2021-2025
STEM Education Plan

Oregon STEM Investment Council

HIGHER EDUCATION COORDINATING COMMISSION

Oregon STEM Investment Council

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Oregon STEM Investment Council

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STEM Education Vision for Oregon

Reimagine and transform how we educate learners in order to enhance their life prospects, empower their communities, and build an inclusive, sustainable, innovation-based economy. Oregonians of all races, economic status, and regions will develop the fundamental STEM-enabled skills and mindsets necessary to:

- Improve the prosperity of all individuals and communities across the state
- Become creative life-long learners who can adapt to changing social and economic conditions
- Fully contribute to an increasingly complex and technologically rich global society
- Address high-demand, competitive workforce and industry needs

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Executive Summary

Context

Five years since the introduction of Oregon's first STEM Education Plan, the state has taken important steps toward realizing that plan's vision. While Oregon has made headway on a number of the goals outlined in the 2016 STEM Education Plan, we have yet to move the needle in a big way statewide.

As communities across Oregon grapple with the effects of the COVID-19 pandemic, the crisis only highlighted the critical need for community-based, collaborative organizations, like Oregon's STEM Hubs, and the type of engaging, hands-on, project-based learning that is at the core of STEM education. As districts, schools, educators, parents, and students adapted to virtual learning, STEM Hubs stepped up. Hubs have developed and shared at-home STEM learning activities, organized virtual field trips, internships, and learning opportunities with local employers, and provided online professional development for educators.

Further, the expected lasting economic impact of COVID-19 means that now, more than ever, young Oregonians need STEM education. The skills and mindsets developed through STEM – problem solving, critical thinking, adaptability, innovation, design thinking, etc. – are exactly those skills that will help our young people thrive in an uncertain economy, and restart Oregon's economic engines.

We believe that now, with Oregon's Regional STEM Hub Network firmly in place and continuing to strengthen and mature, and an expanded STEM Investment Council that includes representatives from education, community-based organizations, and other partner organization, we have the opportunity and capability to accelerate progress. We need a STEM Education Plan to match this new phase.

It is the STEM Investment Council's intent that this plan will be used statewide to guide investments, policy, and programming related to STEM education. Specifically, the Council hopes that the audience for this plan will include STEM Hubs, education service district, school district, and school administrators, postsecondary education and training institution administrators, P-20+ educators, employers, education, workforce, and economic development agencies, non-profit organizations, philanthropy, and elected officials.

The 2021-2025 STEM Education Plan maintains and builds off of the grand vision for STEM education set forth in the 2016 plan. The updated plan attempts to operationalize the existing goals and assign clear indicators, performance targets, and roles. This plan is highly ambitious, outlining roughly 40 different strategies to implement in order to achieve our four overarching goals. As such, we have identified 10 priority strategies that will be the main focus for the next biennium. While all outcomes and strategies identified in the STEM Education Plan are essential, we believe that the following strategies are the most critical in the near-term.

Goals

- **GOAL 1:** Inspire and empower our students to develop the knowledge, skills, and mindsets necessary to thrive in a rapidly changing, technologically rich, global society.
- **GOAL 2:** Ensure equitable opportunities and access for every student to become a part of an inclusive innovation economy.
- **GOAL 3:** Continuously improve the effectiveness, support, and number of formal and informal P-20 STEM educators.
- **GOAL 4:** Develop a sustainable funding and policy environment for STEM and CTE that provides reliable, seamless, and sufficient support across biennia.

Priority Strategies for 2021-2023

The STEM Investment Council believes that, over the next biennium, Oregon should focus its STEM-related efforts and investments on the following 10 strategies.

- **GOAL 1:** Inspire and empower our students to develop the knowledge, skills, and mindsets necessary to thrive in a rapidly changing, technologically rich, global society.

  Priority Strategies:

  - Incorporate applied learning, project-based learning, and other engaging practices across K-12 curricula.
  - Increase time on science in elementary school.
  - Increase access to high quality out-of-school STEM experiences.

- **GOAL 2:** Ensure equitable opportunities and access for every student to become a part of an inclusive innovation economy.

  Priority Strategies:

  - Promote culturally and linguistically responsive, place-based instructional strategies and material as the basis for STEM lesson plans, units, and courses.
  - Provide financial aid for postsecondary students from underserved/underrepresented communities pursuing STEM postsecondary education and training pathways.
  - Reform math and science course content, sequencing, and/or tracking.

- **GOAL 3:** Continuously improve the effectiveness, support, and number of formal and informal P-20 STEM educators.

  Priority Strategies:

  - Provide STEM-based professional development sessions and communities of practice.
  - Provide high-quality STEM professional development to school and district administrators.

- **GOAL 4:** Develop a sustainable funding and policy environment for STEM and CTE that provides reliable, seamless, and sufficient support across biennia.

  Priority Strategies:

  - Conduct fundraising outreach to business and philanthropy.
  - Collaborate with CTE, workforce, early learning, and educator network leaders, and others to propose, fund, and implement local and regional initiatives.

Introduction

The STEM Investment Council completed Oregon's first statewide STEM Education Plan in November of 2016 after more than 18 months of research, deliberation, and engagement.

The plan set forth the following four, overarching goals:

1. Inspire and empower our students to develop the knowledge, skills, and mindsets necessary to thrive in a rapidly changing, technology rich, global society.
2. Ensure equitable opportunities and access for every student to become a part of an inclusive innovation economy.
3. Continuously improve the effectiveness, support, and number of formal and informal P-20 STEM educators.
4. Create sustainable and supportive conditions to achieve STEM outcomes aligned to Oregon's economic, education, and community goals.

The inaugural STEM Education Plan introduced a sweeping, comprehensive vision of the future of Oregon's education system – a system predicated on STEM education principles and practices. Now, nearly eight years after the formation of Oregon's Regional STEM Hub Network, and seven years after the establishment of the STEM Investment Council, the STEM Education Plan is due for an update.

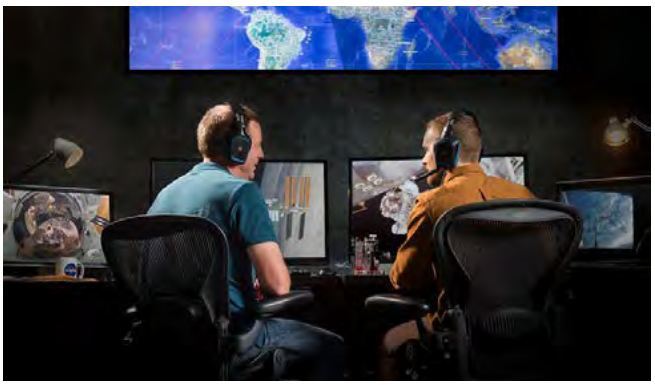
Our hope for this new iteration of Oregon's STEM Education Plan is that it will maintain the aspirational and transformative ethos of the initial plan, while identifying the specific steps Oregon must take to realize our grand vision.

