Oregon Learns

Time to Invest Seriously in STEM

Oregon STEM Employer Coalition

November 2012

Contents

Coalition Leadership

The Oregon STEM Employer Coalition is an employer-led advocacy effort in partnership with educators and others. Nearly 60 business and education leaders attended one or both of the two conferences (See p. 16) that created the STEM Coalition. These are the members of the Coalition steering committee.

Jill Eiland (Co-Chair), *Intel Corporation*

Eric Meslow (Co-Chair), *Timbercon*

Eileen Boerger, *CorSource Technology Group, Inc.*

Chris Brooks, *WebMD Health Services Group*

John Cimral, *Cambia Health Solutions*

Craig Hudson, *Garmin AT*

Dick Knight, *retired business executive*

Molly O'Hearn, *iovation*

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Summary Argument

Time to Act on STEM

The Oregon STEM Employer Coalition represents business employers and an array of partners in education. The STEM Coalition believes it is time for Oregon to get serious about greater investment in the STEM education disciplines (science, technology, engineering, and math). Oregon companies need a larger STEM-educated workforce but there is a gap between this need and the output of our education system. To meet that need Oregon must increase STEM attainment at all grade levels and double STEM postsecondary graduates. The economic impact (see box) justifies the investment.

By the Numbers: STEM Investment in Oregon

2X student proficiency

+

2X postsecondary graduates

=

$9 billion more personal income
$1.4 billion more public revenue
$389 million more General Fund revenue
62% reduction in per capita income gap

Why

Companies that compete through innovation depend on STEM postsecondary graduates. Whether in or out of scientific occupations, STEM graduates generate new ideas, new companies, new industries, and higher levels of productivity and value. They make more money than their non-STEM peers.

The Goal

Double student STEM proficiency in the K12 system by 2025, and in the same time frame double STEM postsecondary graduates. Similar focus and goal setting through the Engineering and Technology Industry Council (ETIC) helped Oregon higher education move towards doubling its engineering output. The ETIC model will work for a broader STEM effort.

The Economic Impact

Targeted investment to achieve the goal above would dramatically increase Oregon's overall personal income, public revenue, and General Fund revenue, and it would erase half of the gap between Oregon per capita income and the national average per capita income.

The Action Plan

The Coalition recommends that the Governor, the Oregon Education Investment Board, and the Legislature adopt aggressive STEM education goals and adopt funding strategies and policies to advance them in the 2013-15 budget. It also recommends that public schools and nonprofit organizations work with the business community on this agenda.

Coalition Role

The Coalition will advocate for this agenda with elected policymakers and it will work with all stakeholders to maintain and monitor STEM investments and outcomes.

It's Time to Step Up on STEM

Oregon must elevate science, technology, engineering, and mathematics (STEM) attainment from the earliest grades through postsecondary programs. Not just a bit but a lot.

That's the assessment of the Oregon STEM Employer Coalition. The Coalition was formed in April 2012 through the efforts of nearly 60 business and education leaders who advocate for stronger STEM education. Formation of this employer-led coalition underscores the urgency of this issue and the need to make STEM education an investment priority in Oregon's redesigned education continuum.

> *It's time to elevate STEM education and build Oregon's STEM capacity in concert with state education redesign.*

The STEM Gap

Coalition participants have reviewed data that confirm a significant STEM education gap in Oregon, a gap that they can see every day as employers. They know that innovation and productivity, which drive economic success, depend on strong STEM education. However:

- Oregon is failing to produce enough STEM graduates for the foreseeable future to fill demanding scientific and technical occupations and, in the near term, to replace retiring baby boomers in those fields.
- Too many of our high school graduates lack the foundation skills in math, science, and communication commonly required now in further education and in job responsibilities across the state's economy. STEM skills are essential in specialty fields, but also in further studies, work, and life.

The Solution

As a result, the Coalition recommends that the state begin a long-range effort to achieve a challenging STEM goal in two parts:

1) By 2025, double the percentage of Oregon's 4th and 8th graders who are "proficient" and "advanced" in math and science as measured by the National Assessment of Educational Progress.

2) By 2025, double the number of Oregon STEM postsecondary graduates.

As the first step in that effort, with assistance from ECONorthwest, the Coalition has developed this document, which spells out the need to elevate STEM education and build Oregon's STEM capacity in concert with state education redesign now taking place.

This document makes the case for stronger STEM education in Oregon, especially in terms of return on investment. It fleshes out the goal for STEM in student outcomes. It characterizes current STEM efforts and describes the strategic principles to elevate STEM within the broader education reforms being implemented under Oregon Learns. Most importantly, it positions STEM as a worthy, focused investment in the state's 2013-15 education budget.

The Case for STEM

Debt-financed consumption has proved to be an unsustainable model for the Oregon and US economies. To get back on a path of long-term prosperity in the global economy, we need long-term growth — high-quality jobs and higher incomes. Looking forward, economists see exports to the emerging consumer economies of China, Brazil, and India as a promising strategy for long-term growth.

