

*Recommendations to Improve Science,  
Technology, Engineering and Mathematics  
(STEM) Education in California*

# **HIGH STAKES: STEM Education**

The Essential Ingredient for California Competitiveness



**This STEM Collaborative Action Plan is a Product of**

The California Space Education and Workforce Institute (CSEWI)

**developed with the support of**

The Alliance for Regional Collaborations to Heighten Educational Success (ARCHES)

**November 2008**

# EXECUTIVE SUMMARY

*RECOMMENDATIONS TO IMPROVE SCIENCE, TECHNOLOGY, ENGINEERING  
AND MATHEMATICS (STEM) EDUCATION IN CALIFORNIA*

## HIGH STAKES: STEM EDUCATION

### ESSENTIAL INGREDIENT FOR CALIFORNIA COMPETITIVENESS

The 20<sup>th</sup> Century California is noted worldwide for its innovation, knowledge creation and research discoveries that can be attributed to a steady stream of individuals proficient in Science, Technology, Engineering and Mathematics (STEM). STEM expertise has produced exponential returns on investment for California and the nation and is inarguably an essential component for sustained economic prosperity. The benefit to the 21<sup>st</sup> Century California by sustaining this legacy of world-renowned success through a deliberate, focused investment and commitment to STEM is priceless. The outcome for a 21<sup>st</sup> Century California which decides to defer attention and investments in STEM to more prosperous times is an economic downward spiral for California's children and grandchildren.

#### **Goal: Science, Technology, Engineering and Math (STEM) Collaborative Action Plan**

Develop a collaboration and strategic action plan to increase the number and support the development of Science, Technology, Engineering and Math students, graduates, teachers, professors and mentors within the California Innovation Corridor and the State of California, leveraging the resources and efforts not only of education and academia (K-20, public and private) but of industry and the informal science network.

The stakes are high. California students today have limited interest in studying mathematics and science, the number of teachers well trained in these subjects is not sufficient and attempts to remedy the situation are too modest and fragmented. Preparation for STEM success is one concern. Equally important are trends in the overall supply and employment of STEM workers. The STEM workforce challenge is not just about the supply and quality of those with advanced degrees; a large percentage of the workforce in California industries that rely on STEM knowledge and skills are technicians and others who enter and advance in their field through career technical education (CTE) programs, two-year degrees and certificates. It is imperative that California leaders demonstrate their commitment to all levels of science, technology, engineering and mathematics while motivating our youth to innovate and invent, thus ensuring sustained economic growth for our great State. It is time to invest in our workforce of the future in ways that are strategic, scalable and sustainable.

Accomplishing these crucial goals will require a transformational change in California. This report, "High Stakes: STEM Education," provides a comprehensive action plan to address the fundamental issues and set California on the path to lead the nation in STEM education and ensure that California retains its competitive edge and economic vitality.

The recommendations and guiding principles in "High Stakes: STEM Education" are the result of a major U.S. Department of Labor-funded initiative in California with the goal of establishing a system that will support a sustainable growth economy, create a highly-skilled 21<sup>st</sup> Century workforce and maintain the state's position of leadership in the global technology market. That system must educate, graduate and employ an exemplary STEM workforce that can drive innovation and invention and propel California's economy, thereby ensuring that it retains a world-wide leadership role. These are nothing short of essential ingredients for California's competitiveness.

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## GUIDING PRINCIPLES

To compete effectively for the minds, imaginations and career ambitions of America's young people, "High Stakes: STEM Education" proposes a set of guiding principles, recommendations and actions. The guiding principles are the foundation for the recommendations. Without these principles, the recommendations will have minimal impact. The guiding principles establish a new relationship among industry, education and the informal science network.

**Shared Vision by Leaders** Business and education leaders, in concert with partner stakeholders, must work collectively as strong advocates to create an entity outside of the conventional system that brings together stakeholders to tackle the issues that are beyond the resources of education. Such a collaborative effort will send a strong signal to all Californians that our best and brightest are needed, valued and supported.