In 2019, the Council held several work sessions to review and comment on the current version of the STEM Education Plan. The Council determined that the next iteration of the plan must be more focused and actionable, and will include specifics around accountability for achieving the goals set forth in the plan. In particular, the Council believes that assigning roles and responsibilities to state agencies, STEM Hubs, school districts, schools, and other key stakeholders is critical to achieving the STEM Education Plan's vision and realizing Oregon's STEM goals. These entities must feel ownership over the STEM Education Plan and its components in order for systemic change to occur.

Furthermore, the Council was clear that any new iteration of the STEM Education Plan must continue to focus the state's efforts on serving the students who face the greatest barriers to a future in STEM.

Why STEM?

We live in a time of exponential change – where we are flooded by information, where new technologies alter nearly every facet of our lives, and where the pace of global developments have an increasing impact on our communities and our planet. In this shifting context Oregon must prepare its learners for a future that we can't even imagine today, to solve problems that we are just beginning to fathom, using technologies that haven't yet been invented. In their various personal and occupational roles Oregonians will be called upon to understand these complex challenges, find solutions, adjust to change, innovate, work together, and build on the knowledge, enterprise, and achievements of previous generations.



Portland State University

That is what STEM education is all about. We all know what the acronym stands for – science, technology, engineering, and math. But when we say STEM, we're talking about a much bigger idea. It isn't just about content knowledge in the disciplines that make up the acronym. STEM is a way of teaching and learning. STEM emphasizes applied learning, interdisciplinary instruction, and skills like critical thinking and problem

solving. Our students' education must enrich their lives, prepare them to successfully adapt to an unforeseeable future, and strengthen the economic prospects of Oregon's communities – that is what STEM will do.

STEM and Oregon's Economy

By 2029, our economy will have more than 52,000 new job openings in STEM-related fields. Of those projected new job openings, 91 percent will be in high demand occupations, 96 percent will be in high wage occupations, and 89 percent will be in high wage, high demand occupations. The bottom line: Oregon's growing economy requires a statewide strategy to prepare individuals for high-wage, high-growth STEM careers.[1]

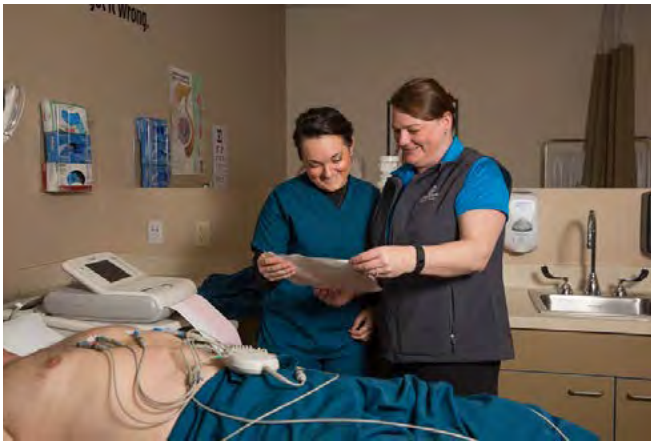
Against this backdrop, there looms a disconnect between the in-demand skills and talent sought after by Oregon's employers and the number of young Oregonians emerging from our education system who possess such skills and talent, especially in the STEM disciplines. This disconnect represents a threat to the job prospects of our people, the prosperity of our communities, and the competitive capacity of our economy.

Oregon must act now. And, we must act together. We must strive to help each student discover and develop their talents and interest, achieve individual prosperity, and thrive as a citizen of Oregon and of the world. Each student must be equipped with the cross-cutting skills, attitudes, and dispositions needed to be successful in work, family, and community life. When asked what those skills, attitudes, and dispositions are, educators, parents, and employers have nearly identical responses. They say that what students need goes far beyond specific content knowledge to include critical thinking, problem solving, creativity, communication, flexibility, perseverance, risk-taking, adaptability, teamwork, and initiative. In a society where information and academic content is readily searchable online, those who are able to analyze, synthesize, and apply that information in unique situations are the ones who will be in the highest demand, and will also be the change-makers of our future.

Engaging Learners through STEM

Let's be clear: the challenge before us is not simply about filling jobs and driving economic growth. More of our students will succeed in school when the connection between their learning and their future is clear and when there is readily-available access to opportunities to become more prepared to adapt and contribute to a rapidly evolving, technologically-rich society.

STEM education, when based in career-connected, applied learning approaches, gets students excited about their studies, empowers students to think about the possibilities for their futures, and increases student outcomes. Through its multidisciplinary, cross-sector methodology, STEM education provides students with the set of skills – critical thinking, problem solving, adaptability, etc. – to succeed in the future, whatever path they choose to follow.



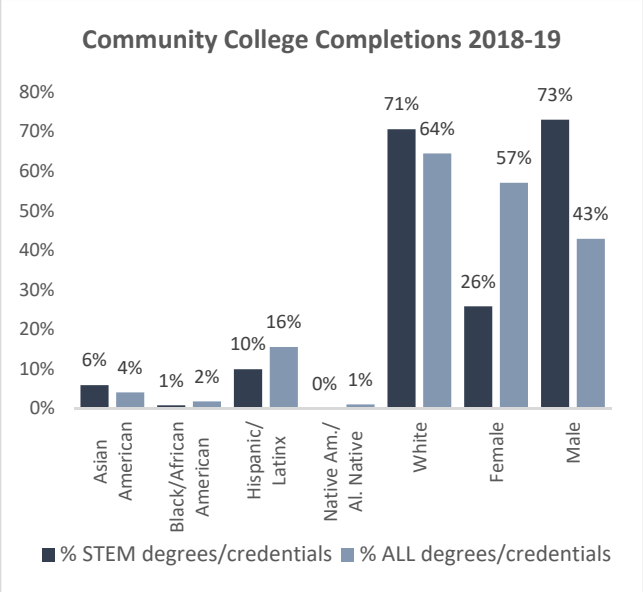
Chemeketa Community College

Career Connected Learning

Career connected learning is a continuum of experiences within a framework of career awareness, exploration, preparation, and training that are both learner-relevant and directly linked to professional and industry-based expectations. These experiences provide multiple paths to success and are selected by individual learners based on their own lived experiences, skills, interests, learning styles, and life goals. Educators, counselors, business and industry, and community leaders work as partners to deliver career-connected learning opportunities and support along the continuum. This continuum recognizes that learners may have multiple entry and exit points as their balance of work and education may shift as paths diverge and reconnect over time and that each individual should be able to build academic, technical, entrepreneurial, and work-ready skills that will prepare them for meaningful careers and life-long learning.[2]

Equity in STEM and STEM as an Equity Strategy

The STEM Investment Council is committed to seeing its vision – and the state's statutory STEM education goals – realized for all student populations – most especially, for students from underserved and underrepresented communities, including Black, Indigenous, and People of Color (BIPOC), rural, low income, and female students, and students with disabilities. We know that there are severe disparities across demographic groups in access to and success in STEM education, and, as a result, in representation in the STEM workforce. As we track progress on Oregon's STEM education goals and metrics, we must disaggregate the data by race/ethnicity, gender, socioeconomic status, rural/urban status, and any other demographic characteristic correlated with underrepresentation in STEM fields. The state, led by the Regional STEM Hub Network, must employ targeted strategies to shrink opportunity and attainment gaps in STEM. The Council believes that closing these gaps is both a moral and economic imperative.



