

**STEM Visions and Challenges**  
**Central Coast STEM Education Collaborative Online Inventory – Spring 2011**

**BUSINESS**

<b>STEM VISION</b>	<b>CHALLENGES/BARRIERS</b>
<ul style="list-style-type: none"> <li>• Business must have a place at the table in this discussion along with academia and the political side. The technology sector depends on a robust level of human capital that is critical for continued growth, so like any capital requirement long range planning and investments must be made. Business can no longer stand back and hope the educational system provides the talent needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Short falls in our workforce include the trades who now require education well beyond high school all the way to our demand for those with advanced degrees...we should not depend on off-shore students to fill our gaps.</li> </ul>
<ul style="list-style-type: none"> <li>• iFixit would love to play an active part in helping to make hands-on engineering an accessible activity, from college to primary school.</li> </ul>	<ul style="list-style-type: none"> <li>• Colleges:</li> <li>• Developing contacts with new schools</li> <li>• Managing students and their teams (in a TA-type role) remotely</li> <li>• High Schools:</li> <li>• Developing contacts with new schools</li> <li>• Getting the buy-in at the levels required to partner.</li> <li>• Online:</li> <li>• Much more consumers out there than contributors: encouraging engagement from consistent users.</li> <li>• Educating people that the software is open and can be edited by anyone.</li> </ul>
<ul style="list-style-type: none"> <li>• We must teach STEM and young people must learn logic, reasoning, critical thinking. Solarponics is willing to provide intern programs and has hired green graduates from Cuesta.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

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**FORMAL EDUCATION: K-12**

<b>STEM VISION</b>	<b>CHALLENGES/BARRIERS</b>
<ul style="list-style-type: none"> <li>• I would like to see an articulated vision for STEM in our local schools where community partners provide support. I believe that units of instruction need to be created that blend the strands of STEM into project-based learning so that students get an integrated approach to learning. Also we need this approach as the school day is already too short. Community partners could provide resources, materials, additional funds and guest speakers to address STEM education. Teachers will receive training on best practices for teaching the concepts embedded in STEM units at their grade-levels. Students would have the change to share their project learning with audiences.</li> <li>• County school districts, along with community partners might be able to work together to create the STEM units and hands-on projects.</li> <li>• Take current science and math curriculums and see where they overlap to create the units. Having curriculum support that is already in place is always a strong place to start so that you are not reinventing the wheel. Then add and delete to achieve the STEM focus that is desired.</li> </ul>	<ul style="list-style-type: none"> <li>• Time to teach STEM in the school day is always a concern. This needs to be an integrated approach with project learning that covers many state standards. These strands cannot be taught separately and it often does not make sense to teach all of them separately. Who will put this together for classroom teachers into units that interweave the STEM strands?</li> <li>• Funding is always a huge hurdle:               <ul style="list-style-type: none"> <li>○ funds to purchase technology</li> <li>○ funds to maintain technology</li> <li>○ funds to up grade technology</li> <li>○ funds to purchase materials</li> </ul> </li> <li>• An easy way to order or get needed materials for hands-on project learning</li> <li>• Engineering is not addressed well at the elementary level.</li> <li>• The state math standards are too cumbersome at this point. It takes teaching one concept per day to teach them all and leaves relatively no time for reinforcement and review - not a best practice. We need articulated CORE math and science standards for each grade-level that overlap and support STEM in an articulated approach.</li> </ul>
<ul style="list-style-type: none"> <li>• AUSD's vision is a comprehensive STEM program fort PreK-grade 12 with appropriate facilities to promote STEM education and professional development to bring the highest level of teacher expertise to the classroom.</li> </ul>	<ul style="list-style-type: none"> <li>• Quality STEM professional development for teachers and administrators</li> <li>• Collaboration with higher education</li> <li>• Articulation of courses so that high school students may take college level courses during high school.</li> <li>• Budget for STEM materials and equipment</li> </ul>