STEM for Economic Competition

Boosting exports requires diverse, thriving clusters of traded-sector industries that are global leaders in innovation. For decades, however, the US has seen low- and middle-income traded-sector jobs move overseas into emerging economies with lower labor costs. As other nations continue to produce large pools of highly skilled and educated workers, we will face increasing competition for our higher income jobs as well.[1] To reverse this trend, the US—and Oregon—must invest in raising the skills and knowledge of its workers, particularly in science, technology, engineering, and mathematics (STEM).[2] STEM workers determine the long-term growth trajectory of our nation's innovation and competitiveness by generating new ideas, new companies, new industries, and higher levels of productivity and value.

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STEM for Higher Incomes

STEM graduates and workers also add value to the economy through higher lifetime earnings. On average, workers in STEM occupations earn about 25 percent more than workers in non-STEM occupations, with the largest differences among workers with less education (see Table 1). Moreover, all STEM graduates receive a wage premium relative to non-STEM graduates, whether they have a STEM job (19 percent premium) or not (12 percent premium). These higher wages for STEM workers and graduates are good for individuals and families, but also the public sector. Higher per capita income leads to a larger tax base, with more dollars available for investments in public services.

Table 1. Average Hourly Earnings for STEM and Non-STEM Workers

	STEM job	Non-STEM job	% difference
High school diploma or less	$24.82	$15.55	60%
Some college or associate degree	$26.63	$19.02	40%
Bachelor's degree only	$35.81	$28.27	27%
Graduate degree	$40.69	$36.22	12%

Notes: Includes full-time private wage and salary workers. STEM jobs include 50 occupations in computer science and math, engineering, life and physical sciences, and management. Education, health care, and social science jobs are excluded.
Source: ESA calculations using Current Population Survey public-use microdata. Beede, D. & Langdon, D. "Understanding and Expanding the STEM Workforce." Economics and Statistics Administration, U.S. Department of Commerce.

The STEM Challenge

Compared with other countries, STEM achievement and attainment in the US has been lagging for years. As measured by the Program for International Student Assessment (PISA), we rank 26th in math scores and 13th in science scores.[3] Fewer than 40 percent of US students are proficient in math and science.[4] And STEM degrees represent about one third of bachelor's degrees in the US, compared with half of degrees in Japan, China, and Singapore.[5] The US needs to increase its number of STEM graduates by more than 30 percent to stay competitive in STEM-related industries and markets.[6]

Oregon's P20 education system is currently not producing enough STEM graduates needed by Oregon employers to fill new openings and to replace retiring baby boomers (see Figure 1).

Oregon's P20 education system is currently not producing enough STEM graduates needed by Oregon employers to fill new openings and to replace retiring baby boomers.

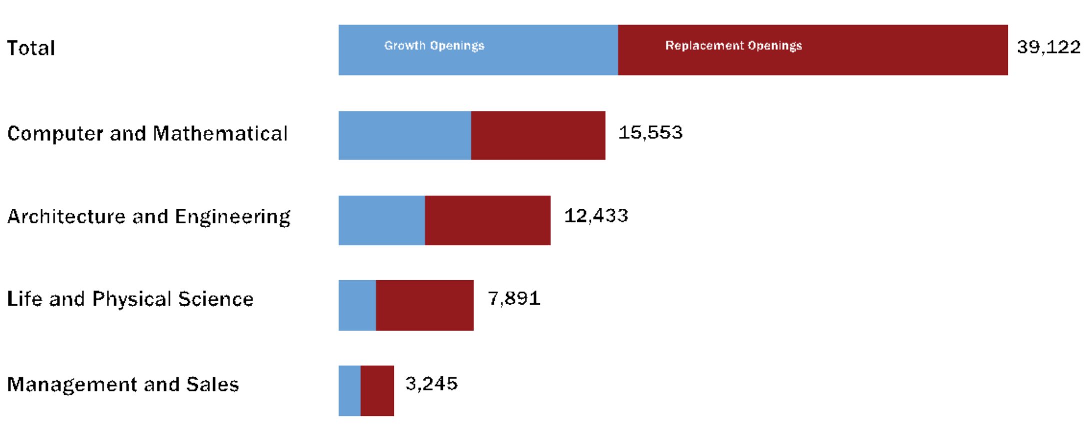
Too long, Oregon has been relying on imported STEM talent. According to ECONorthwest analysis, non-native STEM college graduates outnumber native STEM graduates 3:1.

Oregon needs to grow, attract, and retain STEM graduates. While this includes STEM workers with advanced degrees, workers at all levels of production need a more solid foundation in math, science, and communication abilities.[7]

Other states have demonstrated that progress is possible. For example, Massachusetts improved its average NAEP math scores for 4th and 8th graders by about 12 points from 2003-2011, compared with Oregon's 2-point improvements on the same tests.[8]

STEM skills and degrees are key to driving innovation and boosting productivity. Strategic investments in STEM education in Oregon are required to lift the math and science skills of younger learners, expose students to exciting STEM careers, and ensure access and affordability of degree attainment.

