STEM Investment Council

June 26, 2015
9:00am – 12:00pm
2 World Trade Center
Sky Bridge A&B
121 SW Salmon St., Portland

Call-In Information:
Dial (888) 204 5984
Code 992939

JIM PIRO, Chair

AUBREY CLARK

HERB FRICKE

LISA GRAHAM

DWAYNE JOHNSON

ERIC MESLOW

THOMPSON MORRISON

Staff:
MARK LEWIS

AGENDA

1. **Welcome & Introductions**

2. **Education Updates**
   Dr. Nancy Golden, Chief Education Officer
   Lindsey Capps, Governor's Education Policy Advisor

3. **Strategic Planning Committee Updates**
   Thompson Morrison, Subcommittee Chair

4. **Current STEM Grants**
   Jo Oshiro, Education Specialist, Oregon Department of Education

5. **2015-17 Investments**
   Mark Lewis, Director of STEM Education, OEIB

6. **Public Comment**
   Members of the public wanting to give public testimony must sign in.
   There will only be one speaker from each group.
   Each individual speaker or group spokesman will have three (3) minutes.

All meetings of the STEM Investment Council are open to the public and will conform to Oregon public meetings laws. The upcoming meeting schedule and materials from past meetings are posted online. A request for an interpreter for the hearing impaired or for accommodations for people with disabilities should be made to Seth Allen at 503-378-8213 or by email at Seth.Allen@state.or.us. Requests for accommodation should be made at least 48 hours in advance.

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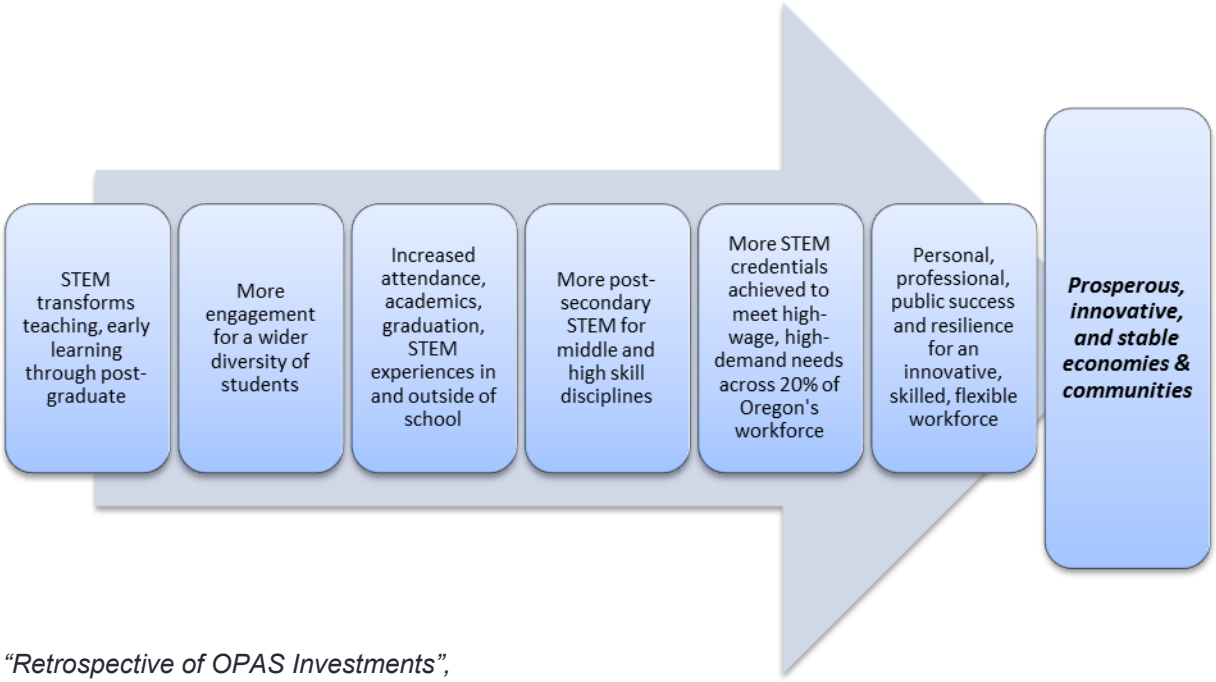
Why STEM for Oregon?



Source: "Retrospective of OPAS Investments", June 16, 2014, Oregon University System

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Connecting to the World of Work – STEM Investments
$6.7 M

- $2.6M **Regional STEM Hubs**: Bridge pockets of excellence, capture and share best practices & resources, galvanize communities to build on local assets.
- $2.3M **STEM/STEAM/CTE Activities**: Close the opportunity gap: expand transformed STEAM and CTE learning programs within and beyond the school day, focus on underserved and underrepresented students.
- $1.8M **STEM Lab Schools**: Inclusive learning environments that takes a deeper dive into transforming teaching and learning; heightened student engagement and success through authentic demonstrations of critical thinking and problem solving to the STEM community.

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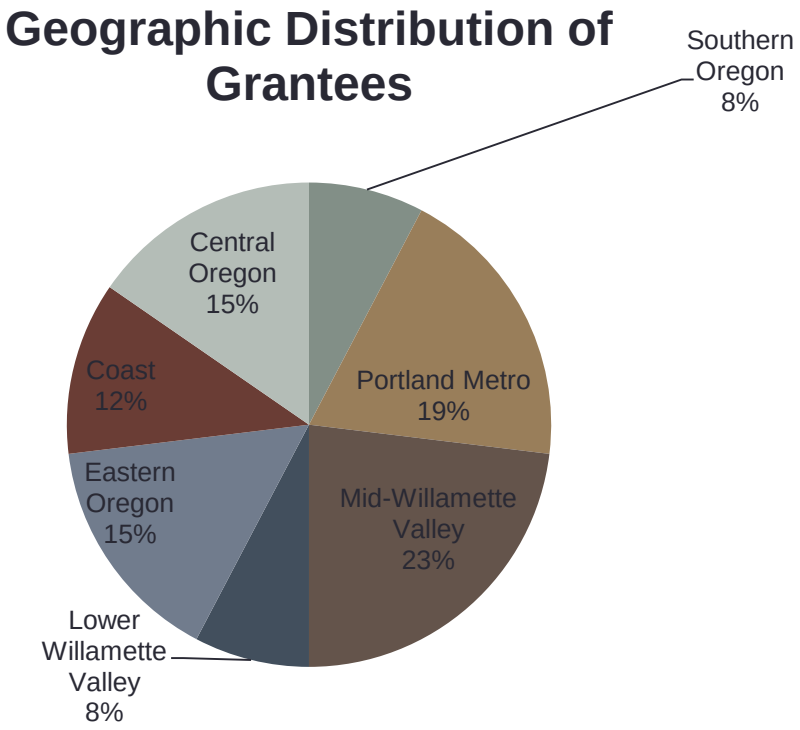
- **Leverage private, public, and community resources** while enabling local control.
- **Establish the STEM Hubs** as networks for collaboration and the development, dissemination, and adaptation of evidence-based models, practices , and tools to transform program delivery, pedagogy, administration, and accountability.
- **Frame STEM education as one key driver of community economic prosperity.**



