

## **WRITTEN TESTIMONY**

### **Hearing on “Innovation in Education through Business and Education STEM Partnerships”**

House of Representatives  
Committee on Education and Labor  
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*Written Testimony of*  
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### **BACKGROUND**

In 1983, the National Commission on Excellence in Education released its scathing report entitled *A Nation at Risk*. In the introduction, the Commission wrote, “We report to the American people that while we can take justifiable pride in what our schools and colleges have historically accomplished and contributed to the United States and the well-being of its people, the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a nation and a people.” In particular, the report detailed the steady decline in science achievement scores by U.S. high school students.

More recently, the National Commission on Mathematics and Science Teaching for the 21<sup>st</sup> Century (the Glenn Commission), the National Science Board, and the National Academies have underscored the urgency for education reform in a series of reports to the nation. In the Glenn Commission’s words, “our students’ performance in mathematics and science is unacceptable.”

To address these issues, schools and businesses have been entering into partnerships with increasing frequency over the past two decades. Many companies have become involved with schools in increasingly complex ways, moving from their initial instincts to provide materials and money, or to “adopt” schools, toward more lasting and comprehensive partnerships. These partnerships represent a substantial commitment on the part of American business to improve the quality of public education.

Departing from the more passive forms of business support common in the past, some corporate leaders are challenging schools to improve, and are willing to work with the schools to make improvement happen. To promote education reform, these leaders are sharing their expertise, resources, and their political capital. These school-business partners are setting high but achievable goals, working together to reform key elements of the school system, mobilizing community support for reform, and setting the agenda for education reform at the state and national levels.

This proactive approach is what Merck envisioned when in 1993 it created the Merck Institute for Science Education, a non-profit organization funded by the Merck Company Foundation. A year earlier, Merck had undertaken an in-depth study of the problems related to student performance and participation in science before making a long-term commitment to address this issue. Based on the results of the study, Merck leadership decided to focus resources on science education in grades K-8. The Institute's charge was to collaborate with teachers, administrators, parents, community members, and Merck employees to improve the teaching and learning of science, beginning in local schools.

### **THE MERCK INSTITUTE FOR SCIENCE EDUCATION**

The Institute's overall goal is to raise the levels of participation and performance in science for all students in kindergarten through 12<sup>th</sup> grade. The Institute began its work by establishing a partnership with four public school districts in New Jersey and Pennsylvania, and more recently has added school districts in New Jersey and Massachusetts, and an international site. These sites were chosen because Merck has major facilities in or near these communities. Initially we sought a full partnership with the school districts, working collaboratively to align and strengthen all aspects of their systems. Over time, the partnership was viewed as not just another funded project, but offered a new way of doing business in which district leaders worked closely with teachers and the Institute to develop and implement a carefully planned, focused vision of teaching and learning in science.

The Institute is guided by a vision of high-quality instruction in which inquiry is a regular part of the classroom experience of all students. In other words, science teaching and learning parallel the methods used by scientists to understand the natural world. Student investigations of natural phenomena are at the heart of this approach, and the purpose of these investigations is to develop the skills and habits of mind that are central to scientific inquiry.

This type of instruction requires teachers to possess a relatively sophisticated knowledge of science and the teaching skills to guide and manage inquiry. In addition, teachers need long-term support in and outside of the classroom. Corresponding changes must be made in curriculum, instructional materials, assessment, professional development, resource allocation, and other district policies. To enact such changes, policymakers and administrators must give science greater priority, and they must be willing to invest more to provide teachers with the time, support, training, and materials required. Similarly, parents must learn about and support the new instructional approach. Only training

teachers, however, is not sufficient; a systemic strategy is necessary to achieve such fundamental changes.

Accordingly, our strategy at the Institute is to simultaneously:

- Enhance teachers' knowledge and skills,
- Provide access to instructional materials to support reform,
- Build strong professional communities within and across schools, and
- Create local, state, and national policy environments that support our vision.

### **MEASURING RESULTS**

In 1992, even before the official launch of the Institute, we engaged the services of the Consortium for Policy Research in Education (CPRE) at the University of Pennsylvania to conduct a long-term evaluation of our work. Each year through 2003, CPRE assessed the progress of the Institute using a range of measurable criteria: student performance and course selection; quality of professional development; and changes in classroom teaching, school culture, and district policy. Since 2003, the impact of the Institute's programs has been being measured by an external evaluator, Horizon Research, Inc. Institute programs are continually modified in response to the evaluator's recommendations, the considerations of the Institute's national advisory board, and feedback from teachers and administrators in the partner school districts.

