorities with that standardized regulation.

"Hypocrisy?" Sizer asks. "Not really," he answers. "Just indifference and the unwillingness to think hard and honestly about the process of education."

It seemed to me that much of the frustration with the many requests for contributions Exxon was receiving could be traced to the lack of hard and honest thinking. Still today, oversimplified notions about education continue to lead to programs that have no chance of producing the improvements they promise. It continues to be widely believed that, since we have all been to school, we qualify as experts. If teachers would only cover the material in the books we give them, if they would make the children pay attention, if parents would simply turn off the TV and make the children do their homework, then students would learn. Those of you who have your own classrooms know the process of education is more complex than such reasoning suggests.

A business acquaintance who is serious and thoughtful about education once asked me what he might do to help a prominent private school's board of trustees to be more effective in developing the great educational potential of its students, much of which he felt was being wasted. I suggested that the board read and discuss Sizer's *Horace's Compromise*. Sadly, he concluded the board would never read a 200-page book about education.

On another occasion, I phoned a local realtor to complain about a flyer he had mailed to many in our community that showed the SAT scores of students from a dozen or so area school districts. I attempted to explain that because the students who take the SAT are self-selected, such a comparison of scores without substantial analysis of student characteristics was misleading. He said, "I don't know anything about that, I am just trying to sell houses," and he hung up on me.

The "unwillingness to think hard and honestly about the process of education" remains pervasive in this country, and impacts education at all levels.

Thankfully—and as you know—there have been and continue to be places where serious thought is given to the process of education. My acceptance of my mentor's direction in reading *Horace's Compromise* encouraged him to stick with me. Scott Miller next directed my attention to a then new study published by the business organization known as the Committee for Economic Development. The Foundation had been one of the contributors to the project. Marsha Levine was a principal author, and the study was called "Investing in our Children." The study included the following simple matrix (Figure 1) identifying major types of involvement with education and examples of activities that might be reasonable approaches for pursuing several strategies for improving education.

This is a fairly simple device, and yet I was amazed at how few businesses made any attempt to use such a device to manage their education-related activity. I suspect that you could update this and change a few words and it would be a useful device for a mathematics department in examining its activities. For me, a picture is worth a

TYPES OF PRIVATE-SECTOR INVOLVEMENT IN EDUCATION

Type of Involvement	STRATEGIES		
	System Support	Incremental Change	Structural Reform
Funding	Donation of Equipment Public Education Funds Teacher Recognition Programs Minigrants Programs Public Relations Campaigns		Support of Major Research
Program Involvement	Career Days Speaker's Programs Adopt-A-School Programs Management Training	Magnet School Development School-to-Work Programs	
Policy Involvement	Local School Board Participation	State Education Task Force	Major State Policy Initiative National Policy Statement

("Investing in Our Children," Committee for Economic Development, New York, 1985, p. 87)

Figure 1.

thousand words, and even simple models such as this matrix can help us to understand what otherwise might be hard to see.

My frustration with continuing widespread unwillingness to think hard and honestly about the process of education led me to develop what I called "Witte's First Law of Productivity":

> If you work on the wrong thing,
> no matter how hard you work,
> you will never get the right answer.

For those who *still* didn't get the message, there is a corollary:

> If everyone who works on the problem is ill-informed,
> you will get a stupid answer.

In 1992 I was offered the opportunity to join the Foundation staff. Through my contacts with Scott Miller and others at the Foundation, I'd like to believe they thought I was capable of some "hard and honest thinking about the processes of education." On the other hand, part of the reason for the invitation may have been that my superiors in public affairs felt that I was becoming somewhat more outspoken than good public relations practice could tolerate. In any event, I was delighted with my new opportunity.