Figure 1. STEM Occupations in Oregon: 2010-2020



Source: Oregon Employment Department

Note: Includes 77 occupations (see appendix for list). Does not include education, social science, or health care occupations.

Oregon STEM Goal

Never has education been more important to the lives and fortunes of Oregonians and our communities. Our educational attainment rates aren't rising as fast as they need to, and persistent achievement gaps continue to challenge educators and policymakers.

A high-quality math and science education is essential for the success of all students, not only those who graduate with a STEM degree.

The Larger State Goal

The 2011 Oregon Legislature addressed these challenges and opportunities head on, passing the most ambitious package of education reforms in 20 years. The goal: By 2025, we must ensure that 40 percent of adult Oregonians have earned a bachelor's degree or higher, that 40 percent have earned an associate's degree or postsecondary credential, and that the remaining 20 percent or less have earned a high school diploma or its equivalent. These targets are known as the "40/40/20" goal. Governor Kitzhaber and the Legislature have set in motion the needed transformation by creating the Oregon Education Investment Board (OEIB) and charging it to ensure that educational dollars are applied where they do the most good for student success.

The Role of STEM

STEM education will play a key role in Oregon's efforts to reach 40-40-20. As discussed above, a high-quality math and science education is essential for the success of *all* students, not only those who graduate with STEM degrees. Competencies acquired through STEM education—basic math and computer skills, problem solving, spatial awareness—are needed in a broad range of occupations and industries.

But increasing the number of STEM graduates is just as important: the contributions of STEM innovators will propel the Oregon economy toward long-term competitiveness. Companies across industry lines, from high technology to wood products, from service providers to tourism and government, rely on engineers, computer scientists, and knowledge workers to keep their enterprises competitive and profitable.

STEM Goal

In sum, STEM degrees and competencies are required for long-term growth and innovation. With this in mind, more than 40 Oregon business and education leaders convened on February 28, 2012, and developed a STEM goal for Oregon in two parts:

1) By 2025, double the percentage of Oregon's 4th and 8th graders who are "proficient" and "advanced" in math and science as measured by the National Assessment of Educational Progress.

2) By 2025, double the number of Oregon STEM postsecondary graduates.

Similar focus and goal setting through the Engineering and Technology Investment Council (ETIC) helped Oregon higher education double its engineering output. The ETIC model will work for a broader STEM effort.

The STEM goal will complement the state's 40-40-20 goal and efforts while providing needed focus on STEM achievement and progress.

Economic Return on STEM Investment

Governor Kitzhaber has set a goal of raising Oregon's per capita income to the US level or higher. Achieving these STEM goals would make a major contribution to the income goal.

To illustrate the potential, consider the plausible long-run economic impacts if Oregon were able to match, and sustain, math proficiency at the levels measured on the National Assessment of Educational Progress (NAEP) for 4th graders in Massachusetts in 2011. Massachusetts' 4th graders outperformed Oregonians by 16-scale points (253 to 237) in math—or 0.57 of a standard deviation. An analysis of the relationship between achievement and earnings suggests that such a shift in elementary test scores would increase long-run state earnings by more than 6 percent.[9]

- Measured on today's base, that would represent a $9 billion increase in personal income annually.
- Personal income per capita would increase from $37,909 to $40,243 (see Figure 2.) —erasing over 60 percent of the existing difference with the U.S. average.
- State and local government general tax and fee revenue would increase by $1.4 billion annually.
- State general fund revenue would increase by $389 million annually.

Oregonians might expect an even higher return. The stated goal of doubling the share of Oregon students deemed proficient in math likely would move Oregon past Massachusetts' current achievement levels. On the other hand, high expectations should be tempered by the understanding that long-run impacts would also depend on broader economic changes, the demand for STEM labor, and the migration of people and firms.

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- *$9 billion more personal income*
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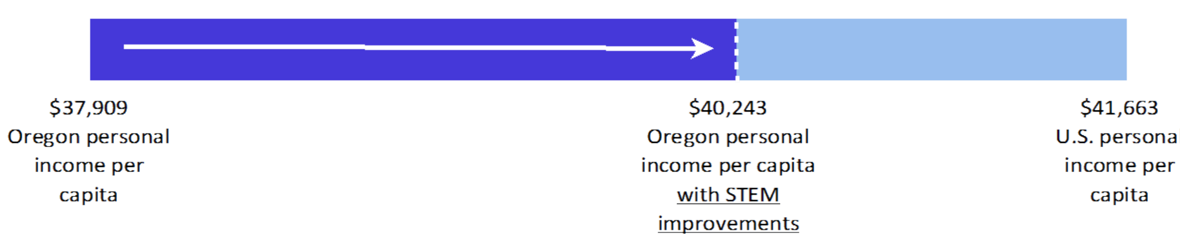
- *62% reduction in per capita income gap*

Figure 2. How stronger STEM education would help close Oregon's per capita income gap.



