UPDATE: Science, Technology, Engineering, and Mathematics (STEM) Education

2013

Authorizing legislation: RCW 28A.300.515
Recodified as RCW 28A.188.020 pursuant to 2013 2nd sp.s. c 25 § 8.

Career and College Readiness
Kathleen Lopp, Assistant Superintendent

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Executive Summary

To succeed in the 21st century knowledge economy, Washington students need the ability to create, design, innovate, and think critically to solve complex challenges. Every young person should possess deep knowledge and strong skills in mathematics, science, technology, and engineering, and be excited and ready to use the knowledge in the real world.

The Office of Superintendent of Public Instruction (OSPI), as required by legislation, coordinates STEM education across the state. Our work includes:

- creating curriculum and professional development for teachers;
- coordinating youth opportunities in STEM;
- working with four-year universities on developing articulations for engineering and pre-engineering courses;
- developing and maintaining public-partnerships to generate business and industry assistance;
- and more.

For example, in 2012–13 the Seattle University Bioengineering Teacher Training provided professional development to middle and high school teachers in a curriculum rich in STEM. Thirty-three teachers and 33 school districts participated. Similarly, 33 teachers and 23 school districts participated in the WSU–Spokane Biomedical Teacher Training.

In another example, we saw dozens of schools increase student engagement through 64 different competitive events at the middle and high school level. These competitions let students explore, develop, and test their technical, leadership, and employability skills at the regional, state, and national levels. Middle schools, in particular are increasing hands-on STEM projects. Sixty-five middle schools took part in First Robotics challenges alone, a 27 percent increase over the previous year.

This report further describes our work over the past year. In some areas, funding was not available, and these are noted in the report. We also summarize the next steps associated with legislation passed in 2013 “to increase learning opportunities and improve educational outcomes in STEM through multiple strategies and statewide partnerships.”
Background

In 2010, the Washington State Legislature provided funding and direction for the Office of Superintendent of Public Instruction (OSPI) to create a STEM working group. On December 1, 2010, 27 members on the STEM Work Group presented to the Legislature a comprehensive plan and report with recommendations, including a timeline for specific actions. OSPI has since continued to collaborate with state agencies, community colleges, and STEM community partners to increase the STEM education efforts in Washington state. We are also gearing up for new requirements passed in 2013, which are noted in the “Conclusion and Next Steps” section of this report.

Update Status

OSPI provided statewide coordination for STEM in 2013. The following update parallels the requirements of RCW 28A.188.020.

1. Project-based high school and middle school technology curriculum that includes a comprehensive professional development component for teachers:
The Legislature mandated H 5863 in the 2010-11 budget to provide grants of $2,500 to 20 middle and high school teachers. The received development training for implementing integrated math, science, technology, and engineering programs in their schools. In addition, 3ESHB 2127 provided funds for fiscal years 2012 and 2013, to be used for the exact same purpose as in 2010.

Seattle University became a Project Lead The Way (PLTW) affiliate in 2008. Seattle University is the only postsecondary institution in Washington that is able to provide PLTW engineering training for teachers. Seattle University provided professional development training to middle and high school teachers in a curriculum rich in STEM. PLTW requires teacher training in the basics of a pre-engineering program so the instructor can teach high level STEM in a nationally established curriculum. Local companies such as Boeing, Microsoft, Kenworth, AT&T, Cisco partner with school districts and teachers to present students with real problems needing real solutions. These business and community members provide mentorship and assist students in developing leadership and communications skills.

Table 1: PLTW — Seattle University Bioengineering Teacher Training

<table>
<thead>
<tr>
<th>School Year</th>
<th>Number of Teachers</th>
<th>Number of School Districts</th>
<th>Total Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>20</td>
<td>20</td>
<td>$50,000</td>
</tr>
<tr>
<td>2011-12</td>
<td>20</td>
<td>20</td>
<td>$50,000</td>
</tr>
<tr>
<td>2012-13</td>
<td>33</td>
<td>33</td>
<td>$50,000</td>
</tr>
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</table>
Washington State University (WSU) Spokane joined PLTW in 2010 as an affiliate university for the new Biomedical Sciences program. WSU is the only postsecondary institution in Washington State that is able to provide PLTW biomedical training for teachers.

PLTW’s comprehensive curriculum emphasizes critical thinking, creativity, innovation, and real-world problem solving. Each course curricula represents a complete package, which allows the instructor to focus on teaching, student achievement, assessment and professional development. The hands-on, project-based program engages students on multiple levels, exposes them to subjects that they typically would not pursue, provides them with a strong foundation for achieving their academic goals in any chosen field of study and, if pursued, establishes a proven path to college and career success in STEM related industries. The training was funded with Carl D. Perkins federal funding.