To my further delight, I had the good fortune to inherit responsibility for the Foundation's Mathematics Education Program. In 1988, the Foundation had begun its Mathematics program with initiatives aimed at three targets:

1. Introducing the use of math specialists in elementary schools
2. Supporting mathematics education policy and planning efforts
3. Supporting organizations that are providing leadership in mathematics education

My next big lesson came from the splendid teachers in the Math Specialist Program. I inherited not only a thoughtful program design that was based on long-term teacher professional development in mathematics and in leadership, but also the teachers' trust, which had been won by my predecessors. Our teachers were willing to share with me both their successes and failures, and they had the patience to help me begin to understand the complex environments in which they worked. I got an up-close and personal view of the classroom realities that make it so difficult to sustain the very best teaching in our schools. One cannot work with these teachers and continue to hold oversimplified ideas about education. The mathematics specialist program continues in its fourteenth year, and many of the teachers from the early years remain active, along with new colleagues each year. I always believed it was to the Foundation's great credit that it began its mathematics program with the understanding that it would have to support that work for at least a decade. And it has. A lesson in this is that change takes time. Those of you who have dedicated yourselves to changing mathematics education know, it can be a lifetime's work!

The MAA, of course, was among the first mathematics organizations to receive unrestricted grants to help build its leadership capacities. When the Foundation's mathematics program began, your Association and its partners in the NCTM and the AMS, along with the MSEB and the National Research Council and the mathematics invest-

ments of the National Science Foundation, had created the capacities and accumulated the resources to present new opportunities for mathematics education. Seizing some of these opportunities, the MAA quickly became a productive and valued grantee, and the Foundation supported a number of important MAA initiatives.

Before long, the Foundation concluded that more new initiatives might be timely. As to what those initiatives might be, we chose to ask the mathematics community. In the summer of 1993, the task of phoning Dr. Marcia Sward with that question fell to me. If there were an opportunity to undertake a major new program to advance mathematics education, I asked, what would it be?

A July 1 letter provided the answer: "The area that we would like to recommend for your new Exxon program is faculty development." The four-page letter outlined the basic structure and operation of what we now know as Project NExT. "It has been developed by Jim Leitzel and Chris Stevens," the letter explained, "along with several other people." By November 8 I had received a thirty-page proposal, and on December 20 Foundation President Ed Ahnert signed a letter telling Marcia, "I am happy to inform you that the Exxon Education Foundation has awarded the Mathematical Association of America a three-year grant of $336,711. . . ." Happily, and the annoyance it causes with spell checking software notwithstanding, the original project title of "Meeting the Challenges of Collegiate Mathematics Education" quickly became "Project NExT."

I am convinced that the Foundation's experience with its elementary math specialist program positioned us to recognize the potential of Project NExT, and to accept the reality that truly productive faculty development supports faculty in learning to do new things in new ways. NExT is not just a new technique, a new curriculum, a new insight from research, although such resources are important. NExT demands sustaining the courage to question the status quo and the willingness to change the ways in which you fulfill, indeed, live out, your responsibilities. And in the most crucial ways NExT is the network you have created, the powerfully supporting network of fellows, mentor consultants, leaders, and directors.

The MAA has given itself and NExT another powerful resource in its support for the Association for Research in Undergraduate Mathematics Education. Taken in total, I am hard-pressed to identify any other association that has done more than the MAA to foster "thinking hard and honestly about the processes of education."

Watching NExT blossom and grow has confirmed for me the power of people who care deeply about their work together. And this Association REALLY DOES care about teaching and learning mathematics, and about how you are assuring that teaching and learning will meet the needs of students in coming generations.

I spent the larger part of my time with Exxon in Houston. One evening, Johnny Carson appeared in the early evening on my television with a teaser for his show. "The Tonight Show," he said, "is a lot like Houston's Gulf Freeway. It is often exciting, and it is never finished."

That is an apt characterization for the work you have chosen here, and for the work you do in your classrooms, which is also often exciting and is certainly never finished. So I want to suggest some of the tasks that are not finished. And these are tasks that I believe the mathematics community and this Association are uniquely equipped and perhaps even obligated to address. I offer these ideas knowing full well that having more things to do is not high on the MAA's wish list.

First, I believe there is both great opportunity and great need for you to invent new roles for your profession, your departments, and yourselves in our nation's K–12 schools. My experience with the Foundation's mathematics specialist program persuades me the needs and opportunities may be greatest in the elementary schools.