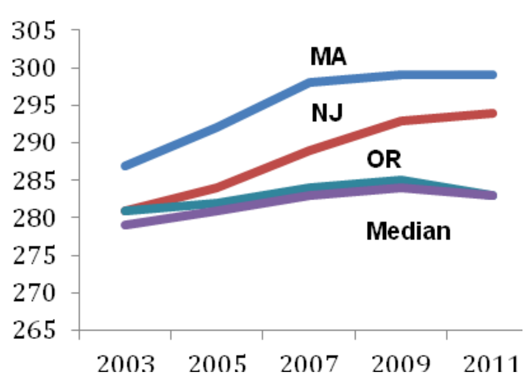
Current STEM Conditions

Oregon's approach to STEM education needs to account for how the state is already doing. This section highlights how Oregon's performance on standardized tests compares with national scores, and takes a "deep-dive" look at the Oregon high school class of 2006 and its attainment of STEM degrees as of 2011.

Middling NAEP Performance

During 2003-2011, Oregon students showed little progress in math and science proficiency as measured by the National Assessment of Educational Progress. While Oregon's experience was typical for the nation, a small number of leading states—including Massachusetts and New Jersey—made significant gains over that period. A comparison with New Jersey on 8th grade mathematics is particularly telling. In 2003, average scores were an identical 281. By 2011, New Jersey students scored 294 compared with Oregon's 283 (see Figure 3).

Figure 3. Over the past eight years, Oregon's gains in eighth grade NAEP math scores have badly trailed leaders such as Massachusetts and New Jersey.



Weak AP Scores

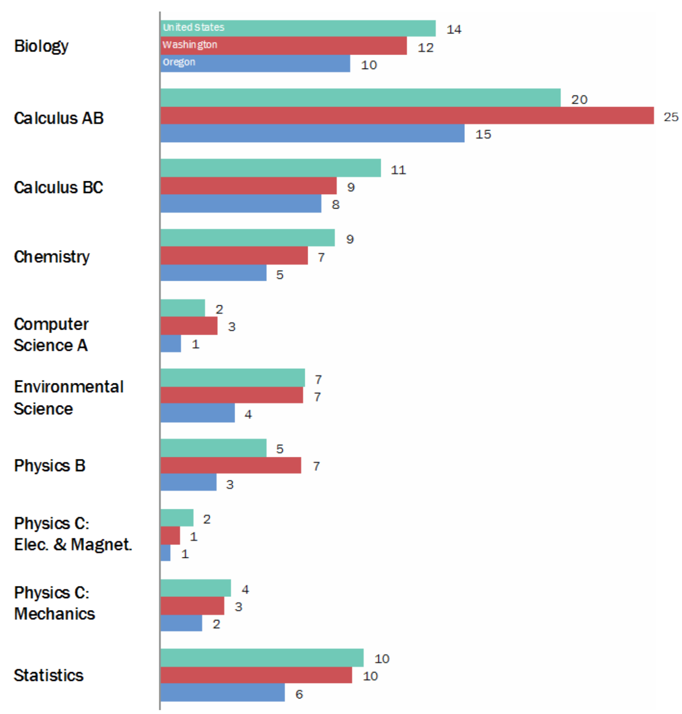
Another performance indicator is the distribution of Advanced Placement (AP) exam scores in STEM-related subjects. Here, Oregon doesn't fare well either. The state produces fewer high AP scores per capita than the U.S. and Washington on every STEM subject (see Figure 4). For example, 15 out of every 1,000 18-year-olds in Oregon score a 4 or 5 on the Calculus AB exam; the corresponding numbers for Washington and the U.S. are 25 and 20 students per 1,000, respectively.

Low STEM Degree Output

A detailed look at the Oregon high school class of 2006 reveals that, five years after high school graduation, only 2 percent of students had received a STEM degree (17 percent had received degrees of any kind; see the appendix for the definition of a STEM

Figure 4. How do Oregon students fare on STEM-related Advanced Placement exams?

Number of high scores (4s and 5s) per 1000 18-year-olds



Source: ECONorthwest analysis of College Board and Census data.

degree). Figure 5 illustrates the various points at which potential STEM graduates move onto other pathways. By 2011, 10 percent of the 2006 class had not yet graduated from high school, and 83 percent of the class had not yet received any type of postsecondary degree.