Table 2: PLTW — WSU–Spokane Biomedical Teacher Training

<table>
<thead>
<tr>
<th>School Year</th>
<th>Number of Teachers</th>
<th>Number of School Districts</th>
<th>Total Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>20</td>
<td>11</td>
<td>$57,500</td>
</tr>
<tr>
<td>2011-12</td>
<td>20</td>
<td>12</td>
<td>$50,000</td>
</tr>
<tr>
<td>2012-13</td>
<td>33</td>
<td>23</td>
<td>$50,000</td>
</tr>
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2. Public-private partnership to assist school districts with implementing an ongoing, inquiry-based science program that is based on a research-based model of systemic reform and aligned with Washington State science grade level expectations: No funding.

3. Supporting a public-private partnership to provide enriching opportunities in mathematics, engineering, and science for underrepresented students in grades kindergarten through twelve using exemplary materials and instructional approaches: No funding.

4. Efforts to increase precollege and prework interest in STEM fields in collaboration with the community and technical colleges, the four-year institutions of higher education, and workforce training and education coordinating board (WTECB), conducting outreach efforts to attract middle and high school students to careers in math, science and technology and to educate students about the coursework that is necessary to be adequately prepared to succeed in these fields: As part of the 2010 System Design Plan legislation ([SSB 6355](#)), the status of applied baccalaureate degrees offered by Washington's community and technical colleges was changed from pilot to
The State Board for Community and Technical Colleges (SBCTC) approve all proposals for applied baccalaureate degrees from the community and technical colleges. These programs are intended to:

- Serve professional and technical degree-holding students who have limited access to bachelor degree programs after completing their technical associate degree.
- Provide opportunities for working adults who are place-bound and want to earn a bachelor degree.
- Fill skills gap needs in specific occupations.

The Washington State Legislature passed ESB 5974 in December 2011, allowing OSPI staff to work with four-year universities on developing articulations for engineering and pre-engineering courses. This work is ongoing.

OSPI is working in collaboration with the community and technical colleges, four-year institutions, and the WTECB to increase capacity and successful graduation of highly skilled workers in STEM. The applied baccalaureate degrees are designed to align high quality secondary academic and career and technical programs with professional and technical associate degree programs that provide the foundation for students to enter and graduate from applied baccalaureate STEM programs.

In July 2012, SBCTC retained sole approval authority for applied baccalaureates degrees.

5. Coordinating youth opportunities in math, science, and technology, including facilitating student participation in school clubs, state-level fairs, national competitions, and encouraging partnerships between students and university faculty or industry to facilitate each student’s participation:

OSPI staff works with the Washington Technology Student Association (WTSA) which is a non-profit nationally recognized student leadership organization devoted to teaching STEM, pre-engineering, technology education and industrial technology. With an emphasis on STEM, middle and high school students participate in competitions to demonstrate their technical and leadership skills with leadership and employability training.

Students are part of Career and Technical Education programs at their local high schools. These students are enrolled in courses that include Pre-Engineering, Architecture, Manufacturing, Construction, Industrial Design, Information Technology, Graphics Design, Video Production, Video Game Design, and many other technical areas. One of the goals of these programs and this association is to help students develop the skills that will make them successful later in life.

- Competitions—Students participate in approximately 64 different competitive events at the middle and high school level that allow students to explore, develop, and test their technical, leadership, and employability skills at the regional, state, and national levels. These events range in content from engineering design to public speaking. Students are judged by industry professionals from companies such as Microsoft, PACCAR, Boeing, Pop
Ca Games, and NAC Architects. Through these competitions, students explore and develop skills for STEM industries such as Engineering, Manufacturing, Construction, Architecture, Video Game Design, Computer Programming, and Robotics.

Table 3: First Robotics — Lego League (Middle School Only)

<table>
<thead>
<tr>
<th>School Year</th>
<th>Number of Middle Schools</th>
<th>Number of School Districts</th>
<th>Total Funds</th>
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<tbody>
<tr>
<td>2011-12</td>
<td>51</td>
<td>29</td>
<td>$30,600</td>
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<tr>
<td>2012-13</td>
<td>65</td>
<td>34</td>
<td>$33,200</td>
</tr>
</tbody>
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Table 4: First Robotics Challenge

