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| *Oregon achieves . . . together!*  **Colt Gill, Acting Deputy Superintendent**  **STEM and CTE Investments: A Report on House Bill 3072**  *Tom Thompson, Education Specialist, Office of Teaching and Learning Theresa Richards, Director, Office of Teaching and Learning* |

# Executive Summary

Section 1 of Oregon House Bill (HB) 3072, passed during the 2015 Regular Session of the Oregon Legislature, requires the Oregon Department of Education (ODE) to submit a report related to Science, Technology, Engineering and Math (STEM) and Career and Technical Education (CTE) distributions made under the section. The report includes metrics on how distributions contribute to the development of a skilled workforce that is able to secure high-wage and high-demand jobs. Copies of this report are available [online](http://www.oregon.gov/ode/learning-options/CTE/resources/Pages/InitiativesPartnershipsPromisingPractices.aspx). A copy of the report can be obtained through an email request to Tom Thompson at the Oregon Department of Education ([tom.thompson@ode.state.or.us](mailto:tom.thompson@ode.state.or.us)). The key findings of this report are:

* State-approved CTE programs provide sequences of courses linked to specific careers. CTE program growth over the last biennium has provided greater opportunities for students to explore careers that can lead to high-wage and high-demand jobs. This growth includes career clusters that are considered high-wage and high-demand.
* CTE Revitalization Grants and Secondary Career Pathways funding provided financial support to grow CTE programs. The largest number of grants were awarded to support high-wage and high-demand programs in Industrial and Engineering Systems which include Construction, Manufacturing, Engineering, and Automotive.
* The number of students who have earned three or more high school credits in high-wage and high-demand CTE programs has increased during the biennium. This suggests that schools are helping students focus their career interests.
* Students who attended schools with CTE Revitalization grants were able to connect with employers. Internships and job shadows provide a highly personalized connection, while career fairs and job site visits present students with a broad overview of occupations. Similar strategies are used in schools that have not received a CTE Revitalization Grant.
* The number of teachers requesting CTE endorsements has increased during the biennium. Generally, this is an indicator that schools are either replacing CTE teachers who are retiring or are expanding program options. This trend also applies for some high-wage and high-demand career clusters.
* It is clear that the multifaceted approach to building student interest in high-wage and high-demand jobs promoted in HB 3072 is necessary. These investments helped enhance classroom experiences for students, helped teachers improve their own practice, and increased regional STEM and CTE education supports.

STEM and CTE Investments in Oregon

(2015 House Bill 3072)

Section 1 of Oregon House Bill (HB) 3072, passed during the 2015 Regular Session of the Oregon Legislature, requires the Oregon Department of Education (ODE) to submit a report related to Science, Technology, Engineering and Math (STEM) and Career and Technical Education (CTE) distributions made under the section. The report includes metrics on how distributions contribute to the development of a skilled workforce that is able to secure high-wage and high-demand jobs. The following submission is a response to that requirement.

# Background

House Bill 3072 was the latest iteration of legislation to create support for CTE and STEM education. The work began in the 2011-2013 biennium with a small but critical investment in a new CTE grant program in HB 3362. During the 2013-2015 biennium, the Legislature increased the support for the CTE Revitalization Grant, refined the purpose of the grant, and invested in a small number of STEM projects, including the creation of a network of STEM Hubs. During the 2015-2017 biennium, HB 3072 was introduced to combine STEM and CTE investments under one piece of legislation and increase the funds and number of programs supported with those funds.

## High-Wage and High-Demand Occupations

According to the December 2017 Oregon Economic and Revenue Forecast, the State continues to experience economic growth and low rates of unemployment. A deeper look into those trends shows an acceleration in the retirement rate. Industry has long signaled its concern with the mismatch between the loss of a skilled workforce due to retirement and the skill mismatch among younger adults who will be the pool of replacements. The Oregon Employment Department (OED) points out that the number of difficult-to-fill jobs is at a record high of 68% in 2017. The solutions to the emerging issues related to economic growth are multifaceted. Targeted investments in K-12 education can be part of the solution, and HB 3072 provided a framework to fund:

**Activities related to science, technology, engineering and mathematics education and activities related to career and technical education that can lead to high wage and high demand jobs…**

OED defines high-wage and high-demand occupations based on the median wage and median number of total job openings. This is a useful metric that creates a list of more than 240 occupations in 2016. Conversations about what qualifies as a high-wage and high-demand job often encompass more than just wages and openings. The table below shows four occupations that, by the OED definition, are high-wage and high-demand. In 2016, the overall median wage was $18.15 per hour, and the median total number of openings was 233. Some would argue that all the occupations listed in the table should be considered to have the same high-wage and high-demand status.