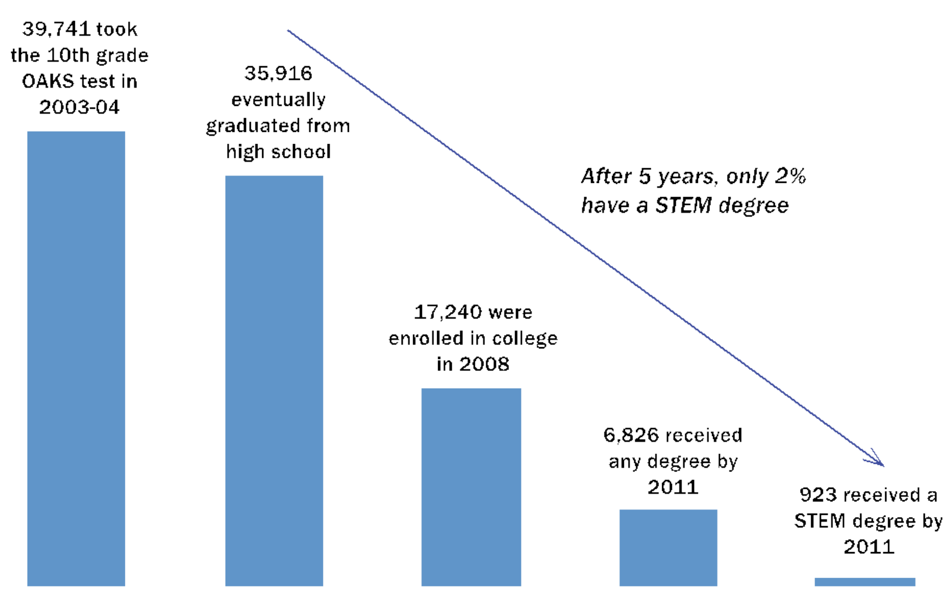
We can also look at the characteristics of STEM graduates. On average, they have above-average math and science scores on Oregon's 10th grade standardized test (OAKS) (see Figure 6). Of members of the 2006 class with college degrees by 2011, STEM graduates have a median OAKS score of 504 and non-STEM graduates have a median score of 485.

Some groups of students are disproportionately represented among STEM graduates (see Figure 7). For example, 60 of every 1,000 Asian members of the 2006 graduating class completed a STEM degree by 2011, compared with only 3 out of every 1,000 Hispanic students. STEM graduates are also likely to be economically stable: only 7 of every 1,000 economically disadvantaged students had a STEM degree in 2011.

If only 14 percent of Oregon's top math and science students are earning STEM degrees five years after high school graduation, what are the rest of those students doing?

Perhaps the key question is, if only 14 percent of Oregon's top math and science students are earning STEM degrees five years after high school graduation (see Figure 8), what are the rest of those students doing? If the class of 2006 is any indication, nearly one third are receiving non-STEM degrees or certificates, another 30 percent are still enrolled in two- or four-year institutions, and about 27 percent are not enrolled in school.

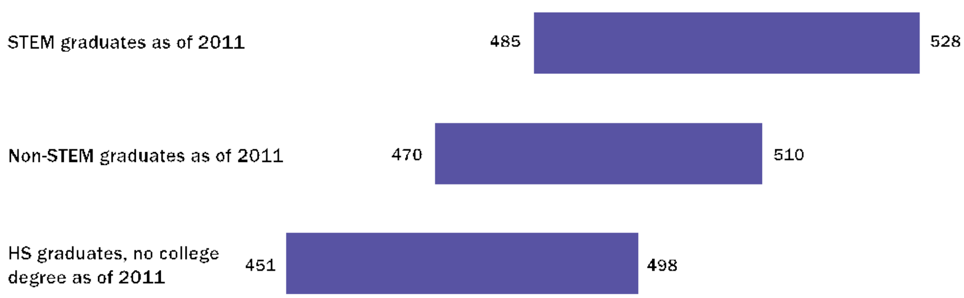
Figure 5. What happened to the Oregon high school class of 2006?



Source: ECONorthwest analysis of ODE and National Student Clearinghouse data.

Figure 6. What does it take to become a STEM graduate?

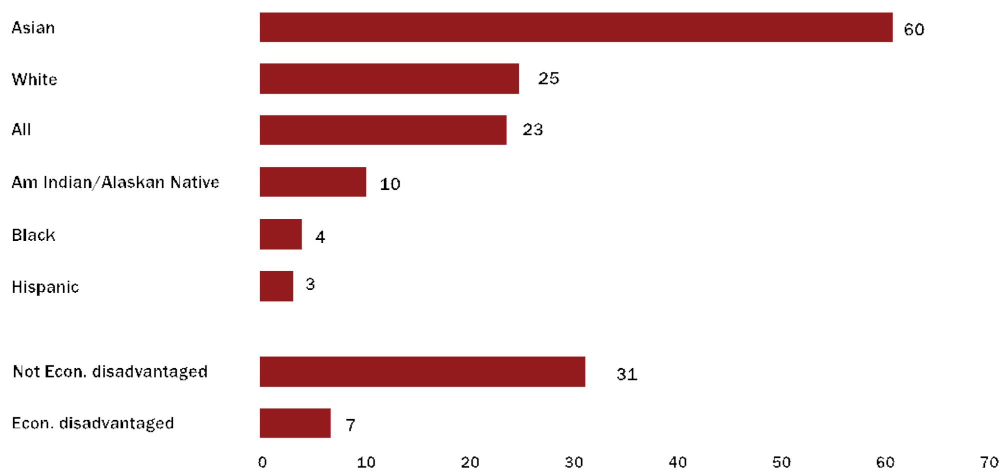
10th-90th percentile scores shown (Combined math and science scores on Oregon's 10th grade standardized test.)