White Oregonians are overrepresented in STEM community college completions. While 64% of all community college degrees and credentials are completed by white students, 71% of STEM degrees and credentials are earned by white students. Conversely, Hispanic/Latinx students represent 16% of all community college completions, but only 10% of STEM completions. Even more apparent is the overrepresentation of males in community college STEM completions. Significantly more female students complete community college degrees and credentials than male students – 57% compared to 43%. Yet, just 26% of community college STEM degrees and credentials are earned by female students.

When we successfully achieve equity in STEM by dramatically increasing access and sustained, targeted engagement for diverse students, STEM becomes an equity strategy in and of itself. As described above, STEM education sparks curiosity and fosters students' interest in their studies. We know that when students are interested and engaged, they learn more and are better able to demonstrate that knowledge. And when academic achievement increases, particularly in STEM subject-matter courses, students are more likely to succeed in a STEM career pathway and ultimately find employment in a STEM occupation. These in-demand, high-paying jobs are the very jobs that lead individuals – and our state – toward economic prosperity.

STEM and CTE

STEM and CTE are highly complementary and frequently overlap. Both engage and motivate students through real world, applied learning, and foster creativity, critical thinking, problem solving, communication, and teamwork. When STEM and CTE leaders and educators work together, they can leverage funding, broaden students' exposure to a variety of academic and work-based learning opportunities, and ensure our future workforce possesses the mix of skills and knowledge necessary to catalyze economic development.

Many CTE programs are in STEM fields, and, by including instruction on STEM concepts, provide students with the knowledge, theories, and assumptions underpinning the career and technical skills they are learning. These CTE programs can offer an entry point into STEM fields, particularly for students from underrepresented populations. Similarly, STEM education incorporates elements of CTE, illuminating for students the connection between abstract concepts and future careers, and provides students with the foundational knowledge and skills they need to be interested and succeed in CTE electives.

A prime example of how STEM and CTE can and should work together is Oregon's Measure 98, which established the High School Success fund with up to $170 million in the 2017-19 biennium. The measure provides funding for dropout prevention, career & technical education, and college level education opportunities. The Department of Education, in dispersing these funds, has made an effort to ensure that funded CTE programming contains a STEM component. However, the Measure 98 funding focuses on high school only. Similar investments must be made in middle school – and even earlier – to create an active pipeline into high school programs.

Work-based Learning

Work-based learning is structured learning in the workplace or simulated environment that provides opportunities for sustained interactions with industry or community professionals that foster in-depth firsthand experience of the expectations and application of knowledge and skills required in a given career field.[3]

STEM, STEAM, What does it all mean?

This strategic plan is acronym agnostic. Whether you call it STEM, STEAM, STREAM, STEMM, METS, i-STEM, e-STEM, TEAMS, S2TEM, MESHT, or other associated acronym, Oregonians generally agree on the fundamental principles and values put forward in the following STEM Manifesto. These guiding belief statements were created by the Council's strategic planning committee as the foundation for this plan, and they strive to communicate a vision of STEM education through which we ignite an inclusive renaissance of curiosity, creativity, wonderment, innovation, and the joyful pursuit of life long learning and talent discovery. In this light STEM can be viewed as "applied curiosity"—the insatiable desire to know and wonder, coupled with a creative drive to make, invent, and contribute to the betterment of humanity.

Oregon's STEM Infrastructure

A Brief History

For more than 20 years, Oregon's leaders have relied on industry-driven, legislatively-established councils and task forces to shape the state's vision for and investments in STEM education. What follows is a summary of the key pieces of legislation – and the entities and initiatives they created – that led to the establishment of the STEM Investment Council.

Senate Bill 504 (1997) – Oregon Engineering Education Investment Fund and Engineering and Technology Industry Council

HB 504 created the Oregon Engineering Education Investment Fund and directed the Oregon University System to establish the Engineering and Technology Industry Council (ETIC). By law, ETIC's membership was to be majority representatives of high-technology companies in Oregon, and its mandate was to establish criteria for the disbursement engineering investments from the Oregon Engineering Education Investment Fund.[4]

With the disbandment of the Oregon University System in 2015, ETIC was disbanded, though the Legislative Assembly has continued to fund public university engineering and technology programs.

House Bill 4056 (2012) – Joint Interim Task Force on STEM Access and Success/STEM Fund

In 2012, the passage of HB 4056 created the Joint Interim Task Force on STEM Access and Success, and established the STEM Fund in the State Treasury. The Task Force, whose main focus was to encourage students to study science, technology, engineering, and math, comprised 17 members from the Legislative Assembly, industry, education, STEM organizations, and student groups. The Task Force was directed to assess the STEM education landscape in the state and make recommendations regarding the future of STEM in Oregon.[5]

The Task Force submitted a report to the Legislature with four legislative recommendations, including:

1. The establishment of a STEM Council, tasked with:
    a. Adopting and advancing an ambitious STEM education agenda;
    b. Developing and managing the infrastructure for STEM Hubs;
    c. Administering money appropriated from the general fund for STEM development;
    d. Ensuring appropriate resource distribution and accountability for STEM Hubs and other STEM programs.
2. Establishment of regional STEM Hubs – centers to channel and coordinate community, regional, and state STEM resources for P-20 students, teachers, and industry professionals.
3. Increased investment in IT infrastructure, tuition support for STEM degree pursuers, and base funding to ensure success for students in the STEM pipeline.
4. Incentivizing industry partnerships in STEM Education.

House Bill 2636 (2013) – STEM Investment Council

Heeding the advice of the Joint Interim Task Force on STEM Access and Success, in 2013, through the passage and signing into law of HB 2636, Oregon's Legislative Assembly and Governor Kitzhaber established the STEM Investment Council.

Originally operating under the direction of the Chief Education Office and supported by the staff of the Chief Education Office, on July 1, 2018, the Higher Education Coordinating Commission (HECC) assumed the role of supporting the Council. With the sunset of the Chief

Education Office on July 1, 2019, the Council began to operate under the joint direction of the State Board of Education (State Board) and HECC.

House Bill 2323 (2013) – Funding the Regional STEM Hub Network

Along with the creation of the STEM Investment Council, Oregon's Legislative Assembly codified the Regional STEM Hub Network and provided funding to support that network.

STEM Investment Council

Oregon's STEM Investment Council has a legislative mandate to assist the Oregon Higher Education Coordinating Commission and Oregon Department of Education with the development and implementation of a long-term strategy to advance the state's STEM goals. This plan represents the Council's recommended suite of long-term strategies.