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<ul style="list-style-type: none"> <li>• CalTAC provides a K-community college perspective from around the state of CA.</li> <li>• I believe that efforts here in the central coast to make STEM educational experiences more engaging, more reflective of what the workforce is needing, and more a part of each student's education experience needs a large collaborative group. Creating links to what others are doing in the state is a powerful way to make changes locally.</li> </ul>	<ul style="list-style-type: none"> <li>• Leadership in schools that understands the needs and importance of science education.</li> <li>• The focus on a very narrow state test that emphasizes facts and not processes. (and does very little to assess science/technology/engineering)</li> <li>• Lack of leadership and understanding on how to use most current technology to enhance and inspire educational practices.</li> <li>• General lack of support of public education.</li> </ul>
<ul style="list-style-type: none"> <li>• ifixit.com</li> <li>• mouse squad</li> <li>• programming mobile devices using aris games</li> <li>• <a href="http://arisgames.org/demo/">http://arisgames.org/demo/</a></li> </ul>	<ul style="list-style-type: none"> <li>• Funding</li> </ul>
<ul style="list-style-type: none"> <li>• Our Academy is building a reputation for supporting STEM education. We would love to have more opportunities for our students to share ideas, learn from others and compete. The STEM forum is a great opportunity for us.</li> </ul>	<ul style="list-style-type: none"> <li>• Numbers of course offerings</li> <li>• Equipment (particularly computers)</li> <li>• Money</li> <li>• Experts</li> <li>• We have had a lot of super partnerships. I am very hopeful that things will continue to grow at the Academy.</li> </ul>
<ul style="list-style-type: none"> <li>• Our newly adopted district initiatives include developing STEM educational opportunities in our school district. We are just beginning to establish a foundation for STEM education.</li> </ul>	
<ul style="list-style-type: none"> <li>• P-16 partner in STEM professional development grant seeking efforts; including in-kind support with staff time and other resources.</li> <li>• Interface with P-12 school districts including County Superintendent, District Superintendents, curriculum leaders and teachers.</li> </ul>	
<ul style="list-style-type: none"> <li>• STEM emphasis K-12 with hands-on, application-based lessons</li> </ul>	<ul style="list-style-type: none"> <li>• Funding</li> <li>• Large class sizes</li> <li>• Lesson implementation strategies</li> </ul>

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<ul style="list-style-type: none"> <li>We are just getting started and are looking for new ideas. We are putting together a science committee (parents, teachers, support staff, and principal) to determine our next steps.</li> </ul>	<p>Lack of funding.</p>
<ul style="list-style-type: none"> <li>We are looking at expanding our offerings in the STEM areas of education.</li> </ul>	<ul style="list-style-type: none"> <li>A major barrier common to many is budget shortfalls.</li> </ul>
<ul style="list-style-type: none"> <li>We have the vision that STEM education will include environmental science, life science, earth science and efforts to connect kids to nature. We also have the vision that STEM education will be involved in efforts to use green technology in schools.</li> </ul>	<ul style="list-style-type: none"> <li>Funding and time are limited resources currently. The CREEC Network and environmental education efforts should be funded full time instead of part time.</li> </ul>
<ul style="list-style-type: none"> <li>We have to think about what can we do now to positively influence more students to go into STEM Careers. We need to start at the elementary level and connect students and teachers with STEM professionals currently working in the field. We need to show students that STEM careers are not beyond their reach.</li> </ul>	<ul style="list-style-type: none"> <li>Teachers may not have functional equipment.</li> <li>Teachers might not have the appropriate background or confidence to teach STEMS, and may inadvertently reinforce that STEMS is difficult or beyond the students' reach.</li> <li>Drill and kill can exterminate a child's interest in a mathematics career.</li> <li>Science has been nearly eliminated due to schools pushing language arts and mathematics so much that there is so little time left in the day.</li> <li>Teachers complain that they either do not have technology, or that it has technical issues and the teachers don't trust that the technology will work with their students.</li> <li>Some teachers are so focused on paper-pencil work that they don't understand the need to accelerate learning by using technology tools to increase student engagement, make activities based upon problem-solving within the students' context and relevancy.</li> <li>21st Century skills emphasizing problem solving, collaboration, communication, and developing creativity and critical thinking skills will help our students to be successful in STEM careers.</li> </ul>

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<ul style="list-style-type: none"><li>• We need more professional development in STEM for teachers who are hesitant or lack confidence in their ability to teach science.</li><li>• We need to look beyond our own staff for the best instructors. The Endeavour Academy was very successful in attracting students to engineering. We need to work with the teachers' union to facilitate creative solutions to enhancing the curriculum.</li></ul>	<ul style="list-style-type: none"><li>• Time</li><li>• Money</li><li>• Too much emphasis on student achievement as measured by standardized tests.</li><li>• Politics</li><li>• Lack of communication within and outside of school district to leverage assets and talent.</li></ul>
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**FORMAL EDUCATION: COMMUNITY COLLEGE/UNIVERSITY**