Source: ECONorthwest analysis of ODE and National Student Clearinghouse data.

Figure 7. 2011 STEM graduates.

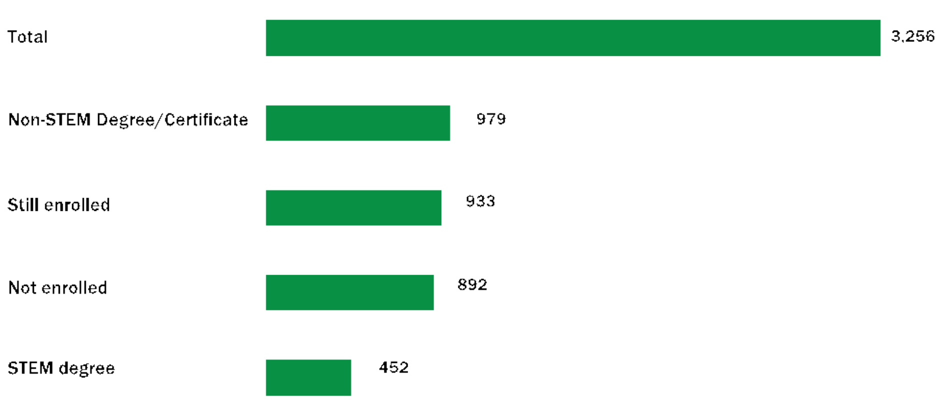
per 1,000 2003-04 10th Graders, by Race/Ethnicity and Income



Source: ECONorthwest analysis of ODE and National Student Clearinghouse data.

Figure 8. What happened to Oregon's top science and math graduates from the class of 2006?

2011 status of students with combined math and science scores of 504 on the 2003-04 10th grade test.



Source: ECONorthwest analysis of ODE and National Student Clearinghouse data.

STEM Investment Principles

In shaping Oregon's STEM investments to achieve the two key goals proposed in this paper, proponents should adhere to a framework of key strategic principles that parallel Oregon's broader redesign of education. With sufficient funding and smart implementation, this framework will result in more STEM graduates and increased STEM competencies for all students. The principles described below are highly interrelated and in some cases interdependent.

STEM proponents should adhere to a framework of key strategic elements – or criteria – that parallel Oregon's broader redesign of education.

1. Define Outcomes as the Basis of all STEM Investments

As Oregon moves from enrollment-based payments in education to investing in outcomes, it should assign specific value to STEM education across the P20 continuum and make long-term, outcome-oriented investments accordingly. In particular, the orientation to targeted outcomes should be an overriding factor in all STEM education investments. For example, investments in STEM degree production might well be focused on degrees that align with forecasted employment demand.

2. Focus Investments on Students and a Seamless, Aligned Path

In Oregon's transformed education system, students will matter more than institutions, and diversified pathways will provide all students with opportunities to progress to college and career readiness. There will be unity and consistency in standards, budgets, and curriculum throughout the P20 continuum, and information will flow freely between stakeholders through a shared data system. Course curriculums will be aligned from elementary through the college years, and postsecondary educators will receive comprehensive transcripts that provide rich descriptions of students' content knowledge and activities (in addition to grades and scores).

3. Invest in Effective STEM Teaching at Larger Scale

Excellent teachers are key to Oregon's STEM strategy, and Oregon has many excellent STEM teachers. However, Oregon will need many more of them. In particular, the state must produce more teachers with STEM degrees and it must raise the STEM competencies of teachers in general. How the state prepares, recruits, compensates, trains, evaluates, and develops more STEM teachers and others along these lines will shape the quality of STEM education for the next several decades.

The OEIB should invest in a coherent, focused, and sustained effort to encourage the hiring of STEM-trained teachers for STEM subjects. Moreover, Oregon should invest in in-service professional development support for STEM teachers to achieve and sustain a range of best practices, including professional learning communities and proficiency-based teaching and learning, discussed further below.

4. Make STEM Investments in Student Proficiency, Not Seat Time

In outcomes-oriented education investment, student proficiency rather than seat time must be the focus of teaching and learning. STEM is no exception. In STEM education students should be afforded the opportunity to learn and demonstrate proficiency at their own best pace, and teachers should have time to collaborate with other educators and improve their practices to foster student proficiency. In a proficiency-based classroom, students assume more responsibility for their own progress, so good learning habits and frequent assessment of progress become more important than content delivery methods.