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Rough Numbers

	Students	Teachers	Family/Community	Business
Hubs	12,882	1760	11,589	37 partners
Activities	6910	87		
Lab Schools	2423	106		
	22,215	1,953		
STEM Week	10,000		2100	
In OR	*587,564*	*26,410*	*3,421,400*	

Some disaggregated data now available in the printed report, more expected after July 31

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Highlights

- Culver Middle School: A series of field trips with OSU biologists to Haystack Reservoir integrates English Language Arts and Social Studies.
- Benson High School: Tech Geometry and Tech Algebra courses get some great press coverage from KGW.
- Kalapuya High School: *"Unanticipated community connections and a larger sphere of influence: Because of this grant we have collaborated with several schools and organizations. For example, we have collaborated with the CTE teacher at the larger high school and with the Lane County ESD. Participation in the STEM Hub was also beneficial for us as it put us in contact with people from industry and gave us some reality checks for what Private-Public collaboration means for them."* Bruce Weinberg, GreenSTEM teacher.

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Highlights

- **Neah-Kah-Nie's** afterschool program is built on the foundations of a previous 21CCLC grant. Among other STEM and Career Exploration activities, retired Intel Engineer Mark Balmer spent 3 days teaching students about programming and circuit boards.

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Hub Partners

Hub, web link	Award	Sch Dists (SD)	(Sub) Urban SD	Rural/ Town SD	Post-Sec-ondary	CBO	Bus/ Ind	Govt incl ODE	Tribe	Other Ed Orgs	Allies & developg
COreSTEM, Central	$124K	1		1	2	2	4	1		3	34
GO-STEM, Eastern	$313K	2		2	9	3	5	6		9	
OregonCoast, South, Central, North	$644K	13		13	5		7	6		8	8
PMSP, Portland Metro	$600K	4	4		9	23	16	12		16	19
SMSP, South Metro Salem	$600K	15	7	8	7	13	1				11
UVSH, Douglas County	$325K	10		10	3	11	4	4	1	2	
238 Partners	$2.8M	45	{11}	{34}	35	53	37	29	1	38	{72}

{ } = not counted in total

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Hub Highlights

- STEM study and post-secondary credentials are not only for the university-bound; the **Oregon Coast STEM Hub** helped send **Waldport High School** students with developmental disabilities for a career-connected, hands-on field trip to **the Oregon Hatchery Research Center** (link).

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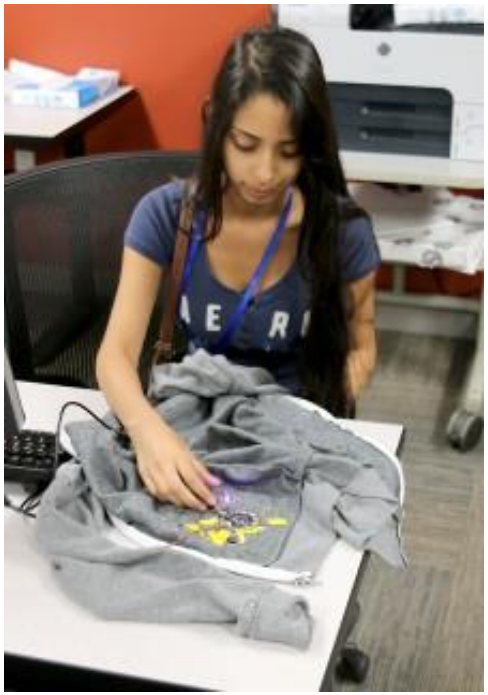
Grant Synergy

- **Portland Community College**
  Engineering 100 Dual Credit Course and Wearable Tech camps ; campers were recruited through Adelante Mujeres and Las Hermanas. Collaborated with both Portland Metro and South Metro Salem Hubs to recruit teachers and students and to map curriculum to Next Generation Science Standards.



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Platform for Future Synergy

- South Metro Salem's Oregon Connections – Streamlines the matching and management of STEM Professionals to educators. During an ongoing, carefully controlled rollout of the system:
  - 93 teachers brought on;
  - 136 STEM professionals brought on;
  - 15 OregonTech faculty and graduate students brought on;
  - 50 in-person matches (classroom visit; teacher professional development) impacting an estimated 1200 students;
  - 12 virtual matches via real-time weblink impacting 360 students;
  - Recruiting, outreach, and cost-sharing discussions with PMSP, other hubs, workforce organizations, and CTE staff at ODE.

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Looking Back, Looking Forward

Early Wins	Challenges

• New exemplar STEM Programs, Resources, equipment lending libraries
• NGSS mapping, alignment, teacher confidence
• Developing cadre of STEM educator leaders
• Hub credibility as STEM evangelists
• Inclusion of Afterschool
• Poised for statewide use
  • Oregon Connections
  • Evaluation methodology
	• Duration and timing of funding
	  • Summer Advanced Payment policy helps bridge biennial gap
	  • Legislative timing mismatch with School District budget cycle
	  • 14-16 months, not 2 years
	• Sustaining momentum needs $, particularly for the Hubs and small rural districts & programs
	• Grant management learning curve at ODE – capturing that knowledge
	• Better integration across other granting programs, e.g. SIG

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Thank you!

