Oregon Afterschool Expanded Learning Opportunities and STEM

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Research over the last two decades confirms the positive impact of afterschool programs on children, families and communities nationwide. At the national, state and local levels there is increased attention to and demand for schools and afterschool / summer programs to genuinely collaborate. That process will require multiple institutions and people to commit to being boundary crossers, to be open to creative solutions as they discover and design a new day for learning that supports all of America's children and youth.

In Oregon and across the nation afterschool and summer learning programs have been able to provide engaging STEM education opportunities to young people by making science, mathematics, technology and engineering subjects come alive through hands-on, experiential learning. The Oregon afterschool network believes that the innovative programs and strategies have been developed locally can and should be scaled up and integrated with ESEA to benefit students.

Whether robotics, rocketry, designing apps for mobile devices, gardening, water conservation, cooking, crime scene investigation (CSI) simulations, or other programs, out of school programs can complement school day lessons while encouraging students to embrace the scientific method, and have fun.

An expanded learning opportunity connected to the school day is NOT more school after school (Einstein's definition of insanity, after all) using project-, service- and place-based learning with culminating events such as exhibitions, presentations, and competitions (e.g., *FIRST* LEGO robotics, www.usfirst.org nationally or www.ortop.org in Oregon).

There are many challenges facing education from our perspective they are:

The challenge to the widespread adoption of STEM afterschool has been the professional development opportunities for staff and consistent implementation funding. Too often professional development opportunities are limited to teacher. Opening these opportunities up to afterschool educators would be helpful.

Program funds not tied to "innovation" or "research" but to quality design & delivery by well-trained, well-equipped staff for both afterschool and certain in-school programs. Existing research does tell us the best practices for high quality, effective design & delivery of programs.

Coordination and communication between education providers (schools, afterschool), parents, teachers and community both for better student access to programs, more effective delivery to students and for some form of accountability, preferably longitudinal tracking of student outcomes and the use of higher-order assessment than multiple-guess tests.

Allow flexibility, so that if one community has a very active 4-H program and another has a very active school-based science club, each community gets to leverage its particular resources and does not have to re-invent any wheels, only connect them to the vehicle. This is particularly important for rural areas.

Instructional time during the school day for STEM, emphasizing deeper rather than broader knowledge, using application of knowledge to integrate and contextualize knowledge and skills (answer "When will I ever use THIS in my life? Why should I care about THIS?" with engaging projects using math, science, engineering, computer, language & social skills)

The most important thing for the re-authorization of ESEA would be to ensure afterschool and summer learning opportunities remain as the key funded programs under the 21st Century Community Learning Centers initiative in Title IV Part B of ESEA. We encourage and support additional funding for science education that connects school and afterschool / summer programs.

We are beginning to recognize that organized and intentionally designed non-school hour programs not only help keep communities safe, but they keep kids engaged in learning which supports collaboration, problem solving, creative thinking, and helps develop life skills and enrichment opportunities that they would otherwise not be able to access.

Oregon

Our Oregon Department of Education is currently drafting a Statewide Framework for STEM Education. The initial input for the framework was provided by representatives from business and education including organizations that focus on STEM education outside of the school day. We anticipate that the framework will be available for broader review in September of 2011. The framework will:

1. Define STEM education and goals related to preparation for college, careers, and citizenship.

2. Identify critical components needed for improvement in STEM education.

3. Describe a mechanism for linking educators and communities interested in improving STEM education.

A brief summary of the existing work on each of these sections is included here.

Proposed Definition for Oregon STEM Education

"An approach to teaching and lifelong learning that emphasizes the natural interconnectedness of the four separate STEM disciplines. The connections are made explicit through collaboration between educators resulting in real and appropriate context built into instruction, curriculum, and assessment. The common element of problem solving is emphasized across all STEM disciplines allowing students to discover, explore, and apply critical thinking skills as they learn. "

Goals for Oregon STEM Education

- *Improve student performance in STEM related content;*
- *Increase interest in and improve preparation for STEM careers; and*
- *Become proficient in STEM concepts necessary to make personal and societal decisions.*

Components of Oregon STEM Education

Improving STEM education in Oregon will require more than a new curriculum, more professional development, or enhanced after-school activities. The Components of Oregon STEM Education describe the broader set of issues that need to be addressed so that the individual actions of schools, districts, state agencies, educational program providers, businesses, and communities provide maximum impact. Key components of Oregon STEM Education include Community Engagement, Effective Instruction, Effective Leadership, Evaluation and Research, Effective Learning Environments, and Coherent Standards and Policies.

- ***Community Engagement***

STEM education is the responsibility of a community that extends beyond schools. Business and industry has an interest in STEM education in order to grow a literate and innovative workforce. Wide ranges of organizations provide STEM learning opportunities through classes, competitive events, and mentorships. Parents and volunteers provide personal knowledge and experience that can engage and inspire students.