<table>
<thead>
<tr>
<th>School Year</th>
<th>Number of High Schools</th>
<th>Number of School Districts</th>
<th>Total Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>81</td>
<td>39</td>
<td>$291,560</td>
</tr>
<tr>
<td>2011-12</td>
<td>62</td>
<td>49</td>
<td>$217,000</td>
</tr>
<tr>
<td>2012-13</td>
<td>56</td>
<td>46</td>
<td>$223,600</td>
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Table 5: First Robotics — Tech Challenge

<table>
<thead>
<tr>
<th>School Year</th>
<th>Number of High Schools</th>
<th>Number of School Districts</th>
<th>Total Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>43</td>
<td>23</td>
<td>$73,945</td>
</tr>
<tr>
<td>2011-12</td>
<td>28</td>
<td>15</td>
<td>$33,925</td>
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<tr>
<td>2012-13</td>
<td>35</td>
<td>20</td>
<td>$42,800</td>
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</table>
• State Education Fair—At state level conferences, students have the opportunity to take part in an annual Education Fair. This event brings a variety of University, Community College, Technical College, Apprenticeship Programs, and Employers in one spot to speak with students about post-secondary opportunities to further develop their STEM skills. Many students do not get the opportunity to learn about these programs in their schools. The State Education Fair brings resources together so every student has an opportunity to learn about their options.

• Fostering Partnerships—Through competitive events, students are encouraged to make connections with industry professionals in their area as they prepare for competition. Many competitions include an interview component in which students talk directly with industry professionals about their project, career planning, and ideas to further develop the student’s skills. Central Washington University hosts events which bring students onto the campus allowing them the opportunity to tour the program. Further, their Technology/Engineering Education majors volunteer as judges and assist in running conferences. This allows those future teachers the opportunity to get practice working with students and assessing student work.

6. Developing and maintaining public-partnerships to generate business and industry assistance to accomplish:

*Increasing student engagement and career awareness, including increasing student participation in the youth opportunities in STEM.*

There are over 100 middle schools participating in STEM education. There has been steady growth over the last three years with the number of districts, number of students participating and the number of approved courses.

<table>
<thead>
<tr>
<th>School Year</th>
<th>Number of Districts</th>
<th>Number of Annual Average FTE</th>
<th>Number of Approved Courses</th>
</tr>
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<tbody>
<tr>
<td>2010-11</td>
<td>101</td>
<td>3,069.17</td>
<td>272</td>
</tr>
<tr>
<td>2011-12</td>
<td>112</td>
<td>4,119.39</td>
<td>369</td>
</tr>
<tr>
<td>2012-13</td>
<td>131</td>
<td>5,809.00</td>
<td>441</td>
</tr>
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STEM Lighthouse schools originated in 2010 with the Legislature’s passage of House Bill 2621. The Legislature also passed 3ESHB 2127, which provided funds for fiscal years 2012 and 2013 to be
used solely for STEM lighthouse projects consistent with chapter 238, Laws of 2010. The bills direct OSPI to designate as many as three middle and three high schools each year as lighthouse schools. STEM Lighthouse Schools are used as best practice models. Schools may come to visit, observe, and replicate teaching strategies and course work. STEM Lighthouse schools will provide advanced STEM-related academic and CTE programs of study that are engaging, rigorous, and lead to industry certification and/or dual credit (high school/college credit).

2013 STEM Lighthouse Schools: Bremerton High School (Bremerton); Delta High School (Kennewick); San Juan School District; Stevens Elementary School (Aberdeen); West Hills STEM Academy (Bremerton); West Valley Junior High School (West Valley Yakima); WF West High School (Chehalis). 2012 STEM Lighthouse Schools: Eastmont Junior High School (Eastmont); Secondary Academy for Success (Northshore); Science and Math Institute (Tacoma); Stewart Middle School (Tacoma); Toppenish High School (Toppenish); Odessa School District. 2011 STEM Lighthouse Schools: Aviation High School (Highline); Komachin Middle School (North Thurston); Mead School District.

Further details about each district and school’s participation is available at http://www.k12.wa.us/STEM/LighthouseSchools.aspx.

<table>
<thead>
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<th>Table 7: STEM Lighthouse Schools</th>
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<tr>
<td><strong>School Year</strong></td>
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<tr>
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<tr>
<td>2010-11</td>
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<td>2011-12</td>
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<td>2012-13</td>
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Creation and promotion of student scholarships, internships, and apprenticeships.

- Teacher Training—OSPI staff worked with professional associations to provide conferences in which teachers share ideas and strategies to better teach STEM to our students and prepare them for the world of work. Partnership with the Seattle Manufacturing Industrial Council has developed a pool of industrial speakers for the conference and other local school events. Worked with Boeing and other groups has provided trainings to teachers in curriculum that meets the needs of industry including the CORE Plus curriculum.