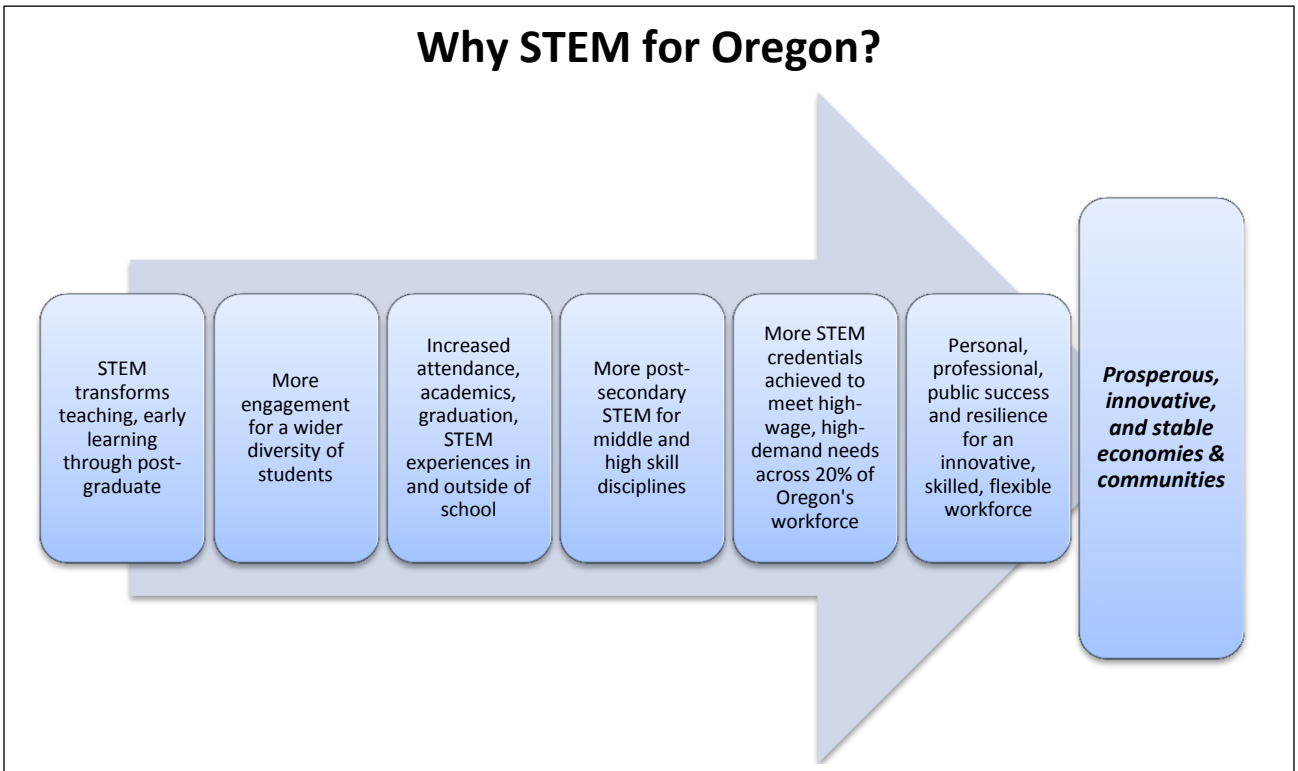
Respectfully submitted,
Jo Oshiro
June 26, 2015

Jo.Oshiro@state.or.us through June 30, 2015

STEM Investments 2013-2015: A Report to the STEM Investment Council

Excerpted from a DRAFT report to the Oregon Legislature, June 2015

STEM (Science, Technology, Engineering, Mathematics): Persistent advocacy by business, industry, education, and civic leaders inspired the establishment of the Joint Interim Task Force on STEM Access and Success (HB 4056 (2012)) and continues to support STEM education efforts and investments. The Task Force's report states: *"Oregon's role in the global economy is defined by its citizens' flexibility to respond to an ever-changing employment climate. Being competitive in the global market means that citizens are literate in the sciences, technologies, engineering, and mathematics: the STEM disciplines."*

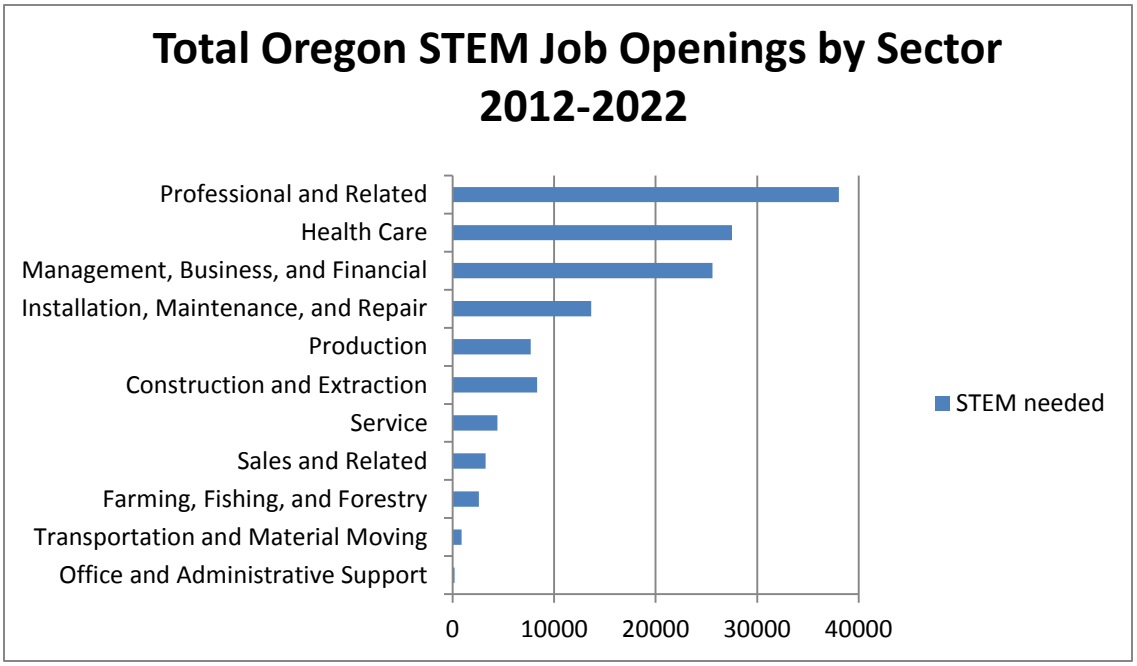


Source: "Retrospective of OPAS Investments", June 16, 2014, Oregon University System.

Workforce demand for STEM skills reaches beyond high-tech jobs into middle-skill, high-wage, high-demand occupations. These jobs currently account for 20.1% of all job openings, 20.7% of all employment, and 43.5% of high-wage, high demand jobs in Oregon. Post-secondary education to meet this need includes apprenticeships, certificates, and Associates' degrees, as well as Bachelor's, Masters, and doctoral degrees. The Oregon Employment Department projects that overall, STEM skills will be required for about 20% of Oregon's employment across many sectors in the next 10 years[1], which echoes national figures cited by the Brookings Institute report, "The Hidden STEM Economy", June 2013.

[1] Brenda P. Turner, Oregon Employment Department. Personal communication to the STEM Investment Council, March, 2015 and to Jo Oshiro, Excel file "Oregon STEM data from Brookings report 031815 060315 for Jo (3)", June 3, 2015.

On the Oregon Coast, STEM skills are needed to meet economic development and workforce needs in marine biology, alternative energy, and natural resource management – video.



Personal quality of life issues are perhaps even more immediate and compelling arguments for STEM education than the economic ones. The opportunity to learn and practice quantitative skills, critical thinking, reasoning from evidence, dealing with uncertainty, persistence, understanding the power and limitations of technology, and systems thinking will help prepare our youngest citizens for future decision-making on issues in their personal finances, family healthcare, and environmental impact.

