STEM – Communications and Advocacy Subcommittee

MEMBERS: Eric Meslow (Chair), Aubrey Clark, Dwayne Johnson, Jim Piro,

January 9, 2014
10:00pm - 12:00pm
University Technology Services Building, Room 503
Portland State University
2125 SW 4th, Portland, OR 97201

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AGENDA

1. **Background & Introductions**

2. **Goals & Charge of the subcommittee**

3. **Overview of other efforts**

4. **Work plan & timeline**

5. **Challenges and perceptions**

6. **Key stakeholders**

7. **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.

Why STEM Matters - Complementary Perspectives

1) Jobs Pipeline - STEM is about filling current high-demand jobs in STEM fields. Often this is translated to mean high-tech, engineering, computer science, and scientific research. Also included is a focus on "big data", analysis, and sophisticated algorithms and modeling. For those in CTE, it's about high-tech manufacturing, utilities, agribusiness, and trades. Seldom is health care or natural resources management included, though momentum is growing to include these in the conversation. A rapidly changing jobs market also requires individuals to be adaptable, critical thinkers, with the ability to collaborate and communicate well using "21st Century Skills."

2) Equity & Social Justice – STEM is a social justice issue. There is a broad societal perception of STEM as being "exclusive"—primarily the domain of upper middle-class white males who are "gifted and talented." STEM literacy creates family-wage earning opportunities that have the potential to break the cycle of poverty. Yet, our non-Asian students of color are scoring less than half of their white counterparts on standardized tests in Oregon. STEM is a passport to opportunity, but lack of STEM literacy is a major barrier.

3) Economic Competitiveness – The argument here is that we need not just to fill jobs, but also create them. With the rapidly growing influence of China, India, Brazil, and South Asia in the world economy, the US is finding it more difficult to compete in technical jobs that require mostly just "content knowledge." However, the US has historically had a competitive advantage in research and bringing ideas to market to drive economic growth. Therefore, investing in a strong STEM research agenda, that will spin-off and support local industries is critical.

4) Innovation & Creativity – The world is changing rapidly and requires individuals, organizations, and industries to adapt and innovate. The heart of innovation is imagination, creativity, entrepreneurship, and the ability to both see possibilities and act upon them. Innovation flourishes at the boundaries and intersection of disciplines, cultures, and ideas. STEM pursuits are naturally integrative and have a strong creative aesthetic—though many outside of STEM do not recognize this. Human centered design is a flourishing field which often combines the arts with engineering. Hence, many make the case for adding "Arts" to the acronym to get STEAM.

5) Transforming Education— STEM in K-12 education is seen a requiring a hands-on, project-based approach with authentic demonstrations of proficiency. Rich, "contextual" questions and explorations, often alongside STEM professionals, are becoming more common. CTE and "academic" courses are beginning to blend. These approaches dramatically increase student engagement and are seen as a model for breaking down other silos within the formal school system. Out-of-school STEM opportunities are also valued and are seen to complement the formal learning environments. Additionally, a STEM mindset encourages challenging assumptions, which is essential to drive transformations in education.

6) Individual Prosperity – STEM jobs pay significantly more than non-STEM jobs, especially if one has a post-secondary degree or credential. Having STEM skills opens doors to opportunity as well as increasing one's ability to adapt to an evolving and dynamic job market.

7) Informed Citizenry & Societal Participation - An increasingly complex, technologically-rich, global society requires STEM skills to fully participate and to be an informed citizen. Most traditionally-defined non-STEM jobs require significant STEM literacy and skills. This includes navigating social media, ability to search and discern data sources, analytical skills to interpret

graphs and statistics, and knowing how to use a variety of appropriate technology to address different needs.

8) National Security – With new technology threats to national security are related to issues such as cyber-security, nano-technology, bio-chemical technologies, and advanced weaponry. Gifted STEM talent is necessary to push the boundaries of these technologies and protect our society as well as intellectual property.

