



Initiatives for Building Quality PreK-12 Science and Mathematics Programs: Recommendations for Florida's Schools

Executive Summary and Recommendations

Never has the need for quality mathematics and science programs in our Nation's schools been more critical than it is now. While we recognized the urgency of improvement in mathematics and science as a result of the Soviet launch of Sputnik in 1957, we have ignored subsequent outcries (e.g., beginning with the 1983 Report: A Nation at Risk through 2003 TIMSS; see also list of websites in Summit packet) for reform of the mathematics and science programs in PreK-12 schools. Although the scope of the present problem may seem overwhelming, the good news is that the *means for pursuing systemic solutions are within our reach, if a direct and substantial effort is put forth to do so*. What is keenly evident is that the "business-as-usual" approach will not produce the much-needed improvement in mathematics and science education in America.

In considering the recommendations that follow, several major points should be applied to all recommendations for improving the quality of PreK-12 science and mathematics. Specifically, *all recommendations should:*

- Result in systemic improvement of schools (i.e., work toward producing long-term, comprehensive solutions) that establish substantially higher expectations for student achievement in science and mathematics
- Specify short-term measures of progress stated in terms of student achievement outcomes that are rigorously evaluated.
- Distinguish between the small-scale testing of innovative approaches and the large scale implementation of proven practices (i.e., the effectiveness of innovative approaches should be established before any large-scale implementation)
- Explicitly address the issue of how school districts are to develop the capacity to implement proven science and mathematics initiatives on a large-scale basis

Overviewed in preparing these recommendations were previous research and reform efforts in mathematics and science, related economic and national security issues, and key problems identified in science and mathematics education. In doing so, the resulting recommendations are intended to provide legislators, practitioners, researchers, community/business stakeholders with specific actions for improving the quality of school science and mathematics instruction from preK-12 through postsecondary education.

I. Improve the Science and Mathematics Knowledge of PreK-12 Teachers

- ***Increase Focus of School Professional Development on Science and Mathematics Understanding and Provide Funding to Do So***
 - For all PreK-12 teachers, professional development initiatives should be conducted by school systems to insure teachers are well prepared in the science and mathematics *content* areas they teach.
 - All school systems should establish districtwide initiatives through collaboration with post-secondary science and mathematics faculty that result in the preparation of teacher curriculum leaders in science and mathematics that are capable of conducting professional development for their peers.

- ***Establish Advanced Degree Opportunities for Teachers and Establish Grants, Scholarships and Other Incentives***
 - 5-Year programs and incentives should be promoted that encourage mathematics and science undergraduate majors to enter the teaching profession.
 - New masters degree programs should be established for elementary teachers to advance their knowledge and understanding of science and mathematics.
 - New graduate programs and courses (e.g., addressing science and mathematics understanding) should be established for returning teachers, and for those interested in changing career focus by entering the field of teaching (e.g., scientists, military, engineers).
 - Incentives should be offered to assist teachers pursuing advanced degrees in the science and/or mathematics areas they will be teaching.

- ***Improve Present Undergraduate Teacher Preparation Programs***
 - Responsibility for existing teacher preparation programs (including alternative certification pathways), especially in mathematics and science, needs to be reconfigured to include *interdisciplinary teams* of faculty from arts and sciences as well as education
 - Teacher preparation programs should ensure that all graduates fully understand national and state standards in mathematics and science and be able to teach them in effective and interesting ways to students, this is especially critical at the elementary school level
 - A statewide panel of scientists and mathematicians should be established to address the critical shortage and examine current degree requirements for teachers

II. Programmatic Curricular Policy Should be Adopted for Teaching Science and Mathematics

- *Insure all PreK-12 students experience quality science instruction every day for every year they are in school* (including At-Risk, Exceptional Students and Limited English Proficient – LEP)
- *Insure all school districts have a quality science and mathematics curriculum that is focused, conceptually organized, and well articulated across grades PreK-12* (A curriculum identifies a coherent body of knowledge and skills students must master within each year of schooling. Such a document is much more ambitious than a list of disconnected benchmarks statements and is designed to build student in-depth understanding rather than superficial test preparation outcomes.)
- *Insure resources necessary for teaching mathematics and science effectively are a priority that is met by all schools*
- *Insure that once students become fluent decoders, curricular emphasis is placed on developing reading comprehension by using science content-area reading materials as well as those in literature.* Students need many opportunities to gain the background knowledge (intellectual capital) necessary for comprehension and further learning.
- *Provide challenging science and mathematics opportunities for gifted students, PreK-12.*

III. Role of Business and Industry in Fostering Collaborative Initiatives Between Higher Education and PreK-12 School Systems for Systemically Improving Science and Mathematics Instruction

- *Establish multi-year collaborative initiatives between schools and university faculty:*
 - *to establish, validate, and disseminate state-of-the-art exemplary programs in science and mathematics that raise achievement expectations that all Florida students can attain.*
 - *to encourage support for applied school research that promises to improve the systemic quality of science and mathematics instruction.*
- *Increase support for academic competitions and internships to motivate student interest in science, mathematics, and engineering.*

The above recommendations offer a comprehensive approach for both the short-term and long-term systemic improvement of science and mathematics that embody much of what has been learned over several decades of school reform. What is needed to accomplish these systemic objectives is a detailed implementation architecture supported by multi-year funding from the Florida legislature. In doing so, the future economic benefits to the next generation of Florida's business community and citizens would well exceed the funding required.

Florida's educational system needs to rise to the challenge of preparing all students for the economic realities of the twenty-first century that require a broadly prepared flexible workforce able to adapt to organizational conditions that require constant learning and changing. Such workforce demands require employees who, in the words of management experts, are "knowledge-workers." The US Department of Labor projects that eight of the ten fastest growing occupations from 2000-2010 will require some form of postsecondary education and that these jobs will be linked to greater income. Further global competition for science, mathematics, and engineering talent is intensifying while the number of American science, mathematics, and engineering graduates entering the workforce is likely to continue to decline unless there is some intervention to improve success in educating students from all demographic groups in mathematics and science. Given these projections, Florida business leaders must join forces with legislators, parents, and educators to address school improvement in mathematics and science.

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