Statewide STEM proficiency also depends on an effective system of standards and assessments that can be adapted to various pathways. Oregon's K12 system has adopted a set of core standards,[10] but these have yet to be linked to postsecondary standards. The state needs to ensure that schools at all levels are using high-quality math and science assessments.

5. Show Students the Relevance, Payoff, and Excitement of STEM Studies to Attract and Retain Them

Oregon's STEM strategy must tap the intrinsic motivation of learners by generating interest and excitement around STEM topics and careers, and dispelling myths that prevent students from completing STEM degrees. Today, fewer than 40 percent of students who enter college intending to graduate in a STEM major actually do so.[11]

Educators, institutions, and parents need to communicate to students the relationship between effective math and science education and future success, regardless of one's field of study or work.[12] Educators need to be supported in creating innovative, empirically validated learning environments that engage and inspire students from all backgrounds. Hands-on experience and informal learning opportunities beyond the classroom can help spark and sustain students' interest in STEM topics and careers.

High schools should apply better teaching methods, supported by counseling and complementary STEM extracurricular activities. Colleges should offer smaller class sizes, math courses customized to the needs of students in specific STEM majors, better teaching methods, and extracurricular activities that better connect STEM students to each other and to faculty.

6. Provide Students Affordable and Equitable Access to STEM Programs

Not only must Oregon raise the STEM skills and aspirations of its students, it must do so in particular with underrepresented groups. All students—not just those from certain backgrounds or types of schools—need to achieve higher levels of learning in STEM areas. Research shows that talented, low-income students are underrepresented and fall farther behind at virtually every stage along the educational continuum.[13] And women and minorities earn only 45 percent of STEM degrees, despite constituting about 70 percent of college students.[14]

Oregon community colleges and universities have already made progress in a variety of ways on the challenge of serving a new generation of minority and nontraditional students, but equity and demographic projections demand that these efforts remain a central part of the state's STEM strategy. The state should invest in scholarships for talented, low-income students—for challenging enrichment activities in high school (e.g., summer programs), and bachelor's, master's, and doctoral programs in STEM areas.

Finally, a coherent STEM strategy should address any lack of technological resources and infrastructure in rural and low-income areas.[15]

7. Expand Postsecondary Course Capacity for STEM Studies

STEM courses, particularly upper division undergraduate courses, are more expensive to offer than many others. Some STEM programs in Oregon have restrictions on how many students can move from the sophomore level to the junior level. In other cases students are allowed to continue their studies but have trouble registering for the classes they need because they are offered infrequently or fill quickly. These problems force well qualified students to change majors, take longer to graduate or change universities. Enhancing capacity at the upper division level would increase the number of students who successfully complete STEM degrees in Oregon. The same argument holds for graduate STEM programs.

Next Steps

Given the goal and strategic principles for STEM attainment identified above, proponents envision the need to restructure STEM related education across the P20 continuum.

This should be done in concert with Oregon's broad redesign of public education and with strong partnership and active engagement of the business community.

The most urgent next steps in this effort are to:

- Adopt the aggressive two-part STEM goal outlined in this document:
  - By 2025, double the percentage of Oregon's 4th and 8th graders who are "proficient" and "advanced" in math and science as measured by the National Assessment of Educational Progress.
  - By 2025, double the number of Oregon STEM postsecondary graduates.
- Develop the STEM strategy outlined in this paper.
- Convert the strategic principles outlined here into a specific investment strategy with discrete investment targets.
- Request that the Governor incorporate the two-part STEM goal, a STEM investment strategy, and specific STEM investment targets in his 2013-15 budget.

The Governor should incorporate the two-part STEM goal, a STEM investment strategy, and specific STEM investment targets in his 2013-15 budget.

The STEM Coalition

The Oregon STEM Employer Coalition is based on a draft charter that employers adopted April 20, 2012, at the second of two extensive conferences involving nearly 60 business and education leaders. The Coalition's stated mission is "to mobilize private sector leaders to advocate for actions by Oregon's public, private and non-profit institutions" to achieve the STEM outcomes described earlier.

The Coalition is a voluntary advocacy association of employers operating under the umbrella of the Oregon Business Council. Although it is not a separate legal entity, does not have fixed membership, and does not assess dues, it does have a leadership structure in the form of a steering committee, and its participants contribute financial and in-kind resources. So far, 38 companies have signed on to participate.

With significant startup donations from Intel, Timbercon, Inc., Portland General Electric, PHTech, and Google, the Coalition is well on its way to securing funding for its work.

That work includes:

- Advocating for ambitious STEM goals.
- Collaborating with state leaders and other businesses to develop a comprehensive STEM strategy that prioritizes targeted state investments.
- Facilitating and ensuring coordination and alignment of public (e.g. OEIB) and private STEM investments.
- Cultivating private sector champions for STEM and coordinate volunteer efforts of employer representatives on key committees, etc.
- Monitoring progress including progress on goals and employer satisfaction.

