A View of the Optimal Federal Role for K-6 Science Education
From a Research Manager’s Perspective

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While much has been written on science education for the elementary school age group, most of it comes from the primary school education community. What follows below is a “consumer’s” view of the best way the Federal Government can enable and facilitate the adequate provision of technical personnel capable of sustaining the American ascendancy in science and hegemony in technology. It takes as given the need for additional technically trained professionals of every type and the necessity of implementing significant changes at the K-6 level of education to achieve this growth.

The clarion call for protecting the American lead in technology reaches the National level and therefore should be a matter of concern to the Federal Government. While National challenges require National responses, the immediacy of the need and the criticality of technology should not and must not blind the U.S. to the obligation to carefully plan any Federal Government intervention. An area of consensus is the criticality of educational capabilities. For purposes of this paper, the elementary school science education programs, both formal and informal, are isolated for discussion. Other parties interested in the K-6 area include the local school districts and private sector education material producers. Augmentation of their ongoing efforts will arguably be less disruptive and therefore more beneficial than would be a Federal effort seen as intrusive or competitive.

Several areas of opportunity to re-inject “real science” into the K-6 environment exist. Some of the possible initiatives, which are not mutually exclusive, are given below:

Formal Education –
- New classroom materials and lesson plans (e.g. CAPSI)
- Enhanced teacher education in science
- Provision of science professionals to teach
- Improved and additional computer resources for science education

Informal Education –
- Creation of science materials with recreational attraction to students (e.g. games and web sites)
- Science mentorship/field trip support
- Additional funding for science museums
- Enhanced TV Programming support
- Broader support for science fairs and camps (e.g., Sally Ride’s programs)

The implementation of the formal education initiatives, while having they may have the surest reach, is fraught with several problems.

1. In each case, there is a problematical overlap with local school district jurisdiction
2. In most of the cases, there is an observed resistance from existing teachers to the disruption of their classroom routine
3. Even if not conceptually disruptive, most teachers report that there is no time available for insertion of new programs
4. Attempts to find, vet, enlist, and administer science professionals has proved difficult
5. Classroom teachers consistently complain that the provision of computers is negated by the lack of training and support
6. With 15,000 U.S. school districts, some programs become prohibitively expensive (e.g. if cost of Project SEED materials is $1M/District, $15B is needed for introduction alone)
7. About 10% of students are in private schools, where formal programs are less likely to reach them.

8. The vast majority of classroom materials are created and sold by commercial concerns who depend on them for existence.

Informal programs, on the other hand, do not suffer from these constraints or political pitfalls. They do not interfere with local school district prerogatives, intrude into functioning classrooms, antagonize politically active groups, or threaten major commercial interests.

Further, informal science does not detract from full classroom schedules, but would amplify and motivate science education in the formal setting.

In the case of games or web sites, there is no necessity to identify and screen large numbers of science personnel. Many analysts now say focusing on desirable qualities is more important than providing personal access. Games and web sites allow leveraging of the best and brightest, to make them nationally available.

Any of the informal initiatives would ostensibly be as available to public, private and parochial students, as well as to the “home schooled.”

In the case of science-teaching games and web sites, there is no significant commercial interest from which the Federal Government need fear hearing complaints. An anecdotal report supporting this assertion would be the lack of industry complaint about “America’s Army” which was created by Dr. Mike Zyda of USC while he was at the Naval Postgraduate School. It is a first person shooter game that is much more of a market threat to EA and other gaming industry giants than would be a science education game.

Similarly, a web site focusing on Science Misconceptions would surely not be seen as a threat to anyone’s commercial web interests. There is no significant commercial interest in museums or extra-curricular programs either.

As the informal programs do not envision putting hardware into any site, the programs are not faced with huge maintenance costs, untenable teacher training, or failure due to lack of hardware. “America’s Army” can be downloaded for free across the internet and runs on virtually all PC platforms. A scientific education instantiation of the same technology could easily be distributed across the network to which the vast majority of homes and virtually all schools have access already.

While not arguing in any way the lack of a need for more close personal relationships between scientists and school children, it can be rationally asserted that the best leverage can be obtained by the Federal Government’s implementing informal education. That would include internet-distributed games such as that described in the short white paper: “Recovering a Lost Assets in Computer Science Capability”, http://www.isi.edu/~ddavis/DanzFiles/TnAgeFemPrgmgGame_Abstract_0.7v.doc and web sites that are oriented toward science education like the one that can be found described in http://www.isi.edu/~ddavis/DanzFiles/Misconception.html.

Both of these modalities:

- Avoid organizational conflict
- Add to, not supplant or disrupt classrooms
- Present the best, most attractive scientists
- Are available to virtually all students
- Can be carefully designed and delivered to be attractive, effective and measurable
- Neither is prohibitively expensive, providing national coverage for ~ $3M/Annum.

These insights should be used when considering the appropriate federal role in science education in the K-6 student population in the U.S. Our society depends on making the right choice.