9) Improving the Human Condition — Throughout the millennia, advances in STEM have enabled humanity to gather and preserve food, provide shelter, protect communities, settle new lands, combat disease, create works of art and architecture, etc. Increasingly our societal issues have grown exponentially in complexity. Understanding complex human and environmental systems are required to be able to address global issues such as food security, energy, environmental sustainability, overpopulation, health, economic interdependencies, and more…

Connect Education to Careers

(OBC Discussion Draft 13– 10/14/14)

Why This Is Important

Degrees and certificates associated with science, technology, engineering and math (STEM) are in high demand throughout the Oregon economy. Preparing more Oregonians for high-demand, well-paying jobs will expand the personal potential of individuals, keep Oregon's companies and economy more competitive, raise family incomes, strengthen the middle class, promote equity, and reduce poverty.

Quality STEM education engages students in meaningful, applied learning that connects academic content to real world situations. Research shows that hands-on, project-based learning approaches in STEM and Career Technical Education (CTE) dramatically improve graduation rates—essential to achieving our goal of 100% high school graduation by 2025. These hands-on and minds-on approaches promote cognitive skills such as critical thinking, creative problem solving, logical reasoning, and curiosity fundamental to becoming life-long learners. The applied nature of STEM also fosters additional college and career readiness skills such as collaboration, communication, perseverance, and personal responsibility.

At its core, the STEM movement in Oregon is about economic prosperity for individuals and communities. Far too many skilled job openings in the Oregon economy are either going unfilled or are filled by out-of-state applicants because not enough Oregonians have the math, science, and applied technical education required. This is costly to our enterprises, our economy, our tax base, and to our citizens. In particular, it represents a lost opportunity to put many Oregonians on a path from poverty to prosperity.

The skills gap is costly to the economy, the education system, and individuals.

- Too many jobs are going unfilled in Oregon because of skill shortages, forcing employers to import talent. The shortages are acute in degrees relating to science, engineering, math and technical education, as well as many CTE fields.
- The increasing pace of change in job market and industry skill needs is outstripping the education system's ability to respond.

Oregon's economy depends on STEM/CTE jobs.

- STEM jobs are growing at two to three times the rate of non-STEM jobs in Oregon and this growth is projected to continue into the foreseeable future.
- Innovation and entrepreneurship in STEM fields is a fundamental stimulus for economic growth and competitiveness.
- Oregon's economy is dependent upon a diverse and dynamic set of STEM- and CTE-dependent industries including: bio-medical, high tech, computing and software development, civil and mechanical engineering, manufacturing, precision agriculture, advanced food processing, natural resources management, construction, etc. Sectors are competing for the same talent in some areas: computer science, electrical and mechanical engineering, and systems engineering.

Individual equity and prosperity depend on STEM/CTE literacy.

- Far too many students are unprepared for postsecondary education, as evidenced by the high numbers needing to take remedial mathematics.
- Students of color and women are severely underrepresented in STEM fields. In addition to the moral imperative, the diversity of talent and perspectives from these groups would spur additional innovation.
- Less than 20% of students of color are "proficient or advanced" in mathematics and science at 4th and 8th grade as measured by the NAEP (National Assessment of Educational Progress). This limits their ability to compete for higher-wage jobs that can break the cycle of poverty.
- In a complex, technology-rich society, STEM literacy is essential beyond relevance to jobs. An educated citizenry is better prepared to deal with global warming, energy resourcing, security, and other key issues.

Key Outcomes

- Double the number of 4th and 8th grade students proficient in math and science by 2025.
- Double the number of STEM degrees and certificates by 2025, aligned with industry and economic development needs.
- Increase representation of women and students of color in STEM.
- Increase attendance and graduation rates.
- Increase employment of Oregon graduates in Oregon STEM jobs.
- Increase college readiness as evidenced by reductions in need for remedial mathematics.

Barriers

- Workshop and lab infrastructure for CTE and STEM courses has been dismantled and neglected over the past 15 years.
- STEM has a perception problem--widely seen as accessible for academically successful, university-bound, white males.
- CTE has a perception problem--widely viewed as an inferior pathway to that of a four-year degree.
- Many of the programs that produce these degrees/certificates are high cost, and the current funding formulas do not compensate for these higher cost programs.
- Too many students do not see the relevance of what they are learning in their formal education classes to their future lives beyond school.
- There are only 26 high schools in Oregon offering computer science courses.
- We tend too often to think of education pathways in terms of programs rather than integrated systems. A program mentality results in fragmented efforts and outcomes.
- Not enough teachers have sufficient training and experience to teach STEM subjects in a rich, contextual, integrated way.
- The CTE educator workforce is aging out of the system.
- Connections between industry and education are ad hoc and uncoordinated.