<b>STEM VISION</b>	<b>CHALLENGES/BARRIERS</b>
<ul style="list-style-type: none"> <li>• Increase quantity and quality of support for current students</li> <li>• Increase equipment, etc.</li> <li>• Continue various outreach events</li> </ul>	<ul style="list-style-type: none"> <li>• Time to meet with local business</li> <li>• Time to mentor students</li> <li>• Funding</li> </ul>
<ul style="list-style-type: none"> <li>• Enhanced collaboration between stakeholders in STEM</li> <li>• Clearinghouse for information on STEM activities</li> <li>• Professional development for local teachers in STEM</li> <li>• Stronger partnerships between Cal Poly credential programs and K-12 school districts</li> <li>• Focusing on quality of educational experiences</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of time and resources</li> <li>• People looking for quick fixes rather than creating more thoughtful systemic efforts to improve educational opportunities</li> <li>• Lack of attention to diversity and special needs in educational system and STEM preparation</li> </ul>
<ul style="list-style-type: none"> <li>• More service learning projects involving Cal Poly students and the community. One proposal I am a part of would support the development of science exhibits for public spaces in the community that Cal Poly students design and build with input from advisors.</li> <li>• Continued growth of the Learn By Doing Lab in which 3-8 grade students visit campus and Cal Poly student lead hands-on science activities.</li> </ul>	<ul style="list-style-type: none"> <li>• It takes time and opportunities to network with others who have similar visions.</li> </ul>

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<ul style="list-style-type: none"> <li>• My vision is to help teachers, staff, students, and parents learn to help children and young adults become "Young Mathematicians" where they learn to do authentic mathematics. This can be done by working with school staff, teachers, parents, students, Cal Poly faculty and students, to develop appropriate professional development opportunities for teachers, opportunities for children and parents to be more involved and better equipped to engage in Mathematics, and to provide administrators with tools and a vision to help them better allocate resources and help students, teachers, and parents.</li> </ul>	<p>Challenges:</p> <ul style="list-style-type: none"> <li>• Time, time, time</li> <li>• Will of the community</li> <li>• Funding</li> <li>• Organizing efforts so that everyone is on the same page (i.e. marketing and communication).</li> </ul>
<ul style="list-style-type: none"> <li>• Professional development for science and math teachers that integrate reformed teaching methods with the other aspects of learner populations (at-risk students)</li> </ul>	
<ul style="list-style-type: none"> <li>• Research and best practices indicate that school leaders have significant influence on the development and maintenance of capacity within organizations (Barnett, 1987; Bullard &amp; Taylor, 1993; Gentilucci &amp; Muto, 2007; Levine &amp; Lezotte, 1990; Morgan &amp; Petersen, 2002; Petersen, 1999, 2002; Petersen &amp; Gentilucci, 2009). Furthermore, these individuals are resource gatekeepers--what matters to them gets done. Therefore, it seems reasonable to hypothesize that it is not possible to improve preK-12 STEM education simply by producing a greater quantity of well-qualified STEM teachers. We must also develop a new generation of STEM-focused school leaders who possess the skills to create necessary organizational capacity to support world-class STEM teaching and learning in preK-8 schools. This research hypothesis forms the basis of our ongoing work in STEM Education Leadership.</li> </ul>	<ul style="list-style-type: none"> <li>• K-12 school culture that does not value STEM education</li> <li>• K-12 leaders who have little or no background in creating innovative STEM learning environments</li> <li>• NCLB and AYP constraints that limit the amount of time devoted to STEM education, especially in K-8 schools</li> <li>• K-12 leaders who are not trained in inquiry-based or project-based learning</li> </ul>

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<ul style="list-style-type: none"><li>• The availability of quality traditional STEM education appears to me to not be a problem.</li><li>• I think that stimulation of interest in science in schools K-12 must be enhanced.</li><li>• Environmentalism might be a great place to start since so many are interested but students are usually exposed to 'solutions' that are erratically unscientific, ineffective, and sometimes actually harmful to their cause(e.g. corn ethanol).</li><li>• I envision perhaps a traveling lab or 'interactive' museum with focus on topics such as those in Prof. Muller's 'Physics for Future Presidents.'</li></ul>	<ul style="list-style-type: none"><li>• Trying to do everything.</li><li>• Pumping up unscientific (or uneconomic) 'solutions.'</li><li>• Attracting student interest in a social media / gaming culture.</li><li>• Challenging local media to fairly cover all sides of issues (e.g. nuclear power).</li></ul>
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**INFORMAL EDUCATION**