Far too much of the responsibility for the way mathematics teaching is done in elementary schools has been delegated to others for far too long. More than that, I have had many elementary teachers tell me they can use what they have learned about teaching young children mathematics to improve their instruction in other subjects. At the same time, a faculty member who is an important contributor to improving elementary mathematics instruction told me that earlier in her career, when she worked to advance language arts instruction, no teacher ever claimed that her new understanding about language arts could be used to improve her mathematics teaching. These experiences helped me to craft the following assertion:

Give me three elementary schools. Each will have an academic focus: mathematics in one, science in the second, and language arts in the third. Give me comparable faculty and resources and three or four years. After that time, not only the mathematics achievement, but also the science and language arts achievement, will be better in the mathematics school than in the other two schools. I have offered this assertion to dozens of people, most of whom were not mathematicians, and never had anyone challenge it in any way.

I cannot prove this assertion, but there are several facets of mathematics that offer clues to why it is likely true. First, in his book *Weeding and Sowing*, Hans Freudenthal offers this observation [**2**, p. 76]:

> I view mathematics education differently. . . I believe that in all didactical undertakings such as mathematics—moreover concretized in every respect—is a valuable and indispensable starting point, provided that at every step the postulate is recalled that education is one and indivisible, and that every piece—for instance of mathematics instruction—is worth only as much as can be integrated into the total picture of education.

Second, I think those of us in Foundation offices and, frankly, too often in university offices, are inclined to think and talk about education in idealized conditions. I am sure that your classrooms are not always models of the thoughtful and academically productive environments we like to conjure up, and you can be sure that our elementary classrooms are orders of magnitude more chaotic. The array of forces at play may be something like that depicted in Figure 2.

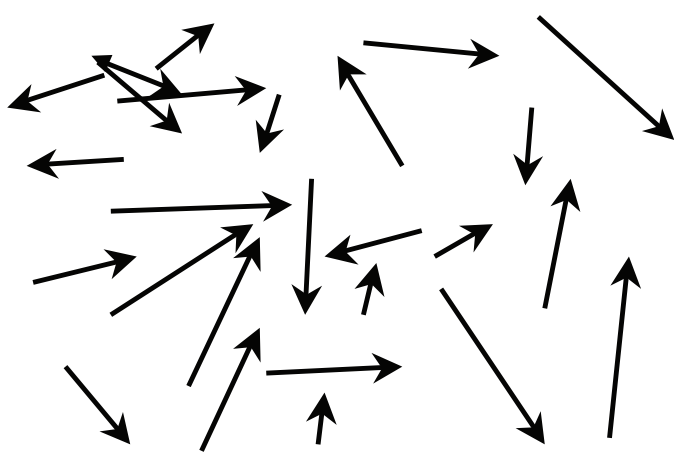

Figure 2.

Now, we place mathematics at the center, and I assert that, no matter what else you change, you get a shift toward the alignment in Figure 3. And there must be a huge advantage to reducing the amount of effort directed at cross-purposes.

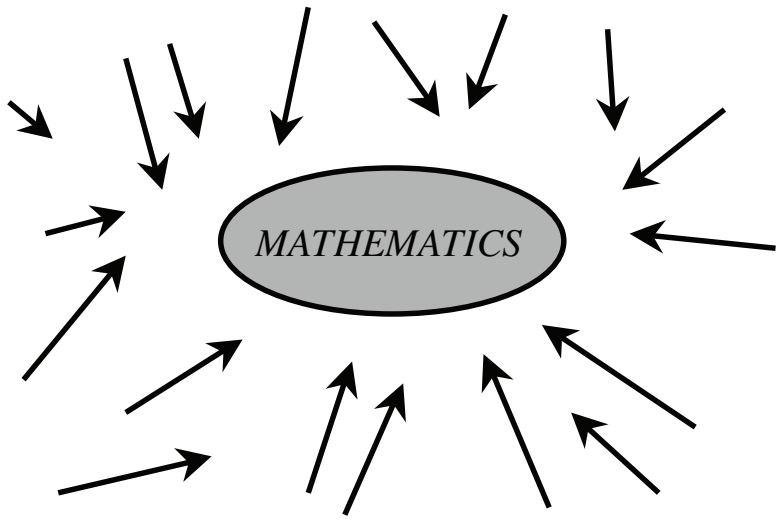

Figure 3.

The teacher in a classroom has almost total control of what takes place in that room. This fact has saved countless children from ill-conceived political and bureaucratic interference with schools. At the same time, this teacher independence suggests that inserting a strong positive force such as mathematics into that environment might have a large impact over time. When this positive force is added to the great educational value of good mathematics instruction, we see mathematics is clearly *the right thing* to work on.