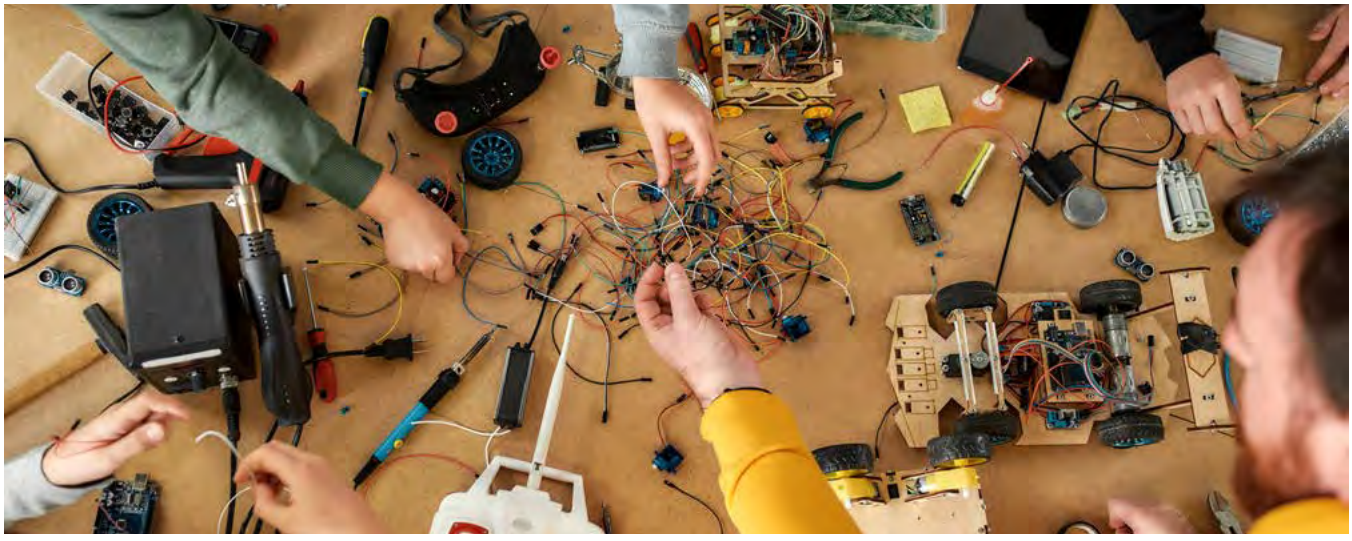
In addition to the development and oversight of a long-term, statewide STEM Education Plan, the Council makes recommendations to the State Board regarding the administration of the STEM Investment Grant Program (ORS 327.380) and grants to Regional STEM Hubs (ORS 327.372), and to the State Board and HECC regarding other investments in STEM education.

The Council is business-driven, comprising nine voting members from the private sector, jointly appointed by the Superintendent of Public Instruction and Executive Director of the HECC. Council membership also includes non-voting, advisory members from K-12 and postsecondary education, sector-specific associations, non-profit organizations, and other key partner organizations.

Regional STEM Hub Network

Oregon's Regional STEM Hub Network comprises 13 STEM Hubs throughout the state. STEM Hubs are multi-sector partnerships linking P-20 educators, schools, school districts, and education service districts to business & industry, CTE regional coordinators, workforce development, economic development and community-based organizations.

Hubs devise local solutions to meet local needs by coordinating regional communication and partnerships, improving student outcomes, building capacity and sustainability for change, and encouraging and supporting local and statewide engagement. Through their coordination and alignment work, Hubs increase efficiency in the system.



The table below provides a snapshot of the impact Oregon's STEM Hub Regional Network over the last two biennia.[6] (*Note that we are only partway through the 2019-21 biennium*)

STEM Hub Impact Data 2017-19 and 2019-21 Biennia	Value	Units
Number of educators who participated in Hub professional development or programs	10,470	Educators
Number of educator hours spent in Hub professional development and programs	99,049	Educator Hours
Average number of professional development hours per educator	9.5	Hours
Projected number of students impacted by educator professional development participation	510,926	Students
Percent of students in Oregon impacted by STEM Hub professional development to their teachers	44%	% of students in Oregon
Number of industry volunteers who participated in Hub activities	5,534	Industry Volunteers
Number of industry volunteer hours	32,460	Industry Volunteer Hours
Number of students who participated in Hub directed programs	102,275	Students
Number of student hours in Hub directed programs	408,891	Student Hours
Estimate of students who benefit from equipment loaning programs	114,141	Students
Estimate of teachers who benefit from equipment loaning programs	2,157	Educators

STEM Hub Leveraged Funding 2017-19 and 2019-21 Biennia	$
Grants and sponsorships (current biennium)	$6,249,667.00
Partner investments in Hub initiatives	$2,810,346.35
In-kind time and resources	$2,605,893.30
Funding and in-kind secured for future biennia	$14,293,738.00
Total	$25,959,644.65

Performance Targets and Data

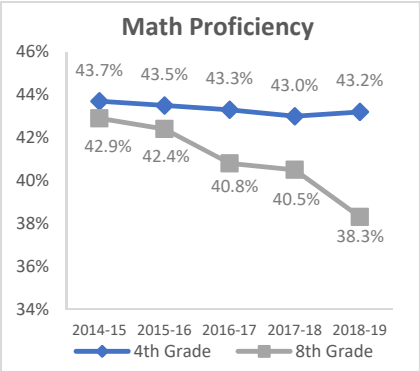
In 2013, the Oregon Legislature established two performance targets for STEM education in Oregon:

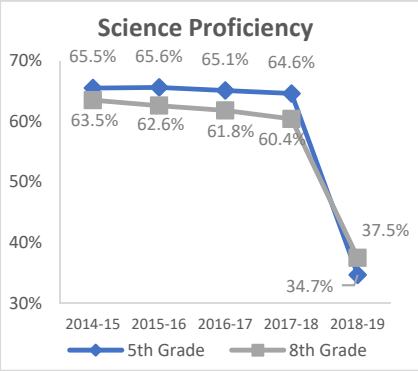
1. Double the number of 4th and 8th grade students proficient in math and science by 2025,
2. Double the number of CTE-STEM degrees and certificates by 2025.

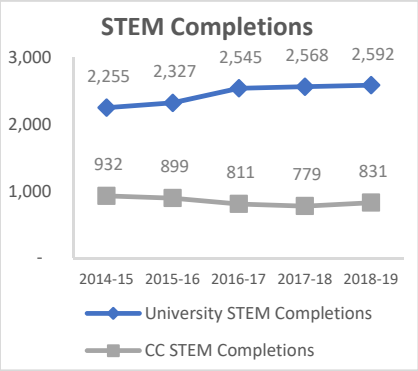
These targets are highly ambitious. To put them in context, in 2019, Minnesota had the highest percentage of students scoring proficient or above on the mathematics National Assessment of Educational Progress at 53 percent. Doubling Oregon's percentage of students in the 2018-19 school year scoring proficient or above on its statewide mathematics assessment would mean 76.6 percent of students scoring proficient or better – a far higher percentage than the best performing state in the nation.

We know that assessment scores are blunt instruments for measuring progress, and that realizing significant gains on test scores statewide takes time, enormous effort, accountability, and sustained investment. Further, in 2018-19, schools throughout Oregon utilized a new statewide Science assessment, aligned to Next Generation Science Standards, which accounts for the significant dip in science assessment proficiency.

The tables below show Oregon's year over year performance on these targets.