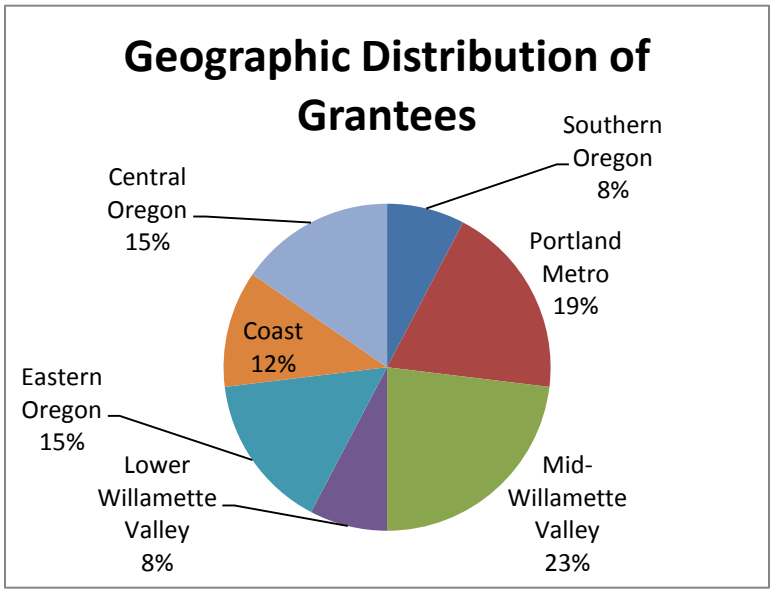
The 2013 legislature began the key strategic investments supporting *"the immediate and long-term efforts necessary to increase STEM education in Oregon by*

(1) appointing a permanent council to develop STEM education,
(2) funding STEM Hub and other programs, and
(3) providing greater resources to educational and infrastructure improvements"

recommended by the Joint Interim Task Force. These investments in STEM Hubs, STEM Lab Schools, and STEM/STEAM/CTE Activities were part of "Connecting to the World of Work" initiatives:

- **Support the 40/40/20 goal** and employability of graduates from Oregon public schools.
- **Address equity by closing opportunity and achievement gaps in STEM in and out of school**. These gaps exist for historically underserved and underrepresented students. Equity foci range from at-risk youth in alternative schools, rural elementary students needing academic support, American Indian youth in Warm Springs, girls underrepresented in STEM disciplines, African-American boys, Latinas, and entire school populations in high needs areas.

- **Break down silos** and promote systems thinking and collaboration between school districts, post-secondary institutions, non-profits, government agencies, regional initiatives and networks (e.g., RACs), and employers.
- **Are spread across the state** reaching from Harney County to Astoria, from Brookings to Wallowa County. Some grantees serve multiple communities or collaborations.
- **Leverage private, public, and community resources** while enabling local control.



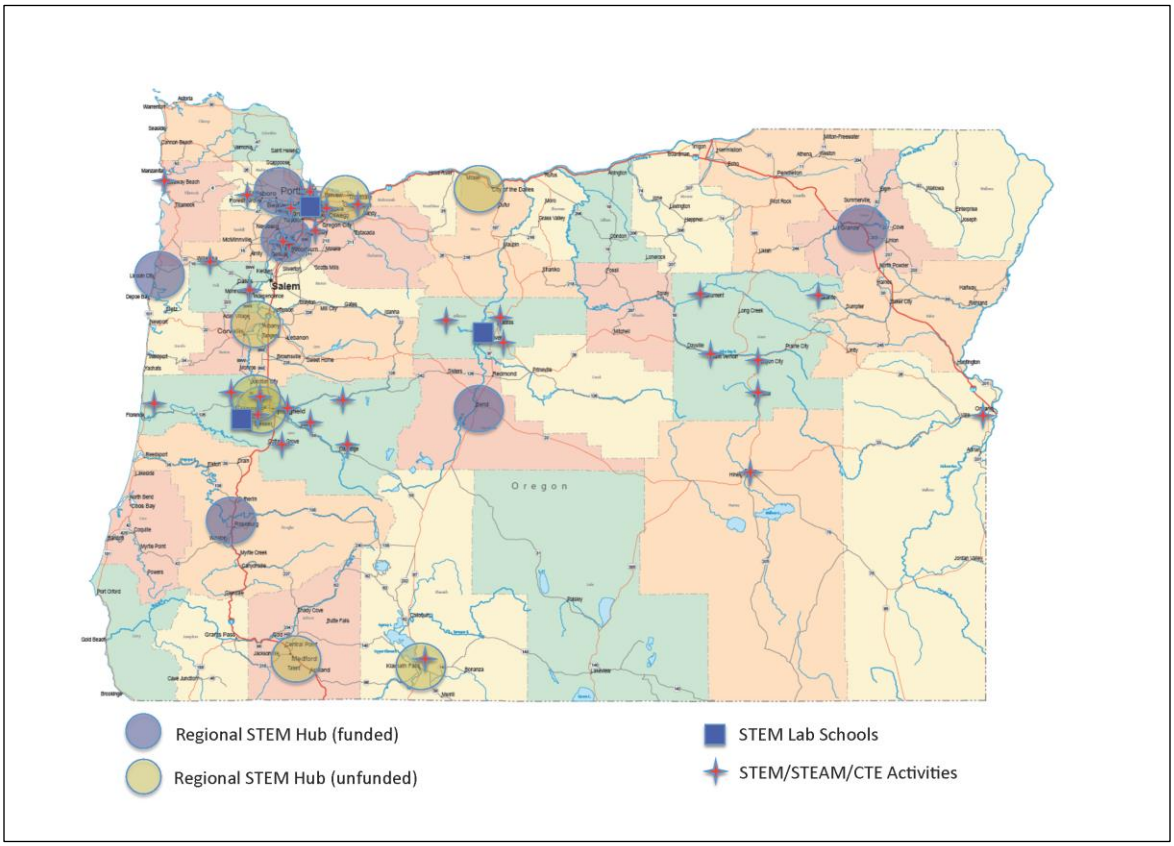
- **Establish the STEM Hubs** as networks for collaboration and the development, dissemination, and adaptation of evidence-based models, practices , and tools to transform program delivery, pedagogy, administration, and accountability.
- **Frame STEM education as one key driver of community economic prosperity**.

STEM education is an approach to teaching and lifelong learning that emphasizes the natural interconnectedness of these disciplines, transforming the learner's experience to be

- cross-disciplinary,
- relevant,
- applied,
- open-ended,
- collaborative,
- hands-on,
- reflective,
- iterative, and
- academically rigorous.

STEM education enable students to learn and practice 21st Century and Oregon Essential Skills. Teaching methods, tools, resources, and programs are different from the current public school norm. Multiple exemplary programs in Oregon, both in and outside of school, have shown that STEM practices engage a wider diversity of students more deeply than text, lecture, and worksheet based experiences. Examples include Oregon State University's Science and Math Investigative Learning Experiences (SMILE), Oregon Robotics Tournament and Outreach Program's (ORTOP) multiple FIRST programs, the Oregon Game Project Challenge (OGPC), iUrbanTeen, ChickTech, and 4-H TechWizards. Many of these programs are nationally respected or replicated outside of the state. Due to lack of coordination, infrastructure, and connections to resources, these and other exemplars tend to work in isolation, reach relatively few students, duplicate effort, and are very vulnerable to personnel and

funding changes. **Oregon's $8M in STEM investments aim to improve coordination, connect these programs to each other and to more, and more diverse, students, educators, employers and community-based organizations to make lasting impact around the state**.