Beyond the educational improvements possible, I believe that mathematics departments must find an adequately intimate association with elementary school classrooms so that it will be impossible to ignore their needs in this perhaps the most critical time to give students a fair mathematical opportunity. What I mean is that you, as college mathematics teachers, should get into a situation that will keep you from sleeping if you try to ignore it. One way to do this could be to engage with one of the Foundation's elementary mathematics specialist projects. It would be wonderful if, in the process, you and your colleagues could define and create a totally new kind of relationship with your colleges of education.

A second task—and one that is currently in the national political spotlight—relates to the issue of accountability for schools. As a Texan, it is my observation that on balance the state's testing and accountability policy has had a positive impact. I believe it has been especially positive for those students trapped in the academically poorest performing schools, where the educators responsible cannot hide. In addition, the policy makes schools report scores by racial and ethnic grouping. This has helped students whose results would otherwise be hidden by averaging them with those of a larger sample of better performing students. This positive assessment must, however, be tempered by the acknowledgement that the tests establish bare minimum standards.

This has prompted me to develop Witte's Second Law of Productivity.

> If things are bad enough, you don't need to be very good to be a lot better.

Sometimes this is called the Law of Percentage Improvement.

On a more serious note, we must have some appropriate educational accountability. This is not a simple task, and I believe that the mathematics community has important contributions to make. Here again, Dr. Freudenthal is the most thoughtful author I have found [**2**, p. 144]: "Accountability in educational matters is too precious a thing to be debased into a slogan. Yet it is also too precious to be replaced by accountancy. Accountability yes, but not by accountants but by educators who are able to weigh credits and debits more intelligently than can be done by numbers only."

It is not enough to be either "for" or "against" testing. As is the case with many facets of our education system, the issues and the answers, I believe, are more complex than that. I know many of you are involved in efforts to define productive accountability strategies. But I believe your community has additional important contributions to make here.

A related third task is defining an appropriately prominent role for the mathematics community in the national school improvement effort. I believe this role must go beyond the excellent work you are doing in mathematics education. I know that many of you are already involved in educational affairs at the local and state levels. It is my privilege to serve as a board member for the National Alliance of State Science and Mathematics Coalitions, known as NASSMC. This group is the only discipline-based organization active at the policy development levels in states with coalitions.

Among other things, NASSMC offers an education news summary service by e-mail and an on-line archive of those summaries. It is my experience that keeping up with the two or three items NASSMC circulates most days is a very efficient way to stay abreast of the national K–12 education scene. (To examine the NBS briefings, visit the NBS archive, and subscribe at: http://nbs.nassmc.org.)

A fourth task is to identify the reasons that no other major science discipline has any faculty development initiative like Project NExT—and then help your colleagues in those disciplines to correct that state of affairs. This could, and should, create totally new kinds of relationships between mathematics departments and the physical sciences.

To summarize, here are four items to place on the "unfinished business" agenda:

1. New roles in K–12 Schools
2. Leadership in shaping education accountability policy
3. A prominent role for the mathematics community in national school reform
4. NExT for other disciplines

Much of what I have had to say today is about the importance of caring about education. The members of this Association and its work are splendid demonstrations of that caring. With models and mentors like Jim Leitzel, that wonderful work will certainly continue—and it will prosper.

ACKNOWLEDGMENT. This is the text of an address delivered at MathFest 2001 in Madison, Wisconsin on August 3, 2001.

REFERENCES

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The students in my classes learned mathematical operations pretty well. They learned virtually nothing about mathematical inquiry or mathematical thinking, because I knew virtually nothing about these things. Certainly, my pupils were not inspired by the subject. In a word, they became competent algebra drones. However, if I had not had good texts, an ability to keep discipline with a tough administration behind me, and a supportive spouse, the year would have been a total disaster. Competent drones were the best I could hope for. Fortunately for high school youths, I have not taught mathematics since. My experience would be irrelevant, except that it represents a sadly common situation. Many high school teachers do not know their subjects. They teach, as I did, from day to day, and the textbook is the source of everything.

——Theodore R. Sizer, *Horace's Compromise*, pp. 188–189. (Sizer is writing about the experience that he, a college English major, had during his first year of teaching. In addition to English classes, he was assigned two sections of mathematics, Algebra I and Algebra II.)