| Occupation | Median Wage | Total Openings (Demand) |
| --- | --- | --- |
| Chef and Line Cook | $20.50 | 546 |
| Carpenter | $21.04 | 5,899 |
| Computer Numerical Control Machine Operator | $27.00 | 285 |
| Software Applications Developer | $46.97 | 3,277 |

Another consideration is coordination with economic development work like the sector strategies identified by regional workforce boards. The dominant sectors identified across the state are Healthcare, Manufacturing, and Information Technology. Other sectors such as Construction and Agriculture are identified in single regions.

Finally, there are occupations that are difficult to fill. OED identifies occupations in Transportation, Construction, and Natural Resources as most difficult to fill, according to employers.

For the purpose of this report, we have used two different career categories relevant to the K-12 education system that are directly connected to occupations identified in OED data. Career Learning Areas are very broad categories. Each Career Learning Area is further divided into Career Clusters. A full outline of the organizational structure can be found [here](http://www.oregon.gov/ode/learning-options/CTE/resources/Documents/orgChart6_21_16dodgerevision.xlsx).

# Investments in CTE and STEM Increase Opportunities for Students

We have tried to blend elements of various methods when identifying high-wage and high-demand occupations for the purpose of the investments funded through HB 3072 and reported here. We have also recognized that all investments are not occupation-specific. If the purpose of this legislation is to support the economic growth of the State and improve the prosperity of its citizens, we also need to focus on student understanding of core content, such as mathematics and science, as well as build STEM/CTE networks to mobilize community resources and provide equitable student access.

The following summary is based on data gleaned from specific investment reports and overall data collected by ODE independent of specific investments.

**State-approved CTE programs provide sequences of courses linked to specific careers. CTE program growth over the last biennium has provided greater opportunities for students to explore careers that can lead to high-wage and high-demand jobs. This growth includes career clusters that are considered high-wage and high-demand.**

**CTE Revitalization Grants and Secondary Career Pathways funding provided financial support to grow CTE programs. The largest number of grants were awarded to support high-wage and high-demand programs in Industrial and Engineering Systems which include Construction, Manufacturing, Engineering, and Automotive.**

**The number of students who have earned three or more high school credits in high-wage and high-demand CTE programs has increased during the biennium. This suggests that schools are helping students focus their career interests.**

**Students who attended schools with CTE Revitalization grants were able to connect with employers. Internships and job shadows provide a highly personalized connection, while career fairs and job site visits present students with a broad overview of occupations. Similar strategies are used in schools that have not received a CTE Revitalization Grant.**

**The number of teachers requesting CTE endorsements has increased during the biennium. Generally, this is an indicator that schools are either replacing CTE teachers who are retiring or are expanding program options. This trend also applies for some high-wage and high-demand career clusters. The drop in Information Technology may be a result of a change in how those endorsements are classified rather than a drop in program interest.**

## How Investments Influence Interest in High-Wage and High-Demand Occupations

Building student interest in pursuing jobs in high-wage and high-demand occupations requires a variety of actions at state, regional, and local levels. Student decisions can be influenced by a passionate teacher, a concerned counselor, an involved parent, a dedicated community member, or their own peers. A recent case study of students interested in STEM careers demonstrates how a single comment or experience can influence a student’s choice to stay in a STEM pathway. A national study on how CTE programs influence career choices showed that fewer than 20 percent of students in career academies actually pursued their academy focus into post-secondary education.

It is clear that the multifaceted approach to building student interest in high-wage and high-demand jobs promoted in HB 3072 is necessary. These investments helped enhance classroom experiences for students, helped teachers improve their own practice, and increased regional STEM and CTE education supports. What follows is a small sample of the impact of these investments.

## Support for Students

More than 5,700 middle school and high school students had an opportunity to experience contextualized math lessons developed by their math teachers through the Math in Real Life project. Student interviews and surveys indicate how even these small changes can change student interest in mathematics. This is critical since math can be a barrier to attaining high-wage and high-demand jobs.

Students in five high schools were able to earn core academic credit in Mathematics, Science, and Language Arts through their CTE classes as a result of the CTE Course Equivalency Pilot Project. Core academic requirements can, at times, limit the number of CTE courses a student can take. Offering core academic credit through CTE can open up more opportunities related to high-wage and high-demand jobs.