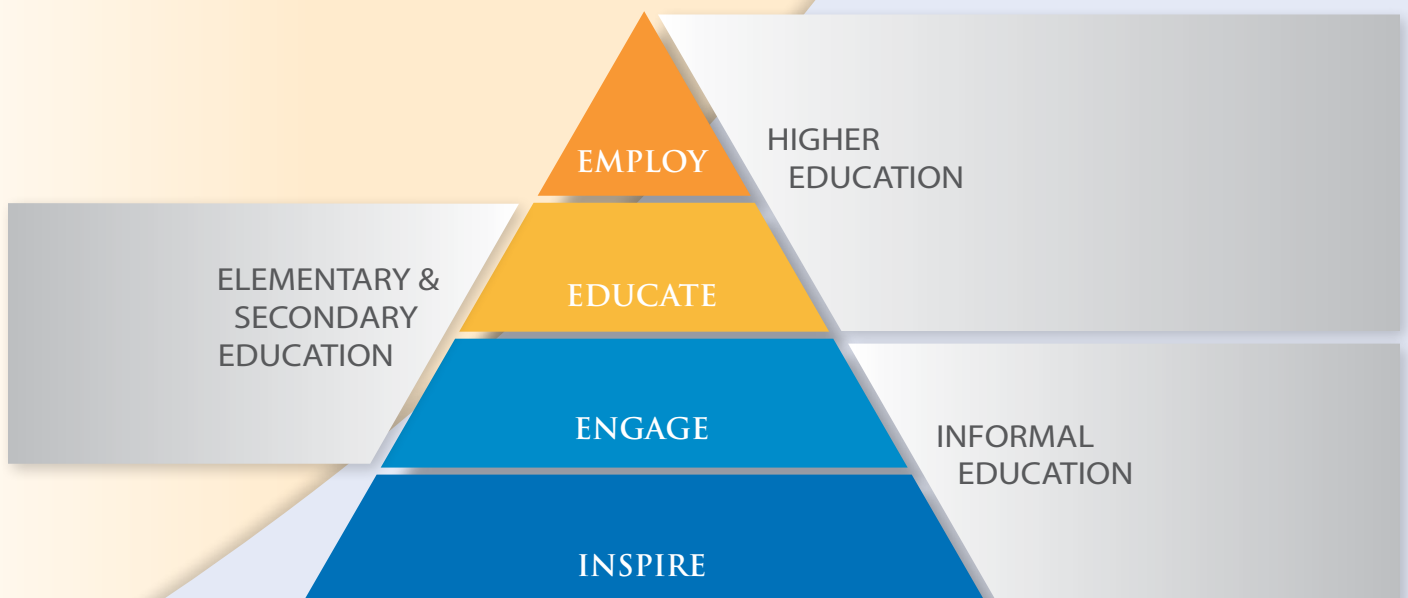
**New Relationships to Leverage Resources** At the core of achieving the STEM CAP recommendations is building relationships that are sustained over time. This collaborative action plan lays out a structure that will leverage the resources of education, industry and informal science.

**Sustained Commitment with a Policy of R&D and Ability to Scale** The recommendations of the STEM CAP require a sustained effort and on-going statewide commitment. Taking the lead from industry's practice of research and development, education initiatives must begin with focused pilots that are fully funded with clear metrics, supported by a system that has the resources to scale the most promising.

**Regional Approach** Improving STEM programs throughout California will require strong local commitment and regionally tailored approaches. It involves coordinating education, business and labor to ensure all elements needed for successful programs are in place.

**Inspire and Engage** Building on NASA's Education Strategic Coordination Framework, an Agency portfolio approach to education, the STEM CAP addresses the stages of inspiring, engaging, educating and employing students, the future workforce. The goal is to direct a subset of the original audience through the pipeline to pursue a career in STEM while drawing in new participants along the way.

[http://education.nasa.gov/pdf/151156main\\_NASA\\_Booklet\\_final\\_3.pdf](http://education.nasa.gov/pdf/151156main_NASA_Booklet_final_3.pdf)



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The recommendations in “High Stakes: STEM Education” are linked to the NASA Education Strategic Framework and its four categories of increasing involvement – inspire, engage, educate and employ. No matter where the individual decides to pursue his or her career, the goal is to direct a subset of the original audience through the educational process to pursue a career in STEM fields while intentionally drawing in new participants along the way.

## INSPIRE

**RECOMMENDATION:** Motivate students and adults, using a variety of incentives, to study and enter STEM careers, with a special effort geared to those in currently underrepresented and underserved groups.

**RECOMMENDATION:** Build public support for and understanding of the value of STEM education for all students and citizens.

## ENGAGE

**RECOMMENDATION:** Provide rigorous, relevant Career Technical Education (CTE) that prepares students for both higher education and the workplace in order to reinforce classroom instruction and provide tangible relevant skills for greater subject matter retention and competency.

**RECOMMENDATION:** Deliver science and math curriculum that motivates, energizes, reinforces and rewards the natural curiosity and interest students initially bring to the subject.

## EDUCATE

**RECOMMENDATION:** Align state K-12 science and mathematics standards and assessments with postsecondary and workforce expectations of what high school graduates should know and be able to do.

**RECOMMENDATION:** Implement a comprehensive package of recruitment strategies for mathematics and science teachers throughout grades K-12 to expand and diversify the pool of fully prepared and certified candidates.

**RECOMMENDATION:** Strengthen teacher preparation programs in mathematics and science through inclusion of hands-on, problem-based instruction and strategies that will benefit all students, including underrepresented and underserved students.

**RECOMMENDATION:** Provide ongoing, research-based professional development programs, focused on both content and pedagogy, for all mathematics and science teachers and faculty K-Higher Education.

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## EMPLOY

**RECOMMENDATION:** Create Industry partnerships directly engaged with educators to deliver relevant, motivational and exciting instruction to reinforce and enhance STEM curriculum while setting the foundation for building a competitive and qualified workforce in tune with emerging work realities.

**RECOMMENDATION:** Create hands-on internships and fellowships for students, teachers & faculty with employers in industry, academia, informal science networks, and civic organizations.

*“Although America has not wavered from its understanding of the power and potential of math and science, it has failed to comprehend that in the highly competitive global economy of the 21<sup>st</sup> century, math and science are no longer pursuits for the few. They are required for all.*

*— A Commitment to America’s Future: Responding to the Crisis in Math and Science Education, Business Higher Education Forum, 2005*