Report to Christine Gregoire, Governor, and the Washington State Legislature

Recommendations for Science, Technology, Engineering and Mathematics Education

STEM Work Group

Prepared by:

Dennis Milliken, OSPI STEM Program Supervisor, STEM Work Group Chair
Dr. Jonelle Adams, WSSDA, Executive Director, Facilitator

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All students develop a core foundation within and across the STEM disciplines so that they can be active and engaged in a society that is scientifically and technologically rich, complex and dynamic.

Executive Summary

Given its importance, STEM education must prepare and engage all students no matter their gender, race, or background.

Science, Technology, Engineering, and Mathematics (STEM) education will determine whether the United States will remain a leader among nations and whether we will be able to solve immense challenges in such areas as energy, health, environmental protection, and national security. It will help produce the capable and flexible workforce needed to compete in a global marketplace. It will ensure our society continues to make fundamental discoveries and to advance our understanding of ourselves, our planet, and the universe. It will generate the scientists, technologists, engineers, and mathematicians who will create the new ideas, new products, and entirely new industries of the 21st century. It will provide the technical skills and quantitative literacy needed for individuals to earn livable wages and make better decisions for themselves, their families and their communities. And it will strengthen our democracy by preparing all citizens to make informed choices in an increasingly technological world. Given its importance, STEM education must prepare and engage all students no matter their gender, race, or background.

STEM learning in Washington will not achieve its potential unless integrated and project based types of learning activities are embedded into the infrastructure of K-12 education. A successful STEM strategy also requires greater connectivity between K-12 and post secondary programs and better support for effective student transition upon high school graduation.

Washington has various models of successful STEM implementation. HB 2621 calls for OSPI to identify up to six exemplary middle school and high school models of STEM implementation that can be considered Lighthouse STEM schools. These schools are in the early stages of implementation and they may provide a pathway for future STEM school design.

In preparing this report and its recommendations, the STEM Work Group represented a diverse group of experts from school administration, higher education, business and industry, educators, state agencies and commissions, school directors, nonprofits, representatives from under-served populations, and a state legislator.

There have been a number of important reports related to STEM education over the past decade, including landmark reports that have called attention to the rationale and challenges associated with effective STEM education, reviews of the research literature and recommendations concerning principles and priorities. Our goal was not to redo the work of previous groups, but to build upon and translate these ideas into a comprehensive STEM plan that focuses on overarching goals, followed by defined strategies and actions with expected outcomes and measures.

Priority recommendations

Included in this report is the overall comprehensive STEM plan that lays out overarching goals and action steps; however, we sought to identify the most critical priorities for rapid action in our Executive Report. Below we summarize three major areas as preferred priority recommendations which would be followed by the full implementation of the STEM Comprehensive Plan over the next five to ten years (2010 – 2020).

Focus I: Improved teaching throughout K-12

The most important factor in ensuring excellence in STEM education is great STEM teachers, with both deep content knowledge in STEM subjects and mastery of the pedagogical skills required to teach these subjects well.

To accelerate student achievement in STEM subjects and close the STEM achievement gap, Washington needs to ensure that every student has a highly effective teacher.

Priority recommendations

- Increase the number of candidates, including those from underrepresented populations, seeking careers in STEM teaching.
- Ensure there are multiple pathways for professionals from Science, Technology, Mathematics, and Engineering fields to enter teaching.
- All teachers have access to job-embedded professional development to build teacher capacity in both content and pedagogy for STEM learning experiences.
- Build the capacity of principals and school leaders to monitor and improve student learning in STEM education and close the opportunity gap.

Focus II: Deep and sustained commitment to STEM innovation throughout K-12

STEM education is most successful when students develop personal connections with the ideas and excitement of STEM fields. This can occur in both the classroom through individualized and group experiences utilizing project based learning and advanced courses, and outside the classroom through experiences such as science fairs, robotics contests and math olympiads.

Priority recommendations:

- School districts will support the expansion of innovative K-12 schools and/or K-12 program models based on STEM themes with a focus on minority, high-poverty, and underserved communities.