What Will Be Required

Meeting these goals will require creation of dynamic education and training delivery throughout Oregon with the following characteristics:

- A wide range of experiences available year-round and throughout the community to spark student curiosity and interest in science and math and to blend academic and applied learning.
- A set of standards, assessments and instructional practices in math and science from early grade levels through postsecondary education that allow each student to learn key concepts thoroughly at his or her own pace.
- Clear definitions for the knowledge and skills to needed to pursue specific STEM careers and opportunities for students to explore those careers through jobs shadows, internships and in other ways.
- Documentation of learning wherever it occurs through a Personalized Achievement Record, which will also be a tool for helping students understand where they stand on a journey towards education and career goals.

What Learning Will Look Like

- **No Walls**: This vision for delivery breaks the walls between schools and “out of school” providers; K-12, community college and universities; education and employers; and, above all, academic and applied learning.
- **Student Centered**: From the student perspective, the education and training experience will be customized, self-paced, and limitless.

WASHINGTON STEM
REIMAGINING SCIENCE, TECHNOLOGY, ENGINEERING + MATH EDUCATION

WHY STEM? WHY NOW?

The facts speak for themselves.

IN THE 21ST CENTURY, STEM = OPPORTUNITY.
We won't rest until every student in Washington is prepared to succeed in our STEM-driven economy.

A SOLID FOUNDATION IN STEM WILL HELP OUR NATION'S STUDENTS SUCCEED.

3x

*In the last 10 years, **growth in STEM jobs** has been three times greater than non-STEM jobs.*

LET'S MAKE MATH AMAZING

*In the next decade, almost all of the fastest-growing jobs will require STEM skills. Yet **61% of middle schoolers** would rather take out the garbage than do their math homework.*

IN 2011 *Only 30% of U.S. high school graduates were **ready for college work in science.***

*Only 45% were **ready in math.***

ONLY 6

*We need to **keep students interested in STEM**, throughout their schooling. Out of every 100 9th graders, only six graduate from college with STEM degrees.*

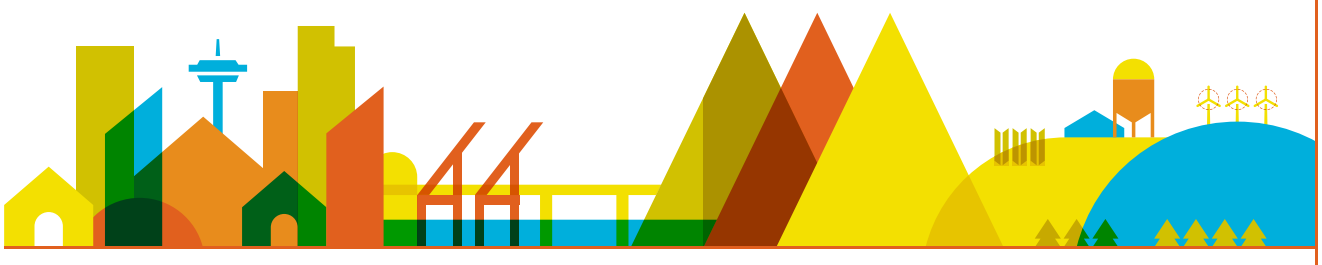
IT'S TIME TO REIMAGINE AND REVITALIZE STEM EDUCATION IN WASHINGTON

#1

***Our state's STEM economy is strong** and will only grow stronger. Washington ranks #1 in the concentration of STEM jobs.*

24%

*By 2018, we'll see a 24% increase in STEM jobs – **seven points above the national average.***



*In Washington, the mismatch between the skills required for available jobs and individuals with those skills is **growing faster than in every state** but one: Delaware.*

49th OUT OF 50

45,000

JOBS IN WASHINGTON WILL GO UNFILLED

*There are 23,200 unfilled STEM jobs in Washington as a result of the **job skills gap**. This **gap is growing and will be 45,000 by 2017**.*

4th VS. 46th

*Washington ranks **4th in the country for technology**-based corporations. And **46th for participation** in science and engineering graduate programs.*

2 HOURS

*Almost half of Washington's 4th grade teachers report teaching science less than two hours per week. **Only four states reported less science instruction.***

WE CAN DO BETTER

*Washington's **achievement gap ranks in the top 10** nationally.*

PASS ALONG THE POWER OF STEM.
JOIN US AT *washingtonstem.org*.