STEM Lab Schools

The STEM Lab School grant of 2013-2015 supports the implementation of three to five public schools that serve as laboratories for innovation, implementation, and research of highly engaging and effective learning environments in STEM education. STEM Lab Schools will be inclusive, comprehensive schools guided by the principles of the Equity Lens and the State's 40/40/20 goal. They are expected to embrace a culture of inquiry where students:

•Learn STEM content that is aligned with state, national, and industry standards and is presented in context that makes learning significant and meaningful;

•Have a voice and a choice in pursuit of deeper understanding of STEM principles and practices;

•Develop 21st STEM skills including the Oregon Essential Learning Skills;

•Explore the big ideas of STEM content in depth through critical thinking and problem solving;

•Present authentic demonstrations of learning to STEM professionals or the community for feedback and revision; and

•Have emotional and social supports for students in conjunction with effective culturally responsive pedagogy.

Because these grants took place within schools, demographic data is fairly complete and comparable:

- Total students impacted: 2,423 with 1,275 female and 1,148 male;
- Total teachers impacted: 106 with 67 female and 39 male;
- Special populations:
    - Students with Disabilities: 351
    - Economically Disadvantaged: 1,588
    - Limited English Proficient: 290
- Race/ethnicity:
    - American Indian/ Alaskan Native: 34 students (1.4%), 1 teacher
    - Asian/Pacific Islander: 110 students (4.5%); 1 teacher
    - Black or African-American: 318 (13%); 0 teachers
    - Hispanic/Latino: 788 students (32.5%); 6 teachers
    - White: 1,033 students (42.6%); 78 teachers
    - Two or More Races (Multi-racial): 140 (5.8%); 1 teacher
- Attendance: 94.33% (from those schools who have provided data)

Highlights

Naomi Little- 7-8 Grade Language Arts Teacher
Grade 7-Haystack Reservoir Community Connections-TEAMS Unit- Research Project
*Culver Middle School**

Naomi is developing a TEAMS (reconfiguration of STEAM to highlight the collaborating between All students and All educators) Unit around her most challenging CCSS-ELA content standard, researching and writing a research paper. Her experience in working with a long-standing environmental partnership between the Hillsboro School District and the restoration of a riparian natural area, led her through the first steps in establishing what she hopes will be the start of an environmental stewardship opportunity for her students.
Dr. Ron Reuter, OSU-Cascades Soil Scientist, and student Viri Serna, a Culver HS graduate and current major in Soil Science, have spent time explaining the need to understand soil in both the context of recreational area, as with Haystack Reservoir, but also in the context of the agriculture along with the greater Culver community. Culver seventh graders recently took a field trip to the reservoir to help them connect to the area and learn about basic soil problems. To prepare her students, Naomi helped them create 'deep thinking questions' relating to environmental problems associated with the recreational area. A classroom visit by Dr. Ron fueled students' curiosity, as he answered the queries with his own questions. Viri brought it all back to the research as she engaged the seventh graders in doing soil quality tests on established trails at Haystack Reservoir last Tuesday, November 4.

Dr. Pat Ball, an OSU-Cascades Biologist, collaborated with Naomi's eighth grade class in similar activities. Haystack Reservoir is known for its toxic cyanobacteria blooms that results in closing the popular swimming and fishing spot for periods during the summer. Students read articles about the problem, wrote 'deep thinking questions' and then were able to ZOOM a videoconference between the two classes and Dr. Ball. Eighth grade

students visited the Reservoir on Wednesday, November 5th, to survey and take baseline observations of the man-made lake with Dr. Ball.

Naomi's next steps will lead the students into choosing and researching a topic specific to their interests. There will be additional visits to the Reservoir in late winter, early spring, and mid-May as students will choose a restoration activity to improve the site. Landon Roberts, MS Social Studies teacher, is planning to team with Naomi to have students research the history of Haystack Reservoir, the first site of the town of Culver. An additional collaboration with the Jefferson County Historical Society will enrich the project.

**This is taken from an excerpt from the STEM Coach's journal notes depicting STEM education at all grade levels and academic content areas. In addition, please view the Culver MS PowerPoint that highlights their learning experiences along with the STEM Coach's journal notes depicting STEM education all grade levels and academic content areas that were sent in an email.*

This is a STEM learning experience occurring in a Language Arts class with planned extensions in social studies.

Conclusions

The STEM Lab Schools are in varying stages of implementation and involve different levels of grade band engagement. For example, while there are three STEM Lab School grantees, there are six schools involved: one K-8 school, one 6-8 middle school & one 9-12 high school and an entire K-12 school district (elementary, middle and high school). However, ALL students involved in the STEM Lab Schools are engaging in a multitude of student-driven, problem-based learning across content disciplines that are aligned to academic standards. Students are not only being exposed to a variety of STEM fields and practices, but are also working alongside STEM professionals in their communities while having high-levels of exposure to possible career pathways. Students have been able to begin to develop and demonstrate the necessary 21st century skills at all grade levels.

Educators have been provided a significant amount of support not only through internal professional learning opportunities, but also through being engaged in teaching strategies and opportunities to increase content knowledge from local and national education agencies (University of Oregon, Oregon State University, Regional STEM Hubs, Education Northwest, Waters Foundation and the Buck Institute for Education). To date, teachers have each engaged in more than 40 hours of STEM focused professional development.

Impact on Student Achievement and Closing Opportunity Gaps

- The fundamental nature is for STEM Lab Schools to function as fully inclusive, highly innovative learning environments. Students are engaging in STEM education experiences in multiple content areas regardless of prior academic achievements. In order to fully support the diverse needs of the students, all of the schools have worked with outside entities to create personal connections and further partnerships with parents, out-of-school providers, community members, business and industry.

- While there are many support strategies and outreach programs in place to engage and support economically disadvantaged students, English language learners and communities of color, closing the achievement gap is an area that will need on-going focus and continual support within the schools.

Sustainability

These schools have significantly increased their connections to STEM professionals along with other business and industry partnerships. The collaborative partnerships will continue beyond the grant funding. For example, Roosevelt High School has been offered an opportunity to pilot a revision of the Engineering the Future Curriculum, a nationally recognized engineering curriculum. In this pilot, Roosevelt will be partnering with Mihir Ravel and Cary Sneider (both Portland State University Research Faculty at the Center for Science Education). Mihir is the former head of research and development for Tektronix and on the faculty of the Franklin W. Olin College of Engineering, and Cary is an co-author of the "Framework" for K12 science education that provided the foundation for the development of the NGSS standards, and a co-author of the NGSS engineering standards themselves. In addition, George Middle School worked with partners from the Bureau of Environmental Services, PMSP, PSU, Sauvie Island Center and Slough School to develop the St Johns Community Conservation Program and was awarded a $100,000 Metro Nature in Neighborhoods grant for environmental programming over a three year timeframe.