Oregon's STEM Goals

The STEM Investment Council and its partners have identified the following Goals and associated Outcomes to guide Oregon's STEM-related efforts and investments. To ensure that this plan can be easily operationalized, each Outcome includes a set of associated strategies, indicators, performance metrics, and evaluation methods.

Goal 1: Inspire and empower our students to develop the knowledge, skills, and mindsets necessary to thrive in a rapidly changing, technologically rich, global society.

OUTCOME I

Oregon students are interested in STEM and develop a STEM identity.

Developing a STEM identity is critical to students' future interest in, pursuit of, and success in STEM learning and careers. Through discovery, discourse, inquiry, and play, children learn to observe natural phenomena, become pattern sleuths, shape and defend an argument, and use problem-solving tactics.[7]

Making a Lasting Impression

According to the Center for Advancement of Informal Science Education, students who develop STEM identities show a deeper interest in these subjects. In fact, "science identity, for example, increases the likelihood that students will, over the long term, continue to develop science literacy or even follow an educational pathway toward a science career or profession that requires or benefits from education or training in STEM."[8]

Importantly, this STEM identity development must begin at a young age. Early STEM experiences are vital because students get hooked on STEM early. Research suggests that students who decide to take advanced science classes and pursue postsecondary STEM fields tend to get interested in STEM and make their choices as early as middle school, or even before.[9] For girls and culturally and linguistically diverse students, early exposure to STEM experiences proves to be a key factor in deciding to pursue STEM coursework and careers.[10]

Improving Outcomes

Further, a random assignment study by the Center for Research in Educational Policy supports the claim that strong inquiry-based science experiences strengthen K-8 science outcomes, even for students who are typically underrepresented in the STEM fields.[11] A landmark 2007 study also showed that early math skills are one of the best predictors of later academic success in both math and language arts.[12]

Providing students with project-based, hands-on, and career-influencing science experiences takes teacher expertise, resources, and time. Oregon must ensure that all of its students receive strong STEM education early so they are prepared for college, career, and life.

Strategies

a. Incorporate applied learning, project-based learning, and other engaging practices into math and science curricula

Lead(s): *STEM Hubs, school and district administrators, educators*
Support: *ODE, non-profits, community-based organizations, employers*

b. Increase time on science in elementary school

Lead(s): *School and district administrators, educators, ODE*
Support: *STEM Hubs*

c. Provide community-based resources, such as community STEM events, maker spaces, and take-home STEM kits

Lead(s): *STEM Hubs*
Support: *Community-based organizations, non-profits, employers, funders*

d. Provide access to high quality out-of-school STEM learning opportunities

Lead(s): *STEM Hubs*
Support: *Community-based organizations, non-profits, funders*

e. Offer opportunities for P-12 students, particularly those from BIPOC and rural communities, to interact with STEM professionals

Lead(s): *STEM Hubs*
Support: *Employers, educators, community-based organizations, non-profits*

f. Offer STEM-based work experiences for high school students

Lead(s): *STEM Hubs, school and district administrators*
Support: *Employers, local workforce boards, economic development organizations*

Indicators, Performance Targets, and Methods

- **Indicator 1:** Difference in student STEM identity before and after participation in STEM Hub-supported STEM experience.
- **Target 1:** Student STEM identity increases after participation in STEM Hub-supported STEM experience.
- **Method 1:** Pre- and post-surveys for students in STEM Hub-supported STEM learning.
- **Indicator 2:** Enrollment in high school STEM electives and/or STEM accelerated learning courses.
- **Target 2:** Increase in enrollment in high school STEM CTE courses, STEM electives, and/or STEM accelerated learning courses.
- **Method 2:** ODE and HECC course enrollment data (might only be for CTE courses).
- **Indicator 3:** Enrollment in postsecondary STEM education and training programs.
- **Target 3:** Increase in enrollment in postsecondary STEM education and training programs.
- **Method 3:** HECC enrollment data.

OUTCOME II

Students are prepared to enter and succeed in postsecondary STEM education and training pathways or STEM careers.

To meet Oregon employers' demand for a STEM-educated workforce, our students, upon completing high school, must be prepared to enter and succeed in STEM postsecondary education and training pathways or STEM careers.

Math and Science Standards

Most postsecondary STEM education and training pathways and STEM fields require students and prospective employees to meet a certain level of proficiency in math and science. Too often, students complete high school and, due to insufficient K-12 math and science courses, are unable to enter directly into their preferred STEM education and training pathway or job. That is why it is so important to use STEM teaching and learning principles to implement math and science standards that align with postsecondary education and training, as well as employer needs.

In 2014, Oregon adopted the Next Generation Science Standards (NGSS). NGSS introduced an integrated approach to learning science that promotes phenomena driven instruction and exploration, and deemphasizes memorization and siloed thinking. While still in progress, the Oregon Department of Education is leading the Oregon Mathways initiative, which includes a major revision of Oregon's Math Standards.

Computer Science Education

Some of state's fastest growing job clusters are in technology and software. In 2015, Oregon had 290 high school students take the AP Computer Science exam. Of those students, 18 percent were female, 11 students were Latino, and four students were African American. Only 15 percent of Oregon's high schools offered at least one coding course in 2012. Only 13 schools offered the AP Computer Science in 2013-14.

Strategies

a. Integrate STEM teaching and learning principles across K-12 curricula.
   Lead(s): *STEM Hubs, school and district administrators, educators*
   Support: *ODE, non-profits, community-based organizations, employers*

b. Provide access to college-level STEM courses and STEM-related CTE courses and programs of study in high school.
   Lead(s): *School and district administrators, postsecondary education institutions*
   Support: *STEM Hubs*

c. Develop and implement a statewide plan to provide all students with digital literacy and computer science education.
   Lead(s): *ODE*
   Support: *STEM Hubs, school and district administrators, educators, postsecondary education institutions, employers*

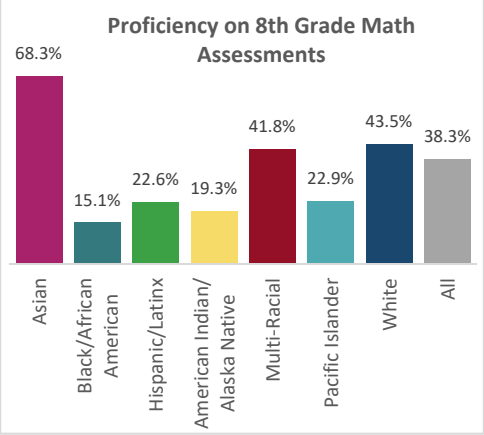
Indicators, Performance Targets, and Methods

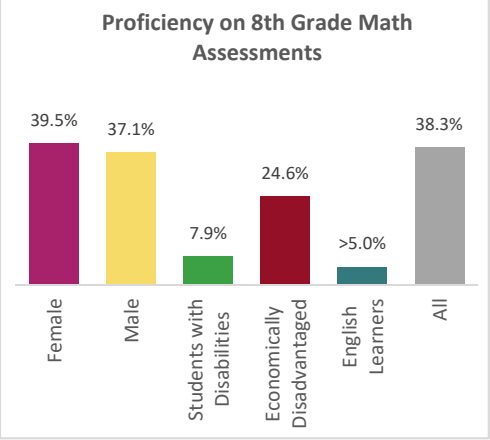
- **Indicator 4:** Percent of students scoring proficient or better on statewide math and science assessments.
- **Target 4:** Increase percent of students scoring proficient or better on statewide math and science assessments.
- **Method 4:** ODE data.
- **Indicator 5:** Percent of students meeting benchmarks on science and math AP, college entrance, and college placement exams.
- **Target 5:** Increase percent of students meeting benchmarks on math and science AP, college entrance, and college placement exams.
- **Method 5:** National data.
- **Indicator 6:** Completion of postsecondary STEM education and training credentials.
- **Target 6:** Increase number of postsecondary STEM education and training credentials earned.
- **Method 6:** HECC data.
- **Indicator 7:** Percent of community college students completing a college level math course in their first year.
- **Target 7:** Increase percent of community college students completing a college level math course in their first year.
- **Method 7:** Community college data.

