

National Science Resources Center

THE NATIONAL ACADEMIES



Smithsonian Institution

National Symposium on K-16 Science Education for Scientists and Engineers

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Reflections

“A thousand points of light is a wonderful thing. However, it is still dark on a starry night, and it takes a single blazing sun to make a bright day”

—Terry C. Wallace, Jr., Los Alamos National Laboratory

Based on your observations and those from your fellow participants, we found that three key ideas emerged from the symposium:

1. There is a critical problem in science and math education in our country, and inquiry-based instruction is an effective, research-based method for addressing the problem
2. A systems-based approach is required for successful education reform. Businesses, K-12, higher education, scientists, and engineers must all work together in a unified way to build a scientifically literate public.
3. Teacher professional development is very important to educational outcomes. We need to teach teachers to think scientifically, both in pre-service and in-service training, and to provide them with effective instructional materials.

Below are your comments, grouped into these three areas.

Inquiry-Based Science and the Current Problems

- Inquiry-based instruction is an effective way to improve science instruction. Something similar is needed in math, where the problems are at least as significant.
- The symposium was wonderful. I have learned new ways to teach science. It was a great place to share and learn new ideas of making things better.
- Inquiry-based science education is good science pedagogy, but it also enhances student performance in other curricular areas by fostering a way of thinking.
- Over and over again, the importance of science content knowledge was emphasized. In fact, the whole purpose is to deliver science content to kids.
- There is a good consistent consensus across education, industry, and labs on the "solution".
- I learned about the amount of true interest and need for a change in educational methods.
- Inquiry-based learning using a backwards design approach (focus on understanding) is the key to improving science and math education.
- We all, although we are from diverse initiatives, have common science education goals. The sessions on increasing teacher content knowledge were good.

- I learned that the inquiry science goals and objectives of the NSRC model really work. Also, I learned that there continues to be lots of evidence to support kit-based (research-based) materials, and well trained and supported teachers (w/scientist/engineer support in cases) make a huge difference!
- The problem I recognized as a result of 32 years of teaching— that gaps in knowledge and preconceived notions interferes with learning— is even worse than I thought, but that there are ways to work on this better (hands-on, inquiry based work, pretests, etc.)
- I learned about the success stories on reform, and about the curriculum.
- Research indicates that inquiry-based learning leads to improved student achievement.
- The misconceptions were really good to know.
- Tests are driving our educational system- teachers are required to teach to the tests.
- Teaching in a hands-on way has great rewards.
- Design good assessments first, then design standards accordingly
- Concepts are buckets; standards/facts can go into the buckets.
- The scientific method has been corrupted; we need to bring standards back into perspective so they can actually be taught; and we need to deal with standards- especially in California.
- We need to improve understanding of STEM education and STEM research, and improve the quality and quantity of research.
- One possible leading indicator of successful reform is career interest.
- Inquiry-based science is promising.
- If I want my child to learn about an elephant, I take him first to a zoo, not a dictionary! First, build interest and passion. Couple it with curiosity. Provide information and a purposeful activity. Let them own the lesson!
- Many individuals share my concern regarding student interests in science education.
- We can't forget high school kids- we need help getting materials into high school labs.

Systems-based Approaches vs. Individual Efforts

- There is a lot going on in education, and the efforts are not connected (1000 points of light). High school is the next frontier.
- States need coordinated efforts – pulling together all the resources and partners – to achieve success and get results.
- I learned about the great initiatives to promote science education at all levels.
- I learned the role of systemic change vs. "1000 points of light".
- Actions needed seem to need to be huge, requiring significant commitment and numerous stakeholders! Keep the big picture in sight at all times.
- I learned about the need for a "systems" approach to science education reform.
- There are a lot of programs that have been running for many years but not a lot of collaboration between programs.
- I learned about the need for a holistic/integrated approach to changing science education (and that there's so much out there to draw upon).
- There are lots of good programs out there.
- There are lots of efforts are happening to address a complex problem at various levels.
- STEM [Science, technology, engineering, and mathematics education] is a local problem that can only be addressed at the local level.
- There is a tension between national and local perspectives on education reform- the national level needs to be more respectful of the local level.
- Reform HAS to impact the whole community- not just K-12.
- Building a “critical mass” is necessary for reform.
- I'm glad to see the successes throughout the country, but they're localized (even if to a whole state). The programs need to have a national focus.
- You need a groundswell for reform- not just top-down.

- New Mexico has 1000 points of light, and has lots of representation from math and science, but no strategically-focused mission. We have the components- we just need to come together, bringing all stakeholders to the table (hearing from teachers, students, and higher education). We need to teach scientists about what to do!
- There was good recognition of the business and industry pipeline.
- There are a good number of opportunities for business to get involved.
- DuPont has a volunteer awards program for their engineers, and part of the engineers evaluations is based on volunteering
- The DOE [Department of Energy] is publishing an education plan next week (4/16/07)
- The DOE wants input on the effectiveness of their programs, and suggestions.
- I learned about the extent of the DOE involvement in education.
- The DOE national labs are an analogous system to my work with the Ocean Science Research Center and efforts to engage scientists in education. We need to make key contacts and share challenges and possible solutions.

Professional Development

- I learned that business/industry has identified the pipeline problem and is working with the education community to meet the demand for more math/science-based education and trained individuals.
- I believe that teachers are the key – K12, higher education, and teacher preparation.
- We need to orient and train scientists and link with K-12 teachers BEFORE they enter classroom.
- Scientists and engineers must continue to join forces with pK-12 education and STEM educators from higher education to improve science education, thereby leading to a more scientifically literate citizenry.
- Parents are as important as teachers in bringing about change.
- Professional development is critical for systemic reform and STEM with professional development of teachers could be the way to generate this change.
- In order for K-20 education institutes to create teachers (people) that think mathematically and scientifically we need business, institutes of higher education, and K-12 partnerships to bear on the professional development, reform materials, support from administration.
- Los Alamos professional development for teachers teaches them to find out what students know
- We are putting too much emphasis on the teachers and too little on the parents. It's too hard for the teachers to do everything.
- Teachers need to learn to think scientifically.
- Sending a well-trained teacher into a classroom without effective curriculum materials is like sending a world-class scientist into an empty lab and telling him to develop his own chemicals and equipment.
- The family needs to talk about education.
- One good program is/was "science at home".
- It's good to see that the Washington LASER is doing professional development for scientists; we also need to focus on teacher preparation and university reform.
- At the university level, reform will probably happen first at the community colleges, because they're more flexible.
- Tenure track is based on publications- so professors don't have time to teach.
- Professors follow dollars- and there are no dollars for good teaching.
- We want to be able to prepare scientists for classroom visits, and give them age appropriate materials to use.