SOURCES: U.S. Chamber. of Commerce, U.S. Bureau of Labor Statistics, Raytheon Corporation, ACT, Inc., National Center for Education Statistics, Georgetown University Center on Education and the Workforce, U.S. Bureau of Labor Statistics and U.S. Census Bureau, America's Edge, TechAlliance, National Assessment of Educational Progress (NAEP)

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PASS ALONG
THE POWER OF STEM
KEY MESSAGES

STEM EQUALS OPPORTUNITY FOR EVERY STUDENT IN THE 21ST CENTURY

STEM isn't just for scientists and engineers.

Key to thriving tomorrow is a foundation in science, technology, engineering, and math today.

Just as language literacy was a requirement in the 20th century, STEM literacy is a requirement in the 21st.

The creativity and critical thinking skills that come with a foundation in STEM are in high demand, for all kinds of jobs, across our state.

STEM is the best ticket to a good job in today's market and the only ticket to a good job in the economy of the future.

STEM is a necessity for every student regardless of their background or the path they pursue.

It's simple: in the 21st century, **STEM opens doors.**

Prioritizing STEM is a chance to tackle the opportunity gap for students who have been historically underserved and underrepresented.

With STEM, we can prepare the next generation to seize the opportunities and tackle the toughest challenges in the 21st century.

STEM IS A GAME CHANGER FOR OUR STUDENTS AND OUR STATE

Investing in STEM education is an investment in our future.

The vitality of our communities and our state depends on our willingness to power student success in STEM.

In the past ten years, STEM jobs have grown three times faster than non-STEM jobs.

Nationally, there will be **1.8 million STEM job openings** in 2018.

STEM is influencing every career out there; in the next decade, most of the 30 fastest-growing jobs will require STEM skills.

Washington's economy is rooted in STEM. Yet too few of our students see STEM's power or possibilities.

Washington ranks 4th in the country for technology-based corporations, but **46th** for participation in science and engineering graduate programs.

We need to close the growing gap between the skills people have in our state and the skills our economy requires.

Prioritizing STEM will bolster communities' ability to **diversify and strengthen their local economies.**

We can't leave any talent on the table; we need to ignite the imaginations and capacities of all young people in Washington.

IT'S TIME TO REIMAGINE AND REVITALIZE STEM EDUCATION

National momentum and local action has created an unprecedented window of opportunity.

From our nation's capital, to our state's top employers, to Washington educators – there's clear agreement that **we need to bring STEM to life** in new ways to inspire and engage the next generation.

We can close the gap between what we know and what we do, reaching every student and improving opportunities for those traditionally underserved and underrepresented in STEM fields.

There are evidence-based practices that we can implement today.

There are Washington teachers pioneering great things just waiting to be discovered and shared.

There are other talented educators ready for the tools and resources to help them reimagine STEM education.

From teacher preparation to curriculum and professional development, the focus on STEM is at an all-time high.

Our kids can't wait and neither can our state; improving and funding STEM education for every student will take all of us working together like never before.

POWERED BY WASHINGTON STEM
Washington STEM advances excellence, equity, and innovation in science, technology, engineering, and math education.

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FACT SHEET:

The following science, technology, engineering, and math (STEM) facts tell the story of STEM today and tomorrow—nationally and in Washington state. Together, they illustrate the growing need and opportunity to power student success in STEM.