Goal 2: Ensure equitable opportunities and access for every student to become a part of an inclusive innovation economy.

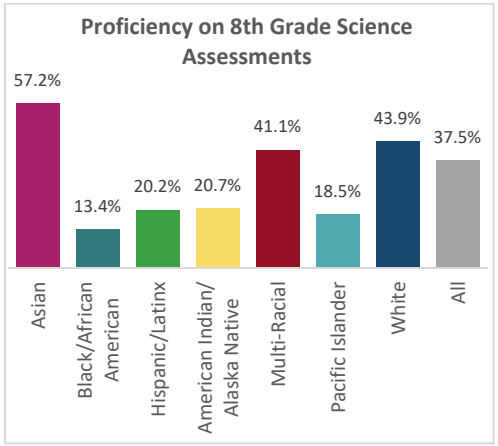
Why a specific goal on equity?

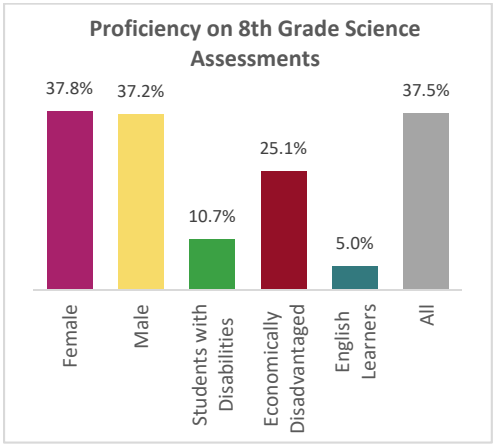
Oregon faces significant opportunity and attainment gaps across its cradle to career education ecosystem, particularly among its students of color, English learners, students experiencing disabilities, and students from families in poverty. For example, while the percentage of all 8th grade students in Oregon who were proficient in math during the 2018-19 school year was 38.3%, that percentage changes dramatically from one subsection of the student population to another. White 8th graders outperformed the overall student population with 43.5% scoring proficient. At the same time, just 15.1% of Black/African American 8th graders, only 7.8% of 8th graders experiencing disabilities, and less than 5% of 8th graders who were English learners met the proficiency threshold.[13]





We see similar trends for science proficiency. In the 2018-19 school year, White 8th graders out performed the overall 8th grade population by more than 5% (43.5% for White 8th graders were proficient compared to 38.3% for all 8th graders). Yet, barely a third as many Black/African American 8th graders, and even fewer English learners and 8th graders experiencing disabilities were considered proficient.





When students begin high school already at a disadvantage, particularly in math and science, their chances of continuing on to pursue a postsecondary STEM degree or credential and entering the workforce in a STEM occupation become even more unlikely. The state must close these gaps and give all students a chance to follow a STEM path.

Further, increasing diversity in the STEM labor force is both a moral and economic imperative. Diversity is an asset in addressing today's complex challenges. Yet, persons of color and women account for far fewer of the country's STEM job holders than their percentage of the general population. Using a broad definition of STEM occupations, Black/African Americans make up 11% of the U.S. workforce overall, but represent 9% of STEM workers, while Latinx/Hispanic Americans comprise 16% of the U.S. workforce, but only 7% of all STEM workers. And, in 2012, though American Indian/Alaska Natives made up .7% of the U.S. population, they accounted for .3% of the engineering workforce.[14]

OUTCOME III

Students from underserved and underrepresented communities see futures in STEM.

Students from underserved and underrepresented communities face an expectation gap, an opportunity gap, an information gap, and an inspiration gap. Key systemic inequities include insufficient access to school programs such as computer science, AP courses, and CTE in and out of classrooms; limited student exposure to diverse STEM faculty and out-of-school role models; and biased messaging and expectations. Students from rural areas and families in poverty also often experience limited access to STEM opportunities. Over 38 percent of Oregon's school districts are classified as rural.

Strategies

a. Promote culturally and linguistically responsive, place-based instructional strategies and material as the basis for STEM lesson plans, units, and courses.
   Lead(s): *STEM Hubs*
   Support: *Community-based organizations, school and district administrators, educators*

b. Diversify the STEM teaching workforce.
   Lead(s): *Postsecondary education institutions*
   Support: *HECC, Teacher Standards and Practices Commission*

c. Increase access to high quality out-of-school STEM learning opportunities for students from underserved and underrepresented communities.
   Lead(s): *STEM Hubs, community-based organizations, non-profits*
   Support: *Funders*

d. Offer STEM experiences, events, and take-home activities in multiple languages.
   Lead(s): *STEM Hubs*
   Support: *Educators, community-based organizations, non-profits*

e. Adapt STEM lesson plans, experiences, materials, and events to be accessible for students experiencing disabilities.
   Lead(s): *STEM Hubs*
   Support: *Educators, community-based organizations, nonprofits*

f. Provide anti-racist professional learning opportunities to educators and administrators.
   Lead(s): *STEM Hubs, Regional Educator Networks*
   Support: *Community-based organizations, non-profits, Educator Advancement Council*

g. Improve the clarity of and access to up-to-date information and data on STEM education pathways and careers.
   Lead(s): *STEM Investment Council*
   Support: *HECC, ODE, Oregon Employment Department*

Indicators, Performance Targets, and Methods

- **Indicator 7:** Gaps in STEM identity across different student populations.
- **Target 7:** Decrease gaps in STEM identify across different student populations.
- **Method 7:** Pre- and post-surveys for students in Hub-supported STEM learning.
- **Indicator 8:** Gaps across student populations in enrollment in high school STEM electives and/or accelerated learning courses.
- **Target 8:** Reduce gaps across student populations in enrollment in high school STEM electives.
- **Method 8:** Oregon Department of Education course enrollment data.

- **Indicator 9:** Gaps across student populations in enrollment in postsecondary STEM education and training programs.
- **Target 9:** Reduce gaps across student populations in enrollment in postsecondary STEM education and training programs.
- **Method 9:** HECC enrollment data.

OUTCOME IV

Students from underserved/underrepresented communities pursue and succeed in postsecondary STEM education and training, and/or STEM careers.