The different roles, perspectives, and resources that businesses can bring to the task of education reform are important, but ultimately results are what really matter. According to analyses by our external evaluators, our work has taken hold. Their reports state:

- First, the Merck Institute's systemic approach has worked. Science has become a priority in the partner districts. There is an inquiry-centered curriculum in place, and district leaders are actively supporting its implementation. The districts have made changes in policy, organization, and assignments in support of our vision of science instruction.
- Second, the Institute and its partners have not only learned how to provide high-quality professional development, they have learned how to provide it at considerable scale, and they have learned how to attract high proportions of teachers to participate.
- Third, participation matters. The more professional development teachers receive, the more their classroom instruction resembles the vision of good practice advanced by the Institute.
- Fourth, it appears that when a critical mass of teachers in a school has received professional development and begun to change their practice, the practice of non-participants also begins to shift in the same direction.
- Fifth, the districts have become increasingly active in promoting the Institute's vision instructional reform. District staffs are now more attentive to how their policies and

procedures affect progress. There are signs that the partner districts have internalized some key lessons drawn from this experience and, within their resource limitations, are applying what they have learned in language arts and mathematics.

- Sixth, all of this has been made easier because Merck’s reputation, expertise, and commitment to public education have enabled the Institute to influence state policy and create an environment more supportive of the reforms.

The seventh and final conclusion concerns the bottom line—the improvement of student performance. Analyses of student performance on standardized tests reveal that students who have received science instruction over several years from teachers who have participated in the partnership professional development outperform students who have been taught by non-participants. These data suggest that, in the long run, as more and more teachers participate in the workshops, there will be a positive and significant impact on student performance in science.

### **LESSONS LEARNED, LESSONS CONFIRMED**

In the course of our work with partner school districts and beyond, the following lessons have become clear:

- If you build good professional development programs, teachers will come. We have learned that they will voluntarily take advantage of opportunities to learn and to improve their teaching practice—if the opportunities are seen as worthwhile. Respect for teachers’ professionalism, expertise, and experience results in a growing commitment by teachers to improvement.
- Teachers’ knowledge and skills are critical factors in the classroom learning experience, but not the only ones. Good curriculum materials are also essential. Teachers need access to and support in implementing standards-based curricula and teaching materials. They need the support and knowledgeable involvement of school and district-level administration, parents, and the community. The Institute addresses these needs through resource centers featuring exemplary science education materials, Merck employee volunteer programs, and parent involvement programs, in addition to its support of long-term professional development.
- Professional development that combines intense engagement with curriculum content with on-the-job opportunities for observation, dialogue, reflection, and revision has the strongest effects on teaching practice. It is not either/or, rather both types of experiences are required.
- Research has repeatedly shown that principals play key roles in instructional change in their schools. Their level of involvement often dictates whether attempts to change instruction succeed or not. Providing professional development for school administrators is critical in helping the principals become a force for sustaining and deepening the work of instructional improvement.

- Better assessment tools in science are needed. Existing measures do not adequately show the effects of better science instruction. Right now, teachers see improved student work in their classrooms and a higher level of student interest in science, but the available measures do not adequately demonstrate this change to parents, school leaders, or the public. In addition to assessments that provide good diagnostic information for teachers' instructional planning, we need assessments that are persuasive to the public and policymakers as well.
- The state policy context on incentives for change can play a pivotal role in stimulating instructional reform, and the Institute's role in shaping state policy has had a high payoff. The Institute has helped lead statewide efforts to establish science content standards, and professional development and teaching standards.
- Numerous businesses have made a commitment to work with educators to build a strong and viable education system. While there are multiple roles business can play to achieve this goal, each company must put in place the systems and structures that will make it possible to deliver on its commitments over time. In addition, greater coordination among businesses working with educators is needed.

### **KEY ELEMENTS OF SUCCESS**

There are certain salient features of the Institute's programs that we believe are critical to our success:

- *Long-term commitment.* Significant changes in the classroom require a long-term, sustained effort on the part of corporations involved in education reform. Increased teacher mobility, high turnover in administrative personnel, and changes in district priorities and policies threaten the reforms that have been accomplished. Scaling up is difficult because of the intensity of the work and the long timeframe for institutionalizing it. Persistence and patience pay off.
- *Corporate reputation.* Merck's corporate reputation for high-quality scientific work and high ethical standards brings credibility to the Institute's work in science education. Merck's corporate image and record of success have enabled us to raise difficult issues and to push hard for change.
- *Maintaining focus.* The Institute's core capabilities include providing high-quality technical assistance to teachers, maintaining constructive and collaborative relationships with partner school districts, addressing systemic issues that influence curriculum and instruction, aligning desired changes with state and national standards, and accepting accountability for its efforts. These strengths represent the Institute's focus, and just as the most effective corporations rarely stray from their core mission, so too does the Merck Institute believe that maintaining its focus is critical to success.