Definition of STEM

Occupations counted in Figure 1. Does not include social science, health care, or education occupations.

STEM Occupations in Oregon

Occupation Group, SOC Code, and Title

Management Occupations
11-3021 Computer and Information Systems Managers
11-9041 Engineering Managers
11-9121 Natural Sciences Managers

Computer and Mathematical Science Occupations
15-1011 Computer and Information Scientists, Research
15-1021 Computer Programmers
15-1031 Computer Software Engineers, Applications
15-1032 Computer Software Engineers, Systems Software
15-1041 Computer Support Specialists
15-1051 Computer Systems Analysts
15-1061 Database Administrators
15-1071 Network and Computer Systems Administrators
15-1081 Network Systems and Data Communications Analysts
15-1099 Computer Specialists, All Other
15-2011 Actuaries
15-2031 Operations Research Analysts
15-2041 Statisticians
15-2091 Mathematical Technicians
15-2099 Mathematical Scientists, All Other

Architecture and Engineering Occupations
17-1021 Cartographers and Photogrammetrists
17-1022 Surveyors
17-2011 Aerospace Engineers
17-2021 Agricultural Engineers
17-2031 Biomedical Engineers
17-2041 Chemical Engineers
17-2051 Civil Engineers
17-2071 Electrical Engineers
17-2072 Electronics Engineers, Except Computer
17-2081 Environmental Engineers
17-2111 Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
17-2112 Industrial Engineers
17-2121 Marine Engineers and Naval Architects
17-2131 Materials Engineers
17-2141 Mechanical Engineers
17-2151 Mining and Geological Engineers, Including Mining Safety Engineers
17-2199 Engineers, All Other
17-3011 Architectural and Civil Drafters
17-3012 Electrical and Electronics Drafters
17-3013 Mechanical Drafters
17-3019 Drafters, All Other
17-3021 Aerospace Engineering and Operations Technicians
17-3022 Civil Engineering Technicians
17-3023 Electrical and Electronic Engineering Technicians
17-3024 Electro-Mechanical Technicians
17-3025 Environmental Engineering Technicians
17-3027 Mechanical Engineering Technicians
17-3029 Engineering Technicians, All Other
17-3031 Surveying and Mapping Technicians

Life, Physical, and Social Science Occupations
19-1011 Animal Scientists
19-1012 Food Scientists and Technologists
19-1013 Soil and Plant Scientists
19-1021 Biochemists and Biophysicists
19-1022 Microbiologists
19-1023 Zoologists and Wildlife Biologists
19-1029 Biological Scientists, All Other
19-1031 Conservation Scientists
19-1032 Foresters
19-1041 Epidemiologists
19-1042 Medical Scientists, Except Epidemiologists
19-1099 Life Scientists, All Other
19-2012 Physicists
19-2021 Atmospheric and Space Scientists
19-2031 Chemists
19-2032 Materials Scientists
19-2041 Environmental Scientists and Specialists, Including Health
19-2042 Geoscientists, Except Hydrologists and Geographers
19-2043 Hydrologists
19-2099 Physical Scientists, All Other
19-4011 Agricultural and Food Science Technicians
19-4021 Biological Technicians
19-4031 Chemical Technicians
19-4041 Geological and Petroleum Technicians
19-4061 Social Science Research Assistants
19-4091 Environmental Science and Protection Technicians, Including Health
19-4092 Forensic Science Technicians
19-4093 Forest and Conservation Technicians
19-4099 Life, Physical, and Social Science Technicians, All Other

Sales and Related Workers
41-9031 Sales Engineers

Notes:
STEM stands for Science, Technology, Engineering, and Math
This list is based on the 2000 federal SOC

In Figures 4-8, STEM degrees are defined by majors in the following categories:

- Biological and biomedical sciences
- Computer and information sciences
- Engineering and engineering technologies
- Mathematics and statistics
- Physical sciences and science technologies

Source: US Department of Education, National Center for Education Statistics, *Digest of Education Statistics, Table 249-252*.

STEM Conference Participants

February 28, 2012

Sonja Andrews, *Oregon State University*
Larry Bekkedahl, *Bonneville Power Administration*
Chris Brooks, *WebMD Health Services Group*
Dick Burnham, *Hoffman Corporation*
Ben Cannon, *Governor's Office*
Aubrey Clark, *Intel Corporation*
Lita Colligan, *Oregon Institute of Technology*
Jill Eiland, *Intel Corporation*
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Mike Holtzclaw, *Central Oregon Community College*
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Art Johnson, *KPFF Consulting Engineers*
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Nick Konidaris, *Electro Scientific Industries*
Rob Krueger, *FEI Company*
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Dorothy Waller, *Governor's Office*
John Willis, *CH2M Hill*
Duncan Wyse, *Oregon Business Council*
Craig Zemke, *Jeld-Wen*

End Notes

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