Closing achievement gaps

Targeted strategies and supports increase the likelihood of success for students historically underrepresented in STEM studies. At the postsecondary level, those STEM-specific strategies include exposure to STEM courses in conjunction with a combination of advising, co-requisite remediation and gateway-course redesign. To persist to a STEM certificate or degree, students must see how their coursework applies to the real world. Research shows that one of the most effective strategies is access to undergraduate research and/or internships during the freshman and sophomore years of postsecondary. To help bridge this gap, postsecondary institutions must forge authentic partnerships with business and industry. Employers can influence programs and curriculum, provide technology and equipment or participate on advisory boards.

Strategies

a. Provide non-financial supports, such as counseling and mentoring, for postsecondary students from underserved/underrepresented communities intending to pursue STEM education and careers
   Lead(s): *Postsecondary education institutions*
   Support: *HECC, community-based organizations, non-profits*

b. Provide financial aid for postsecondary students from underserved/underrepresented communities pursuing STEM postsecondary education and training pathways
   Lead(s): *HECC, funders*
   Support: *Postsecondary education institutions*

c. Reform math and science course content, sequencing, and/or tracking
   Lead(s): *STEM Hubs*
   Support: *School and district administrators, educators, ODE, postsecondary education institutions*

d. Expand and strengthen alumni and professional networks for students of color, students experiencing disabilities, English learners, and women
   Lead(s): *Postsecondary education institutions*
   Support: *STEM Hubs, employers*

e. Require funding for STEM Hubs and STEM Innovation Grants to go toward activities that serve a significant number of students from underserved and underrepresented communities
   Lead(s): *STEM Investment Council*
   Support: *HECC, ODE*

Indicators, Performance Targets, and Methods

- **Indicator 10:** Gaps across student populations scoring proficient or better on statewide math and science assessments.
- **Target 10:** Decrease gaps across student populations scoring proficient or better on statewide math and science assessments.
- **Method 10:** ODE data.
- **Indicator 11:** Gaps across student populations in meeting benchmarks on science and math AP, college entrance, and college placement exams
- **Target 11:** Decrease gaps across student populations in meeting benchmarks on science and math AP, college entrance, and college placement exams.
- **Method 11:** National data.
- **Metric 12:** Gaps across student populations for completion of postsecondary STEM education and training credentials
- **Target 12:** Decrease gaps across student populations for completion of STEM education and training credentials.
- **Method 12:** HECC data.

Goal 3: Continuously improve the effectiveness, support, and number of formal and informal P-20 STEM educators.

Educators have the greatest impact on student success across the education continuum, both inside and outside of classrooms. In Preschool to grade 12 (P-12), for instance, research indicates that a classroom teacher's effectiveness is more important—and has more impact on student achievement—than any other factor controlled by school systems, including class size or the school a student attends.

OUTCOME V

School and district leaders adopt STEM teaching and learning principles school- and district-wide

Leaders determine the culture of their organizations and institutions. The same research that has shown that teachers have the greatest impact on student success in the system, also shows that building principals have the next greatest impact. In schools where high quality STEM is taking place, principals and teacher leaders have worked together to create a positive, student-centered culture where educators work collaboratively and are encouraged to take thoughtful risks in their teaching approaches in order to meaningfully engage students and community members.

Many of Oregon's administrators and classroom educators already understand and embrace the power of STEM education and have created pockets of STEM excellence in their classrooms and schools. To ensure that these efforts reach beyond one administrator or educator – beyond a single classroom or one employee's tenure at the school – cultivating a school-wide STEM culture is necessary.

Strategies

a. Provide high-quality STEM professional development to school and district administrators
   Lead(s): *STEM Hubs*
   Support: *School and district administrators*

b. Develop a community of STEM administrator leaders
   Lead(s): *STEM Hubs*
   Support: *Educators, school and district administrators*

c. Develop and implement a school-wide STEM transformation process
   Lead(s): *STEM Hubs*
   Support: *Educators, school and district administrators*

d. Celebrate and share-out best practices and success stories
   Lead(s): *STEM Investment Council, ODE*
   Support: *STEM Hubs*

e. Create and strengthen collaborative partnerships between school/district administrators and employers.
   Lead(s): *School and district administrators*
   Support: *Employers, STEM Hubs*

Indicators, Performance Targets, and Methods

- **Indicator 16:** Difference in attitude toward STEM before and after Hub-supported professional development.
- **Target 16:** Increase administrator positivity toward STEM.
- **Method 16:** Hub administered and collected pre- and post-surveys.
- **Indicator 17:** Number of schools recognized as "STEM Schools" by STEM Hub Network.
- **Target 17:** Increase the number of schools recognized as "STEM Schools."
- **Method 17:** Hub collected data.

OUTCOME VI

New educators enter the teaching workforce with a deep understanding of STEM teaching and learning principles, and STEM content knowledge.

Thoughtful, skillful teachers who have an understanding of how STEM knowledge and skills are applied in the workplace are the backbone to delivering innovative STEM instruction across elementary and secondary classrooms. They drive differentiated, integrated STEM learning experiences, and develop and deliver hands-on, project-based instruction for learners of all ages.

Strategies

a. Increase the time spent on STEM practices and content in educator preparation programs

   Lead(s): *Postsecondary education institutions*
   Support: *Teachers Standards and Practices Commission, STEM Hubs, Regional Educator Networks*

b. Increase STEM-focused tracks in educator preparation programs

   Lead(s): *Postsecondary education institutions*
   Support: *Teachers Standards and Practices Commission, STEM Hubs, Regional Educator Networks*

c. Include educator preparation faculty in STEM educator communities of practice

   Lead(s): *STEM Hubs*
   Support: *Postsecondary education institutions*

d. Develop expedited pathways for STEM professionals to become educators

   Lead(s): *Teacher Standards and Practices Commission, Regional Educator Networks*
   Support: *Postsecondary education institutions, Educator Advancement Council*

e. Incentivize practicum hours to be earned in STEM classrooms

   Lead(s): *Postsecondary education institutions*
   Support: *Teachers Standards and Practices Commission, STEM Hubs, Regional Educator Networks*

Indicators, Performance Targets, and Methods

- **Indicator 13:** Number and % of educators who completed a STEM track or have a STEM certification.
- **Target 13:** Increase number and % of educators who completed a STEM track or have a STEM certification.
- **Method 13:** Postsecondary education institution completion data.
- **Indicator 14:** Number and % of first-year educators who report feeling confident implementing STEM pedagogy.
- **Target 14:** Increase Number and % of first-year educators who report feeling confident implementing STEM pedagogy.
- **Method 14:** Develop new survey for first-year educators.

OUTCOME VII

The P-12 educator workforce maintains a deep understanding of STEM teaching and learning principles, and is confident in implementing these principles in their practice.

Researchers agree that strengthening educator effectiveness is the most efficient way to boost academic achievement and they believe rigorous, cutting-edge professional development can play a key role in improving educator practices.[15] This type of professional learning is job-embedded (integrated into the work teachers do on a day-to-day basis), collaborative, incorporates coaching and technology, and takes into account the school context.[16] However, access to high-level professional development is often lacking across the state.