STEM Beyond School reached approximately 1,307 students in grades 4 through 8 with high quality science, technology, engineering, and math (STEM) programming. A high number of those students -- 83 percent -- were identified as historically underserved. Many high-wage and high-demand jobs are considered to be STEM-related.

Oregon Connections, an online tool developed to link schools with industry professionals, provided 12,481 students with direct interaction with an industry professional. These interactions appear to help students see themselves as future STEM professionals. Success stories include students of color seeing a STEM professional who looked like them for the first time, underachieving students seeing common bonds with professionals who struggled when they were younger but found their passion later, and students who were inspired to explore new pathways.

More than 10,000 high school students and 2,000 middle school students participated in new and upgraded CTE programs in over 65 schools as part of the CTE Revitalization Grant. The largest proportion of funds were spent to upgrade facilities and equipment so that programs could align to industry needs. Students talked about how these grants help build a sense of professionalism as they work with state-of-the-art equipment in clean and safe facilities.

The Secondary Career Pathways Grant program provides an incentive for programs to increase the number of students who have earned industry-recognized credentials. Nearly 500 students have earned credentials since the program started. Credentials awarded to students in high school have been linked to persistence in continuing career pathways.

## Support for Teachers

Investments in CTE Teacher Mentorship and Development have helped update teacher knowledge about high-wage and high-demand careers. Two opportunities helped teachers explore the growing aerospace industry in Oregon centered on Unmanned Aerial Vehicles. Health Sciences teachers were able to work with Oregon Health Sciences University to improve their knowledge related to high-wage and high-demand health science careers.

The CTE Teacher Mentorship and Development program also helped build capacity to retain quality CTE teachers. Eastern Oregon University and Oregon State University have developed courses aligned to the needs of CTE teachers. The courses are available online. Early career CTE teachers were provided mentorship support in five different projects around the state.

More than 100 teachers worked in teams to develop and teach lessons that contextualize math as part of the Math in Real Life project. The context was frequently aligned with high-wage and high-demand jobs. This intensive professional development helped change teacher practice, as exemplified by one middle school teacher who decided to rethink her entire math curriculum for improved student engagement.

STEM Hubs have helped coordinate regional professional development for teachers. Lane STEM Hub coordinated information technology industry externships for high school teachers. Frontier STEM Hub and Malheur County worked with teachers to incorporate hands-on engineering experiences for elementary students.

More than 400 teachers received professional development related to information technology through the Computer Science and Digital Literacy Grant. This professional development led to more opportunities for students to experience information technology, including development of new CTE Programs of Study.

Math Adaptive Learning project provided technology to elementary teachers for piloting a variety of computer-based math learning systems. Teachers from 33 schools used the technology to help students understand math, and improved their own understanding of how technology can be used to meet the needs of individual students.

## Supports for Regions

By the end of the biennium, the Oregon Department of Education (ODE) funded 11 STEM Hubs that form a statewide network. These STEM Hubs work with regional partners to identify the STEM needs of the region and coordinate activities to expand access for all students. As an example, the East Metro Science, Technology, Engineering, the Arts and Mathematics (STEAM) Partnership (EMSP) funded a Pockets of Innovation project that helped expand the outreach of 15 programs to all five of the school districts in East Multnomah County, serving approximately 2,175 students.

The Math in Real Life grant created a network of projects supporting teacher professional development in contextualized mathematics. One of the results will be a statewide online resource of context-based lessons freely available to all teachers. Many of the lessons will have a focus on math used in high-wage and high-demand careers.

One of the outcomes of the Computer Science and Digital Literacy project was a “playbook” for districts to develop computer science curriculum and programs. At least two STEM Hubs will be piloting the playbook with districts during the 2017-2019 biennium.

Using the extensive network of the OSU Extension Service, STEM Beyond Schools has been able to help non-profit providers of STEM education programming grow their regional capacity. This will result in more access to underserved students that should result in a growing pool of young adults who will pursue STEM-focused careers.

# Conclusion

Developing a skilled workforce that is able to secure high-wage and high-demand jobs requires multiple strategies. House Bill 3072 provided investments that ranged that addressed students, teachers, and the education system. Projects like STEM Beyond Schools and the Adaptive Math Pilots provided alternative ways for students to learn. Math in Real Life and CTE Revitalization put tools in the hands of teachers to improve their own teaching practices. Funds provided to STEM Hubs continue to build a system of support around the state.

The metrics currently available to the Oregon Department of Education indicate we are increasing opportunities for students to experience learning that will help them secure high-wage and high-demand jobs.