- *Capacity-building.* Rather than *do* for the school districts or *give* to the school districts, we look for ways to help them use available resources to improve and then to build upon these successes. Of course, we provide some funding and a great deal of technical assistance—but always with the consideration of how school leaders may sustain and institutionalize the changes we have helped to effect. When teachers train other teachers—and support and advocate for the reform efforts—local capacity is increased.
- *Disseminating lessons learned.* Our narrow geographic focus has provided us with the opportunity to develop significant expertise in science education reform and in continuously improving our core capabilities. We impact a far greater number of school districts through widely-distributed publications, direct technical assistance and our website. This has greatly broadened the reach of the Institute.
- *Sustaining the work.* Right from the start, we include strategies in our plans to sustain the reform efforts. For example, we try to make full use of existing management routines and align our work with national, state and local policies. We make every effort to provide evidence to support the work to garner public support for the reform and gain access to sustainable financial resources. In addition, building a culture of continuous improvement leads to a sense that the work is never "done," but instead requires ongoing attention.
- *Leveraging resources.* We leverage resources and encourage our school district partners to do likewise. We help link them to regional and national sources of expertise in science education, including the National Science Foundation (NSF). In 1996 and again in 2003, NSF awarded the Institute and its partner districts grants to extend and intensify its programs for teachers and administrators. In addition to the monetary benefits, this award also serves to provide valuable technical assistance and external validation of the quality of our programs.
- *Evaluation and benchmarking of results.* An external evaluation team assesses the progress of the Institute through measurable criteria on an ongoing basis. Each year, after receiving feedback from the team and others, we revise our strategies to work more effectively within a changing landscape.

### **EXPANDED FOCUS**

Over the past two years the focus of the Institute has expanded to include college and graduate-level education to build capacity in the biomedical sciences through partnerships with higher education institutions. Examples of these partnerships are the United Negro College Fund (UNCF)/Merck Science Initiative and the American Association for the Advancement of Science/Merck Undergraduate Science Research Program. In addition, the Institute recently initiated a partnership with the National Alliance for Hispanic Health, the Alliance/Merck *Ciencia* Scholars Program. These programs have provided the Institute with unusual opportunities to build synergy and ensure coherence across Merck's K-20 education portfolio. Each of these initiatives has as its mission to develop scientific talent, a long-standing key priority for Merck.

As an example, the UNCF/Merck Science Initiative (UMSI) was launched in 1995. The program makes scholarship and fellowship awards at the undergraduate, graduate and postdoctoral levels to outstanding African American students pursuing studies in biomedical research.

Each year, 37 undergraduate, graduate and postdoctoral students are selected as Fellows from a competitive pool of applicants. To date, 443 fellowships have been awarded.

The initiative incorporates a number of features that we feel have been critical to its success:

- First, it is aimed at transition points where students tend to leave the STEM fields: undergraduate students entering their final academic year; graduate students who are midway through their dissertation research; and post-graduate students entering their postdoctoral training. We now have a number of Fellows who have received multiple fellowships – two have received all three awards and 22 have received two awards.
- Second, the research is robust in pointing to two experiences that make a significant difference in engaging and retaining students: an opportunity to do meaningful and independent research, and a chance to work with a mentor. All undergraduates are provided with funds to complete two summers of research at the Merck Research Laboratories. And each Fellow is assigned a Merck scientist as a mentor. The mentors serve as teachers, career advisors and friends. They ensure that the Fellows move seamlessly from one educational level to the next.
- Third, all of the current awardees are brought together for three days of scientific symposia and poster sessions, as well as activities centered on relationship-building and networking with one another and the scientists at Merck.

Results from a comprehensive evaluation of the initiative indicate that in addition to the financial support, the Fellows found the non-financial benefits important as well. Fellows benefited from the award's prestige; the exposure to the pharmaceutical industry; the mentoring by Merck scientists helped the Fellows in their research and increased awareness about career directions; the internships helped the undergraduates become more confident in themselves and enhanced their research skills; and participation in the event when all the new Fellows are brought together, provided a highly beneficial networking experience.

What are the Fellows doing now? They are pursuing careers in academia, government, and industry — with a number of Fellows choosing to pursue their careers at Merck. The Fellows are working in a wide range of scientific disciplines from biochemistry and microbiology to pharmacology, neuroscience, biophysics and bioengineering. One of the Fellows has been selected to be one of NASA's newest astronauts, another Fellow was selected a Rhodes Scholar. One Fellow's research has led to 16 patents and two biotechnology companies, and another Fellow – a female African American – has an endowed chair in the Department of Chemical Engineering at MIT.

We also found that Merck scientists benefited from their experience as mentors. They derived both personal and professional benefits from their mentoring activities; many mentors remain in contact with the Fellows after the fellowship is completed; and many have mentored more than one Fellow.

### **CONCLUSION**

Noted author Seymour Sarason has written: "The failure of educational reform is the failure to touch deeply and profoundly the entrenched culture of schools. Thus, despite the millions of dollars poured into changing schools and the endless hours educators have devoted to adopting and adapting new practices, the fact is that the educational landscape in this country remains largely unfazed."

The Merck Institute for Science Education has demonstrated its ability to row against this stubborn current. Science education in our partner school districts is no longer in the wings; instead it occupies center stage, as an emotionally engaging and intellectually challenging experience for students. Based on the lessons we have learned about science education reform and the power of collaboration, we will continue to build partnerships to improve student performance and participation in science until high-quality science education is indeed the standard for *all* students.