Strategies

a. Provide STEM-based professional development sessions and communities of practice
   Lead(s): *STEM Hubs, Regional Educator Networks*
   Support: *Educators, school and district administrators, Educator Advancement Council*

b. Provide industry-based experiences for STEM educators
   Lead(s): *STEM Hubs*
   Support: *Employers, educators, school and district administrators*

c. Cultivate a community of STEM teacher leaders
   Lead(s): *STEM Hubs*
   Support: *Educators, school and district administrators, Regional Educator Networks*

d. Create an online repository of STEM instructional resources
   Lead(s): *STEM Hubs*
   Support: *ODE, educators, Regional Educator Networks*

e. Create STEM lending libraries for educators
   Lead(s): *STEM Hubs*
   Support: *Community-based organizations, non-profits, funders, Regional Educator Networks*

Indicators, Performance Targets, and Methods

- **Indicator 15:** Difference in reported confidence in STEM before and after participation in Hub-supported professional development.
- **Target 15:** Increase educator confidence in STEM following participation in Hub-supported professional development.
- **Method 15:** Hub administered and collected pre- and post-surveys.

Goal 4: Develop a sustainable funding and policy environment for STEM and CTE that provides reliable, seamless, and sufficient support across biennia

Oregon must continue to stay the course and build upon the good work it has done since 2011. To do so, Oregon must make stable, sustained investments in STEM education and adopt policies that align STEM and other related efforts.

OUTCOME VIII

STEM-specific initiatives, policy, and funding are aligned and coordinated with related efforts

STEM education does not happen in a vacuum. Rather, it is closely related to – and should be strongly aligned with – other initiatives, such as career and technical education, early learning, educator professional development efforts, education accountability systems, and others.

Strategies

a. Map landscape of existing statewide programs, initiatives, and efforts that highlight STEM work and identify areas of synergy
   Lead(s): *STEM Investment Council*
   Support: *ODE, HECC, STEM Hubs*

b. Collaborate with CTE, workforce, early learning, and educator network leaders, and others to propose, fund, and implement local and regional initiatives
   Lead(s): *STEM Hubs*
   Support: *School and district administrators*

c. Advocate for STEM to be a required or incentivized activity under current and future P-20 funding streams
   Lead(s): *STEM Investment Council*
   Support: *STEM Hubs, employers*

d. Strengthen STEM's inclusion in Oregon's federally required Every Student Succeeds Act state plan
   Lead(s): *ODE*
   Support: *STEM Investment Council, STEM Hubs*

e. Align high school and community college STEM-related CTE programs.
   Lead(s): *CTE Regional Coordinators*
   Support: *high schools, school districts, community colleges*

OSU - Cascades

Indicators, Performance Targets, and Methods

- **Metric 18:** Number of initiatives supported by funding from STEM Hubs and other state-funded entities.
- **Target 18:** Increase umber of initiatives supported by funding from STEM Hubs and other state-funded entities.
- **Method 18:** STEM Hub-reported.
- **Metric 19:** Number of district Student Success Act and High School Success plans that include funding for STEM Hubs and/or STEM Hub-supportive initiatives.
- **Target 19:** Increase number of district Student Success Act and High School Success plans that include funding for STEM Hubs and/or STEM Hub-supportive initiatives.
- **Method 19:** STEM Hub-reported.

OUTCOME IX

School, district, and state-level decision-makers understand, support, and invest in STEM

To ensure continued investment in STEM education, Oregon's leaders, including its education leaders, and the general public must understand and believe in the value of STEM education. Without this buy-in, the multitude of other priorities – education-related and others – will overshadow our STEM efforts. As such, our leaders need to see – firsthand and through data – the positive impacts of STEM education.

Strategies

a. Conduct fundraising outreach to business and philanthropy
   Lead(s): *STEM Hubs*
   Support: *Community-based organizations, non-profits*

b. Develop and implement a STEM communications campaign, including a public-facing STEM data dashboard
   Lead(s): *STEM Investment Council*
   Support: *STEM Hubs, ODE, HECC*

c. Meet with school, district, and state leaders about STEM and bring them to community STEM events
   Lead(s): *STEM Hubs*
   Support: *STEM Investment Council, community-based organizations, non-profits, employers*

Indicators, Performance Targets, and Methods

- **Indicator 18:** Level of state funding for STEM Hubs.
- **Target 18:** Increase state funding for STEM Hubs.
- **Method 18:** HECC and ODE legislatively adopted budgets.
- **Indicator 19:** Amount of funds raised by STEM Hubs.
- **Target 19:** Increase amount of funds raised by STEM Hubs.
- **Method 19:** STEM Hub-reported.

Conclusion

This strategic plan consists of a comprehensive set of strategies and initiatives to strengthen and transform the STEM education ecosystem in Oregon. It is formally submitted to the State Board of Education and Higher Education Coordinating Commission.

Consistent with this plan the STEM Investment Council will continue to monitor the impact of specific investments as well as changes reflected in the indicators and performance targets. This plan will be updated regularly, following a thorough assessment of the changing operating environment in Oregon and input from a broad representation of stakeholders. Each year, the STEM Investment Council will provide a report to the Legislature on progress against these indicators, as well as specific policy and investment recommendations arising from the vision and priorities of this plan.

Respectfully submitted,

Stefan Bird
Chair, STEM Investment Council

Endnotes

1 Oregon Employment Department, *STEM Employment and Wage Projections*.

2 Oregon CTE State Plan, https://www.oregon.gov/ode/learning-options/CTE/FedFund/Documents/Oregon%20CTE%20State%20Plan.pdf, p. 77

3 Oregon CTE State Plan, https://www.oregon.gov/ode/learning-options/CTE/FedFund/Documents/Oregon%20CTE%20State%20Plan.pdf, p. 56

4 http://library.state.or.us/repository/2010/201010061538333/1997.pdf

5 https://olis.leg.state.or.us/liz/2012R1/Downloads/MeasureDocument/HB4056/Enrolled

6 Data collected by Regional STEM Hub Network.

7 TIES STEM Education Monograph Series: Attributes of STEM Education; Aug 2006

8 https://www.informalscience.org/sites/default/files/identity-in-STEM-interview-reflections-v2.pdf

9 What Is the Impact of Decline in Science Instructional Time in Elementary School? 2012

10 Generation STEM: What Girls Say About Science, Technology, Engineering and Math; 2012; https://www.girlscouts.org/research/pdf/generation_stem_full_report.pdf

11 LASER i3 Validation Study by the Center for Research in Educational Policy (CREP) at the University of Memphis; 2015

12 Duncan, et al. "School Readiness and Later Achievement," 2007; http://eprints.ioe.ac.uk/5971/1/Duckworth2007SchoolReadiness1428.pdf?origin=public

13 National Science Foundation, Women, Minorities, and Persons with Disabilities in Science and Engineering

14 National Action Council for Minorities in STEM, https://www.nacme.org/publications/research_briefs/popups/NACME_2014_RB_Vol4_2.pdf.html

15 Nurturing Quality Teachers in Oregon, A Profile of Success and Challenges of Six Oregon Districts; ECONorthwest, 2008

16 Education First: Common Core State Standards & the Transformation of Professional Development

HIGHER EDUCATION COORDINATING COMMISSION