To sustain projects like these, all of the STEM Lab Schools have applied for further funding through other grant mechanisms and additional collaboration with developed partners. They continue to build upon aspects of these projects through their partnerships and Regional STEM Hubs. All of the schools have and will continue to embrace STEM as the fundamental culture of their school and every aspect of future planning will remain focused on providing students with integrated, real-applications of content.

STEM Hubs

The six regional STEM Hubs are multi-sector connectors and ambassadors for the transformation of STEM teaching and experience, so that students, educators, and communities see and act on STEM education collectively, creating and sustaining systemic change and mutual accountability. The Hubs are intended to continue beyond this grant, leveraging both public and private support to capture, preserve, and share evidence-based practices and optimal conditions for the success of those practices. Even though programs come and go, the knowledge gained can keep other programs and organizations moving forward for the success of students, educators, and their communities.

Organizations from Southern Oregon, Lane County, The Columbia Gorge, and the East Metro areas which applied for but did not receive funding have continued to work collaboratively for improved STEM outcomes, working toward becoming full-fledged, funded hubs in the future. These organizations have participated and engaged with other STEM Hubs, ODE, and the Chief Education Office staff to keep moving forward despite constraints posed by lack of funding.

The Hubs and their partners are:

Hub, web link	Award	Sch Dists (SD)	(Sub) Urban SD	Rural/ Town SD	Post-Sec-ondary	CBO	Bus/ Ind	Govt incl ODE	Tribe	Other Ed Orgs	Allies & developg
COreSTEM, Central	$124K			1	2	2	4	1		3	34
GO-STEM, Eastern	$313K	2		2	9	3	5	6		9	
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PMSP, Portland Metro	$600K	4	4		9	23	16	12		16	19
SMSP, South Metro Salem	$600K	15	7	8	7	13	1				11
UVSH, Douglas County	$325K	10		10	3	11	4	4	1	2	
207 Partners	***$2.8M***	***45***	***11***	***34***	***35***	***53***	***37***	***29***	***1***	***38***	***72***

Hubs partnerships and collaborations with schools, districts, non-profits, libraries, civic, and philanthropic organizations have put resources, expertise, students, and educators together in effective STEM experiences, efficiently delivered.

Oregon is the second state in the U.S. to declare STEMWeek in early May, joining Georgia at their invitation. This co-branding effort **drew 2100 adults and nearly 10,000 students for 96 distinct activities**. The Hubs worked together to develop a common logo, curate a toolkit of potential activities, put up the event registration on STEMOregon, and publicize STEMWeek before and during the week of May 2nd through May 10th, 2015, including a PSA and a Twitter hashtag. Surveys from organizers are expected to help hone the process for future years.

As a result of STEMWeek, the South Metro Salem Hub has positioned STEMOregon.org to become the de facto statewide STEM website linking the hubs and providing information to educators and the public. Hubs also have individual websites and newsletters; some use social media channels such as Facebook and Twitter. These channels reach thousands.

Statewide Goals for Hub Funding:

Goal 1: Increase proficiency, interest, and attainment of post-secondary credentials in STEM/STEAM and CTE (Career and Technical Education) for each student, whether child, youth, or adult; increase STEM literacy and 21st century skills for each student; transform teaching and learning practice to create and sustain these gains.

According to Oregon's STEM Investment Council, ***"The best way to learn STEM is to do STEM."***

Research shows that STEM, particularly math and science, should be done early and often. The Hubs serve this goal by working to increase the capacity of their partner organizations and communities to deliver effective, aligned STEM programming. Hubs create evaluation tools; share expertise around program administration, evaluation and use of data; promote collaborations among partners; and share other resources and information. Particularly in more rural areas, hubs help realize economies of scale through delivering and coordinating equipment training and lending; professional development for educators in and beyond the classroom; some carefully chosen programs for students; and events. This student-centered goal intertwines with

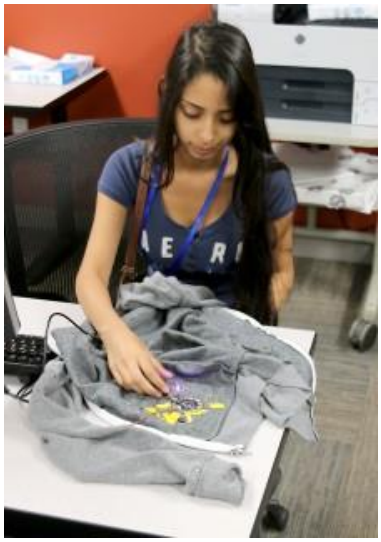
- post-secondary aspirations, e.g., 40-40-20, ASPIRE, Promise Replication grants, GEAR-UP
- Dual credit options for high school students – video.
- Math-Science Partnership grants (federal funds administered through ODE)
- Common Core State Standards, Math and English Language Arts implementation
- Next Generation Science Standards implementation
- Career and Technical Education (CTE)
- Oregon College and Career Readiness Definition
- 21st Century Community Learning Center grants (federal funds administered through ODE)
- STEM Lab School and STEM/STEAM/CTE Activities grants, discussed in this section.

STEM study and post-secondary credentials are not only for the university-bound; the **Oregon Coast STEM Hub** helped send **Waldport High School** students with developmental disabilities for a career-connected, hands-on field trip to **the Oregon Hatchery Research Center** (link).

Goal 2: Connect the wider community to K-20 education organizations to empower education as a driver of local economic prosperity, make effective use of regional/local/state assets within and outside of schools, and focus on regional/local needs.

The **Portland Metro STEM Partnership (PMSP)** has been particularly successful at helping partners outside of K-12 organizations understand and align to the Common Core State Standards (CCSS) and Next Generation Science Standards, while keeping the "not like school" feel of community-based education and youth development:

- **Wind and Oar Boat School** – website -- Facebook
- **Oregon SOLVe**
- **Portland Community College** Engineering 100 Dual Credit Course and Wearable Tech camps ; campers were recruited through Adelante Mujeres and Las Hermanas. This work was funded by an ODE STEM/STEAM/CTE Activities grant, and collaborated with both PMSP and South Metro Salem STEM (SMS) to achieve grant goals. Additional funding was leveraged through the PCC Foundation.