Engagement of the community in STEM education requires communication and collaboration. Community members who are not part of the school setting need to know how to interact with schools, teachers, and students in a meaningful and sustainable fashion. Schools need to understand what resources are available and how to best incorporate those resources into the educational setting. Collaborations between schools and communities can also provide positive support for policy.

- ***Effective Instruction***

Teachers are central to effective STEM instruction whether they are teaching science or mathematics in a school, coaching a robotics team, leading a 4-H club, or guiding a group through a museum. A STEM teacher can be someone who has completed a professional education program, attended training sessions, or accumulated life experience in STEM disciplines. They can hold a variety of credentials and teach in a variety of settings. STEM teachers create opportunities for students to make connections between science, technology, engineering and mathematics and use that knowledge and critical thinking skills as they problem solve.

In order to improve teacher effectiveness in STEM instruction teachers need professional development opportunities to improve their knowledge and skills. Additionally, teachers need to be able to collaborate with others on the development of STEM learning opportunities for students, improve practice through lesson studies, and have access to coaching support.

- ***Effective Leadership***

Effective Leadership is critical to ensuring equitable access to high quality STEM teaching and lifelong learning. Leaders may come from both inside and outside of the schools. An effective leader may be a teacher leader, a school level administrator, a district level curriculum specialist, a regional professional development provider, ESD or school district superintendent, state level education specialist, a community member, or an industry representative.

Effective Leadership requires the engaging others about the importance of STEM, sharing success stories based on data, and building capacity by helping others succeed in providing STEM learning opportunities for students. Effective Leadership includes focused instructional leadership as well as developing and implementing coherent policies, advocacy for equity, providing and supporting effective learning environments, establishing and maintaining the infrastructure and facilities necessary to support teachers in the delivery of effective STEM instruction, building connections to community, parents, and businesses, and ensuring accountability at every level.

- ***Evaluation and Research***

Evaluation of the Oregon STEM Framework is essential for monitoring the impact of this work and fine-tuning based on lessons learned. Our ability to illustrate what STEM learning looks like and the impact on student achievement is imperative for developing sustainable STEM learning opportunities for our students. Research will help us as we provide training for leadership and teachers by providing information about successful strategies, efficiencies, and greater ability to communicate the importance of STEM to our students, parents and community members. Evaluation includes monitoring progress and lessons learned in addition to identification of best practices in STEM.

- ***Effective Learning Environments***

Both the physical and social environments influence STEM learning. With an emphasis on problem solving and critical thinking in STEM, students need to be part of a social environment that encourages dialogue with teachers and other students. Effective learning requires an environment that includes appropriate pacing of instruction, grouping of students and feedback. Careful consideration of physical layout of classrooms or learning environments including appropriate tools and technologies is required to support social aspects of learning.

- ***Coherent Standards and Policies***

Coherent standards and policies help remove barriers to implementation and provide support for development of interconnected STEM education programs. Standards define what is both expected to be taught and learned at each grade level. Coherent standards help support educators in understanding how to meet these standard expectations within a STEM learning environment.

Policies that influence STEM learning may be local, regional, statewide, public, or private. These policies need to be reviewed to make sure that they support rather than set up barriers to STEM teaching and learning.

Linking STEM Educators

Oregon is engaging in a networking model for promoting changes in STEM education statewide that are effective and coordinated. Similar models are at various stages of development in other states such as Ohio, New Mexico, North Carolina, and Massachusetts. In these states, regional networks of schools are being formed to support coherent improvement in STEM education. This concept is identified by the Carnegie Foundation as Networked Improvement Communities and is described in some detail in a document that can be found at http://www.carnegiefoundation.org/sites/default/files/bryk-gomez_building-nics-education.pdf

A draft of a descriptive table of successful, scalable STEM programs in Oregon is attached. It is not comprehensive. Appendix A

Other STEM Education Resources

- Fall 2010 data reference links -- http://opas.ous.edu/Work2009-2011/State-of-Ed-OR-refs.pdf

- Exploring Engineering and Computer Science brochure, locally tuned for Oregon -- http://opas.ous.edu/Work2009-2011/Marketing/E-Week-explore-2011.pdf

- K-12 STEM education opportunities in & around the Portland Metro area -- www.technosciencesupersite.org

State Educational Technology Directors Association Class of 2020 Action Plan – STEM Whitepaper:
http://www.setda.org/web/guest/2020/stem-education
National Academies Press Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics:
http://www.nap.edu/catalog.php?record_id=131581. Reflect on your experiences (as an employer/ teacher/ administrator/ parent/ student) trying to get/working to offer encouragement for, and greater opportunities to Oregon students in science, mathematics, technology and engineering.