NATIONAL

- In the past 10 years, growth in STEM jobs has been three times greater than non-STEM jobs.[i]
- In the next decade, almost all of the 30 fastest-growing jobs will require some STEM skills,[ii] yet 61 percent of middle school students would rather take out the garbage than do their math homework.[iii]
- STEM jobs are expected to keep up an accelerated pace in the coming years leading to 1.8 million STEM-related job openings in 2018.[iv]
- If the United States is to maintain its leadership in STEM, we must produce approximately one million more STEM professionals over the next decade than is currently projected.[v]
- If the United States boosted its math performance by 40 points on the OECD Programme for International Student Assessment (PISA), roughly reaching the level of Canada, we could add on average between 7 and 11 percent annually to the national gross domestic product over the next 80 years, pumping an additional $75 trillion into the U.S. economy.[vi]
- Fewer than 40 percent of students who enter college intending to major in a STEM field complete college with a STEM degree.[vii]
- In a 2009 international exam given to 15 year olds, U.S. high school students ranked significantly behind 12 industrialized nations in science and 17 nations in math. Students in only four industrialized nations scored lower in math.[viii]
- In 2011, only 45 percent of U.S. high school graduates were ready for college work in math; 30 percent were ready in science.[ix]
- Out of every 100 9th graders, only six graduate from college with STEM degrees.[x]

WASHINGTON

- Washington state is a national leader in STEM: we rank third in the concentration of STEM jobs,[xi] first in the concentration of software companies,[xii] and third in the "New Economy" index for innovation and entrepreneurship.[xiii]
- A 2011 Georgetown University study found that our state's STEM economy will only grow stronger. By 2018, we will see a 24 percent increase in STEM jobs, which is 7 points above

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the national average. 94 percent of these jobs will require some post-secondary education.[xiv]

- There are currently 25,000 unfilled jobs in Washington due to a lack of qualified candidates (2013). Eighty percent of those jobs are in high-demand health care and STEM fields, such as computer science and engineering.[xv]
- In the next four years, 45,000 jobs in Washington will go unfilled due to lack of qualified candidates.[xvi]
- Filling the job skills gap would have big impact on our state economy, generating an additional 110,000 jobs, in addition to $720 million in annual state tax revenues and $80 million in local tax revenues by 2017.[xvii]
- While Washington ranks fourth in the country in technology-based corporations, we fall to 46th when it comes to participation in science and engineering graduate programs.[xviii]
- The mismatch in Washington between the skills required for available jobs and individuals with those skills is growing faster than any other state except Delaware.[xix]
- The growing skill-opportunity mismatch has roots in our education system where half of 4th grade teachers in Washington teach less than 2 hours of science per week. Only four states in the country reported less science instruction.[xx]
- Only 48 percent of Washington's fourth-graders and 42 percent of eighth-graders scored proficient or above in math on the 2011 National Assessment of Educational Progress. Just 35 percent in both grades scored that well in science in 2009.[xxi]
- Washington's achievement gaps in math and science have not improved in over a decade and are the 12th largest in the nation.[xxii] If we continue to address the achievement gap at the current glacial rate, it would take 150 years for our African American students to realize the same levels of academic achievement as their peers.[xxiii]
- Less than half of our high school students have completed the necessary credits to apply to a Washington state four-year college. Lack of math courses is the biggest barrier to college for most students: only 21 percent of students had the needed math credits compared to 64 percent in English.
- Too many students in Washington are unprepared for college-level work. 51% of new, first-time college students entering Washington community colleges in 2009-2010 enrolled in remedial - meaning non-credit bearing - math classes.[xxiv] In addition to student tuition, the state expenditure for remedial math was estimated to cost the state over $47 million.[xxv]
- Washington ranks 46th in the nation in terms of the likelihood of a student being enrolled in college by age 19.[xxvi]

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- Washington state universities are not producing enough teachers to meet the growing demand in the coming years, leading to a shortage of nearly 1,000 STEM teachers.[xxvii]

SOURCES

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[xx] National Assessment of Educational Progress (NAEP), 2009.
[xxi] National Assessment of Educational Progress (NAEP), Science 2009 and Math 2011.
[xxii] National Assessment of Educational Progress (NAEP), Science 2009 and Math 2011.
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[xxiv] Washington State Board for Community & Technical Colleges: Role of Pre-College (Developmental and Remedial) Education for Recent High School Graduates Attending Washington Community and Technical Colleges, 2009-10. Revised April, 2012.
[xxv] Washington State Board for Community & Technical Colleges: Role of Pre-College (Developmental and Remedial) Education for Recent High School Graduates Attending Washington Community and Technical Colleges, 2009-10. Revised April, 2012.
[xxvi] Economic Development: Moving Washington State Forward Into Recovery- Washington Roundtable, Washington Research Council, 2011
[xxvii] The New Teacher Project, 2010.