The **South Metro Salem STEM Partnership's (SMS)** approach to connectivity and relationship building: consulting with teachers and businesses to specify requirements, SMS chose Nepris as the webportal for OregonConnections. Teachers can profile requests for professional expertise, and STEM professionals can set up profiles detailing their expertise and availability. The software matches requests to STEM professionals, and streamlines contact and volunteer management for in-person or real-time, online, recorded sessions. OregonConnections does not require potential volunteers to spend time searching for opportunities; the system also streamlines contact management for the educator and organizations. During an ongoing, carefully controlled rollout of the system:

- 93 teachers brought on;
- 136 STEM professionals brought on;

- 15 OregonTech faculty and graduate students brought on;
- 50 in-person matches (classroom visit; teacher professional development) impacting an estimated 1200 students;
- 12 virtual matches via real-time weblink impacting 360 students;
- Recruiting, outreach, and cost-sharing discussions with PMSP, other hubs, workforce organizations, and CTE staff at ODE.

SMS also brought together their cadre of STEM Leadership Team teachers with business over several days in the summer of 2014. Professionals shared some industry practices; teachers took those practices and developed lessons or classroom practice which the professionals then got to review. For computer science teacher and robotics coach Greg Smith of West Salem High School, this meant helping his **robotics teams work more effectively by using industry-standard Agile (or Scrum) processes** as shown in this presentation at the Oregon Association for Career and Technical Education Conference in 2015. The results: "… on many levels the most successful robotics season to date." In the same slide deck, Dan Robinette of Clackamas High School shows the integration of engineering into a physics class.

Greater Oregon STEM (GO-STEM), housed in Eastern Oregon University and encompassing the eastern third of the state, adapted SMS' industry-educator model to an afternoon STEM Fair at which STEM professionals explained their use of science and math (videos), and had an opportunity to start building relationships which were consolidated and celebrated at Dinner with a STEM Professional events.

Goal 3: Identify, manage, and support the backbone organizations that serve around STEM/STEAM: Science Technology Engineering (Arts/Agriculture) and Mathematics and provide continuity, expertise, and capacity-building in the service of Goals 1 and 2.

Hub Roles and Functions around STEM	**Attending To:**
• Chief Collaborator, Connector, Convener • Project Manager • Fiscal Agent • Data Manager • Communication Provider • Professional Development Facilitator • Curriculum Kits and/or Equipment Manager • Build Partner Capacity for effective evaluation and assessment • Seeding and Piloting Programs	• Vision, Mission, Goals • Equity • Student voice • Inclusiveness across demographics and community/business/education sectors • Sustainability • Openness, transparency, knowledge-sharing • Continuous Improvement in governance, partnerships, programming, use of data • Building partner capacity for collaboration, use of data, best practices • Strategic use of programs • Prior and existing work, programs and expertise advocating for STEM education and workforce development

As evidenced by staffing, meeting notes, governance structures documented, formal recognition of cooperation among organizations, subcommittees established, business and partnership plans created and under review, growing numbers of partners, and potential partners knocking at the door, the Regional STEM Hubs have made great strides, but relationship- and trust-building take time, attention, and continuity. Planting some of that continuity in organizations rather than individuals will benefit Oregon STEM education by reducing isolation and duplication of effort, realizing some economies of scale, creating some institutional memory, and building on the momentum and social capital of the hubs.

Final outcomes data and some demographic data will become available after July 31, 2015. Because the work of the hubs is so varied in audience and intent, these data are less straightforward than K-12 school data. In some instances, for example, gathering race/ethnicity data is contraindicated as culturally insensitive. Preliminary data show the hubs served and involved (STEMWeek data not included):

- 1760 educators, including 98 educators developing their STEM leadership potential;
- 12,882 students;
- 3,626 family members;
- 7,963 community members including STEM event volunteers.

The hubs have created and continue to work on shareable tools, lessons, activities, events, and evaluation protocols and instruments and produced more than 30 community events highlighting the importance and excitement of STEM education. The hubs also provide opportunities for people from diverse backgrounds to grow their knowledge and leadership skills in STEM, growing the state's capacity for lasting systemic change.

STEM/STEAM/CTE Activities

As stated in the RFP, these projects "... deepen students' understanding of the fundamental ideas and practices around [STEM], the creative and design related industries (STEAM) & Career and Technical Education (CTE). These STEM/STEAM and CTE programs and activities within and outside of classroom walls increase awareness, interest, and provide pathways to foster 21st century career skills and emphasize access for underserved youth. Together the Regional STEM Hubs grants and the 16 STEM/STEAM/CTE activities grants form a two-pronged grassroots and grasstops deployment to bring higher quality and more accessible opportunities in STEM education, as defined by ODE, to more students across the state. Improved student, educator, program, school and community-based organization (CBO) STEM outcomes will help achieve individual and community capability and prosperity.

Awardee	***$Amount***	***Project Summary***
Bethel School District	$102,514	Renewable Energy CTE in Alternative High School
Canby SD	$128,010	Tiny House Construction in Alternative High School
Foundation for Family Science and Engineering (Central School District)	$68,918	Elementary Curriculum and Family STEM nights
Girls, Inc	$86,384	STEM and positive socioemotional support afterschool
Harney County Schools	$140,274	Natural Resource science curriculum, portable lab
Jefferson County Schools	$181,245	Natural Resources CTE curriculum, equipment
John Day SD	$199,878	Metal Fabrication consortium, 7 districts
Lane Foundation	$225,000	STEAM/CTE access consortium
Neah-Kah-Nie SD	$144,717	STEM in afterschool for younger grades
OHSU	$137,929	Healthcare career mentoring OnTrack! program
PCC	$112,000	Dual credit, culturally responsive engineering course
PPS	$220,000	Tech Geometry and Tech Algebra courses, Benson HS
Saturday Academy	$68,500	STEM enrichment for underserved youth
SMILE	$108,019	STEM afterschool clubs tightly tied to in-school
Treasure Valley CC	$200,000	Welding, Allied Healthcare CTE
Woodburn SD	$172,580	Culturally responsive STEM in afterschool, educator PD
	$2.3M	

Preliminary data show these projects served at least:

- **Total students directly served: 6910**
- **Teachers Impacted: more than 87**

Five of 16 grantees served rural schools and students; an additional four served small towns on or close to the I-5 corridor.

Interim data are inconsistent in demographic reporting categories. This is expected to improve when final outcomes and demographic data becomes available after July 31, 2015. That data is expected include qualitative data on the experiences of participants as well as numbers and demographics of participants, but will vary significantly across grants within this portfolio due to the varying nature of the projects.

Additional outcomes include

- New partnerships between education and community-based organizations, some of which resulted in additional private funding;
- Twelve of 16 STEM/STEAM/CTE Activities grantees cite specific examples of improved collaboration with community partners, initiatives, industry, federal agencies, and postsecondary institutions;
- Leveraging of expertise from the STEM Hubs;
- New equipment available for student learning;
- New curriculum, aligned to Next Generation Science Standards, in use.

Highlights

In **Harney County**, in the course of transforming all science classes to better align with Next Generation Science Standards and creating a portable lab field station for use across the county, 149 students at Burns High School (66% of the student body) worked on Fall-to-Spring project to control invasive species in a plot behind the football field. Working with 5 local scientists, students gained a 55% growth in knowledge of the "*effects of invasive species on sagebrush rangelands, career options in natural resources, what a restoration project entails, how restoration projects would impact habitat, local economies, and the technologies used in natural resources management*" per Project Director Eric Nichols.