<b>STEM VISION</b>	<b>CHALLENGES/BARRIERS</b>
<ul style="list-style-type: none"> <li>• Stronger collaboration efforts between formal and informal education centers</li> <li>• Dedication to engaging the general public's interest</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced funding</li> <li>• Lack of awareness of the importance of STEM</li> <li>• Inadequate support structure for small organizations to work together</li> </ul>
<ul style="list-style-type: none"> <li>• Continue to provide these hands on opportunities to different job training organizations and educational groups.</li> </ul>	
<ul style="list-style-type: none"> <li>• Continuum of engaging activities, formal and informal, from very early age through career that inspires and encourages entry into the space industry.</li> </ul>	
<ul style="list-style-type: none"> <li>• Develop and grow a STEM education Coalition to promote the expansion of the STEM Education P-16 pipeline on the Central California Coast.</li> <li>• To address needs for STEM Education through informal learning experiences that promote content and process skills in STEM at all age levels.</li> <li>• To develop the SLO Discovery Center to promote exciting interactive hands-on, minds-on learning experiences in all fields of science, health, math, engineering, and technology for all ages.</li> </ul>	<ul style="list-style-type: none"> <li>• Difficulty reaching teachers and students though existing lines of communication.</li> <li>• Lack of funding and support to run programs.</li> <li>• General public's ignorance of the vital importance for improving STEM Education at all grade levels.</li> </ul>
<ul style="list-style-type: none"> <li>• I am available to volunteer time in teaching STEM education programs through programs on the Central Coast, as well as continue to apply for grants through my organization that can be used for STEM education. In addition, my organization is available for collaboration.</li> </ul>	<ul style="list-style-type: none"> <li>• Recently, I was involved in formulating a STEM charter school in the Lompoc area. The Lompoc Unified School Board and many teachers in the Lompoc District is not interested in allowing a STEM focused charter school in this area, nor are the teachers and district interested in providing for STEM education in their classrooms. In forming the STEM Forum it is with hopes that more of the community will be interested in learning about STEM education and insisting that their children be provided with STEM education.</li> </ul>

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<ul style="list-style-type: none"> <li>• Incorporating school-based standards for STEM education and school readiness in STEM for pre-K museum visitors is a high priority for our current and future programming and exhibits.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of qualified staff to lead/develop STEM programming</li> <li>• No significant access to local STEM thought leaders</li> <li>• No budget for increased staffing or training</li> </ul>
<ul style="list-style-type: none"> <li>• K-20 Education, Non-Profit and business partnering together to provide more formal and informal K-12 STEM Education professional development opportunities for teachers, and afterschool, Saturday seminars, and outreach programs for students.</li> </ul>	<ul style="list-style-type: none"> <li>• K-12 School Districts embrace partnering with non-profits and businesses to develop STEM during and afterschool classes for K-12 students. Jointly work together to write grants to support these endeavors for the student benefit.</li> </ul>
<ul style="list-style-type: none"> <li>• Our Strategic Plan lays out expansion of our existing facility to include both indoor and outdoor exhibits; focusing on Earth's living systems, humans, cells and atoms.</li> </ul>	<ul style="list-style-type: none"> <li>• Coordination and communication with other STEM organizations.</li> </ul>
<ul style="list-style-type: none"> <li>• Our vision is to support the design of facilities to be usable and adaptable to the student needs in an affective STEM educational environment. We hope to be a resource for any institution that desires to implement STEM education.</li> </ul>	<p>We find that the concepts of STEM are generally well received. We find the challenges to be in</p> <ul style="list-style-type: none"> <li>• funding for facilities</li> <li>• instructor education</li> <li>• integrated educational specifications and understanding of the methods to implement an integrated curriculum</li> </ul>
<ul style="list-style-type: none"> <li>• The EPIC program would like to expand to offer multiple weeks to both Middle School and High School students, and offer a residential program. We also see a potential for collaboration with teacher education where teachers would attend a course on how to integrate engineering to applied math &amp; science education. The course would culminate in the teachers instructing the labs during the EPIC program.</li> </ul>	<ul style="list-style-type: none"> <li>• Finances is the greatest barrier. As an outreach program, EPIC requires subsidization to provide scholarships and to keep the fees affordable for all students.</li> </ul>

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<ul style="list-style-type: none"> <li>• To have FIRST Robotics made available to students at all high schools on the Central Coast. This could be accomplished through a corroborative effort between schools. Several magnet teams could support multiple schools.</li> </ul>	<p>FIRST Teams presently exist at AHS, Arroyo Grand and Orcutt (1st year team assisted by GRR). FIRST (For Inspiration and Recognition of Science and Technology) parallels STEM efforts.</p> <p>Challenges:</p> <ul style="list-style-type: none"> <li>• inadequate shop space</li> <li>• inadequate "practice" space</li> <li>• limited school interest and involvement (not a traditional sport)</li> <li>• funding</li> </ul>
<ul style="list-style-type: none"> <li>• VISION: Our vision is one of: America's youth, enthusiastic and successful, with high paying jobs; as they actively contribute to America's technological future in the new global economy.</li> <li>• MISSION: Promote effective teaching of critical STEM learning and problem-solving skills that students need to succeed; as well as public awareness and support of America's scientific and technological endeavors.</li> <li>• STEM: Technology, Engineering and Math. These are key elements for a world-class economy and are crucial for our nation's future.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a STEM Coalition</li> <li>• Create a Networking Clearinghouse</li> <li>• Building Partnerships</li> <li>• Define avenues of Industry Participation</li> <li>• Seek funding collaboratively</li> <li>• Plan Events</li> </ul>