- Scholarships—WITEA has established the Jere Cary Scholarship at Central Washington University for students pursuing a career as a Technology/Engineering Teacher.
Provision of relevant teacher experience and training, including on-the-job professional development opportunities.

In 2009 the CTE certification rules were changed in order to allow current science teachers to be certified to teach STEM courses. CTE is at the front of innovation in education in Washington. There is nothing more exciting than seeing students engaged in studies that push them to their limits and spark their imaginations. It is our state’s responsibility to prepare all students for success in career, college and life. Each year, thousands of CTE students graduate from high school with career goals, job skills and leadership skills knowing exactly where they will go next to further their academic and hands-on education and training.

CTE programs in Washington are aligned with rigorous industry and academic standards. Teachers participate in meaningful professional development on curricula and instruction, standards and assessment, and academic integration. Program partnerships and advisories communicate this vision with business and industry partners. Such programs meet the demands of the new economy.

Upgrading kindergarten through twelfth grade school equipment and facilities to support high quality math, science, and technology programs.

No funding.

7. Assembling a cadre of speakers employed or experienced in STEM fields:

State conferences focus on speakers at the general sessions that inspire students into STEM careers. Speakers from Boeing and other engineering firms have spoken to the students about their careers and the paths they have taken as well as the rewards of having one of these jobs. Also, motivational speakers have helped to shape students to develop the soft skills needed in the workforce.

8. Providing technical assistance to schools and school districts, including working with counselors in support of the math, science, and technology programs.

STEM program supervisor provides ongoing technical assistance to schools and school districts supporting STEM programs.

9. OSPI to collaborate with the state board community and technical colleges to develop high-demand applied baccalaureate programs that align with high quality STEM programs and CTE programs.

OSPI is working in collaboration with the SBCTC’s and with technical colleges to increase capacity and successful graduation of highly skilled workers in STEM. The applied baccalaureate funds are designate by the Legislature and are specifically designed to align high quality secondary academic and career and technical programs with professional and technical associate degree programs that provide the foundation for students to enter and graduate from applied baccalaureate STEM programs.

These are one-time fund that may be used for program development and design. All funds must be used by June 30, 2014. Total funds to be distributed to colleges through a competitive process is $500,000.
Conclusion and Next Steps

In 2013, the Legislature passed [HB 1872](https://app.leg.wa.gov/bills/housebill/home?Bill='13HB1872'), which provides a results-driven approach to align state agencies and resources around a comprehensive pre-kindergarten to grade 20 (PK-20) STEM strategy and evidence-based framework for accountability. Specifically, this will:

- Provide tools to align the state’s STEM education efforts and target state dollars towards promising innovations and best practices.
- Ensure STEM outcomes are embedded in existing state policy and planning efforts, such as the Washington Student Achievement Council’s 10-year education roadmap.
- Establish a multi-sector Governor’s STEM Education Innovation Alliance.
- Create a pathway for future state investments to accelerate STEM efforts currently led by the nonprofit Washington STEM. These efforts include supporting the growing number of regional STEM networks around the state and making competitive investments to improve STEM teaching and learning.
- STEM skills enhance opportunity for students and economic vitality.

Washington has important work ahead and the following goals developed by the STEM Work Group will continue to be areas of collaboration and focus with the STEM education and business partners in Washington.

**Goal 1:** Teachers and leaders are recruited, prepared and retained to provide effective STEM instruction.

**Goal 2:** Establish STEM-based K-12 educational programs that ensure students graduate from high school STEM literate, well-prepared for college, careers, and informed about civic participation.

**Goal 3:** School districts provide all K-12 students with opportunities in STEM-related activities, coursework, and advance programs of study to prepare for STEM-related post-secondary educational pathways and careers.

**Goal 4:** Families, communities, and employers advocate for excellent STEM education for every student, every day.

**Goal 5:** Business and Industry partner with teachers, schools and districts to plan and provide support and opportunities to engage all students in STEM.

We must prepare and engage all students in a robust STEM foundation that leads to advanced STEM instruction and training no matter their gender, race, or background. This will allow students to be able to meet the demand in STEM-related fields and to compete in the global economy.
OSPI provides equal access to all programs and services without discrimination based on sex, race, creed, religion, color, national origin, age, honorably discharged veteran or military status, sexual orientation including gender expression or identity, the presence of any sensory, mental, or physical disability, or the use of a trained dog guide or service animal by a person with a disability. Questions and complaints of alleged discrimination should be directed to the Equity and Civil Rights Director at (360) 725-6162 or P.O. Box 47200 Olympia, WA 98504-7200.

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