In the **Bethel School District**, a renewable energy program serving 45 at-risk youth has resulted in:

- 50 student visits to job sites, with one student placed in an internship;
- A Lane Community College instructor now offers College Now credit at Kalapuya High School;
- Seniors are now required to complete Dual Credit for graduation; and
- *"Unanticipated community connections and a larger sphere of influence: Because of this grant we have collaborated with several schools and organizations. For example, we have collaborated with the CTE teacher at the larger high school and with the Lane County ESD. Participation in the STEM Hub was also beneficial for us as it put us in contact with people from industry and gave us some reality checks for what Private-Public collaboration means for them." Bruce Weinberg, GreenSTEM teacher.*

Building on the success of their construction-based Tech Geometry class, **Benson Polytechnic High School in the Portland Public Schools** spun up Tech Algebra, a class that applies math to a student-run business. This work has garnered significant support from industry partners and sponsors, and additional funding from the PGE Foundation. Tech Geometry has also gotten video coverage from KGW.

In **Garibaldi, the Neah-Kah-Nie School District's** goal is "to expand STEM classes and to continue to fill the 'gap' our students have in Science, Technology, Engineering, and Math". They addressed this goal through an afterschool program built on the foundations of a previous 21CCLC grant. Among other STEM and Career Exploration activities, retired Intel Engineer Mark Balmer spent 3 days teaching students about programming and circuit boards. Computer technology was also used to learn about nutrition.

In **Canby,** more than 70 At-risk students have participated in a Tiny House project that crosses curricular boundaries, incorporating math, science, construction, language arts and conflict management into the curriculum Here's a video explaining the genesis of the project; by the end of the academic year, significant personnel turnover had taken place, but students were still enthused and engaged.

The **Woodburn Afterschool** Club (WASC) collaborated with Pacific University and OregonASK to create new, culturally responsive curriculum and deliver 537 hours of staff training in STEM curriculum and pedagogy. This curriculum is aligned to Next Generation Science Standards, better connects what's happening afterschool to what is happening in-school, and has been well-received by staff (student results expected after July 31, 2015, but preliminary observations are positive.) An experienced pool of observers in a nationally recognized observation instrument, the Dimensions of Success developed by the Harvard PEAR Institute, has been one outcome of this grant that is likely to have a lasting impact. WASC is one of the longest-standing 21CCLC grantees in the state, so the STEM/STEAM/CTE grant was a force multiplier for federal dollars.

Treasure Valley Community College started both a multi-district Welding program and an Allied Healthcare Careers Program with great success: excerpted from remarks by Matt Hawley, Superintendent of the Vale School District, talking about fall parent teacher conferences with parents of students in the Pilot Welding Program:

"*I had three parents sitting next to me and the teacher in tears because of the program that these kids are now being provided. They could see the first glare of hope for their child achieving a high school diploma and possibly a welding certification that will project them into a possible AA degree of some sort. It was very moving to see these parents who had quit coming to conferences because everything they had heard over the past 6 or 7 years had been negative, and sit down and see them have hope for their child to actually have a living wage job. That is a success in education."*

Derek Morales – A senior at Ontario High School. One of our successful First Year Pilot Welding Program students.

"I really felt fortunate to be in this program. It is a great opportunity for students and young adults to learn the skills to make a living. What I liked most about the program is the hands on experience. You learn by doing. I plan to keep pursuing a degree in welding at TVCC and from there a degree in engineering."

Conclusions

This grant program has resulted in

- Expanded or new CTE Programs of Study and new courses which may become the foundations for future Programs of Study;
- New projects, programs, and courses better aligned to NGSS;
- New exemplars of STEM integrated across the curriculum;
- New exemplars of place-based STEM.
- New partnerships between education and community-based organizations, some of which resulted in additional private funding;
- Existing partnerships strengthened: 12 of 16 STEM/STEAM/CTE Activities grantees cite specific examples of improved collaboration with community partners, initiatives, industry, federal agencies, and postsecondary institutions;
- Improved relationships and understanding across educational sectors, e.g. community colleges to high schools;
- Leveraging of expertise and connections from the STEM Hubs;
- Increased educator confidence in teaching STEM and NGSS;
- New equipment and safer environments available for student learning;
- New curriculum, aligned to Next Generation Science Standards, in use.

Programs are doing good work with intentionality around inclusion, mapping and alignment to standards, and hands-on, minds-on student engagement.

Impact on Student Achievement and Closing Opportunity Gaps

Programs used a variety of strategies to address opportunity gaps, and many depend heavily on school and teacher knowledge of the target population. Culturally responsive programming and/or curricula were intentionally used with targeted partnering with community-based organizations experienced in working with an underserved or underrepresented population.

The projects have focused on thoughtful recruitment or prioritization of target populations and worked closely with inclusive programming in schools and/or districts with large target populations. Note that rural populations have fewer opportunities for STEM education than students in larger and more affluent districts, because much STEM education currently happens in voluntary, and sometimes costly, enrichment environments. One example of making programs more inclusive: the Jefferson County School District, in purchasing equipment for the Natural Resources CTE Program, specified lighter weight models, to make it more usable for those with smaller frames – girls, and in some cases, those who grew up with fewer physical and health advantages.

Translation of materials into Spanish was a priority for some projects, and leveraging national expertise in best practices including family engagement, diverse staff, role models, connection to additional support systems/programs was a main strategy for supporting underrepresented youth in these programs.

All of the programs had some degree of success at recruiting underserved populations, increasing student engagement and achievement, but much work remains to be done to bring these opportunities to scale. These programs constitute a good resource base for that work.

Sustainability

Most of these programs have planned for sustainability. These tended to use funds for start-up costs such as major equipment, NGSS integration and STEM curriculum development. These grantees plan to absorb ongoing costs into regular operations, perhaps supplementing with small grants.

A few had either optimistic sustainability planning or de-railing surprises such as school closure. It may be possible to capture knowledge and outputs, such as curricular materials, in the local STEM Hub or a state-wide online repository so that even if programs do not continue, some of the investment will keep making a potential return.

Portland Community College was able to use work done under this grant and the Summer Advanced payment plan to leverage an additional $32K from the PCC Foundation to continue the work during Summer 2015.

Several of the grantees with successful programs have good track records obtaining grants, sponsorships and other funding, and will likely fold in lessons learned and products from this project into future projects (e.g., Woodburn, Foundation for Family Science and Engineering, Girls, Inc, OHSU, Saturday Academy, SMILE).

Those programs that have had more difficulty tend to have issues that revolve around personnel, such as upper administration changes, teacher changes, or inability to find qualified and willing candidates for part-time coordination or teaching jobs funded under the grants. For example, some schools attempting to create feeder CTE programs in middle schools were not able to find CTE endorsed candidates.