- School districts 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).

- School districts will provide the opportunity for all students to meet science and math learning standards through adequate time spent on standards-based mathematics and science courses of study, appropriate and culturally relevant formative and summative assessments, and high-quality instruction.

- OSPI and school districts will develop and implement interdisciplinary instructional delivery methods that are culturally relevant for each grade level and are aligned with learning standards in all disciplines (STEM and other disciplines, such as literacy, art, and social studies, Grades K-12).

Focus III: Ensure strong community and business engagement for STEM education

Strong leadership and participation from STEM professionals can be a tremendous asset for K-12 education. Many representatives from the range of STEM occupations are willing to contribute to improving STEM education, both in school and out of school, if an efficient and effective way for them to do so could be put into place.

Priority recommendations

- Engage communities, especially those of underrepresented populations, in a discussion about what STEM education would look like in their community to achieve this goal (STEM education for every student, every day).

- Conduct a set of community campaigns statewide using different types of media, including social network channels and entertainment media to deliver key STEM messages. (Examples include such events as a STEM Education Awareness month, media campaigns, statewide summits on STEM education, regional community forums, STEM presentations at school board meetings, family STEM nights, and STEM career awareness presentations for youth in out-of-school programs).

- Provide a framework for local businesses, STEM professionals and community partners to offer jobs, mentorships and internships to students and teachers to extend classroom learning and mobilize advocacy in support of STEM education.

- Enlist business and industry as active partners in STEM education by participating in meaningful engagement through diverse advisory committees, composed of management and labor that work with the schools to plan authentic experiences for all students and teachers.

Introduction

STEM literacy is achieved when a student is able to apply his or her understanding of how the world works within and across the four interrelated STEM disciplines to improve the social, economic, and environmental conditions of their local and global community.

State Proviso

The 2010 Washington State Legislature passed ESSB 6444, providing funding and direction for the operation and expenses of The Offices of the Superintendent of Public Instruction. Section 501 (c) of ESSB 6444 states:

"$25,000 of the general fund — state appropriation for fiscal year 2010 is provided to the office of the superintendent of public instruction solely to convene a science, technology, engineering, and mathematics (STEM) working group to develop:

> A comprehensive plan with a shared vision, goals, and measurable objectives to improve policies and practices to ensure that a pathway is established for elementary schools, middle schools, high schools, postsecondary degree programs, and careers in the areas of STEM.
>
> To include improving practices for recruiting, preparing, hiring, retraining, and supporting teachers and instructors while creating pathways to boost student success, close the achievement gap, and prepare every student to be college and career ready.
>
> The working group shall be composed of the director of STEM at the Office of the Superintendent of Public Instruction who shall be the chair of the working group, and at least one representative from the state board of education, professional educator standards board, state board of community and technical colleges, higher education coordinating board, the achievement gap oversight and accountability committee, and others with appropriate expertise.
>
> The working group shall develop a comprehensive plan and a report with recommendations, including a timeline for specific actions to be taken, which is due to the governor and the appropriate committees of the legislature by December 1, 2010."

The STEM Work Group determined that the products required by this legislative proviso shall include:

- A STEM definition that Work Group members will support and advocate for with their stakeholder constituencies;
- A comprehensive STEM Education Plan to ensure a STEM pathway is established for P-16.

- Recommendations

  1. Recommendations on creating STEM pathways for elementary, middle and high schools that boost student success.
  2. Recommendations on STEM's role in closing the opportunity gap to prepare all students to be career and college ready.

Members of the STEM Work Group

Appointments to the STEM Work Group were made through association recommendation and direct invitations, consistent with the proviso language.

Adams, Jonelle Ed.D., Work Group Facilitator
Washington State School Directors' Association, Executive Director

Bacon, Susan Ellen Ph.D.
Seattle University Coordinating Board, Associate Dean of Professional Development, Continuing Education & Outreach

Bertschi, Rudi
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OSPI Teaching & Learning, Director, Mathematics

Cannard, Bruce
Association of Washington School Principals, Principal, Edison Elementary School, Kennewick, Washington

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University of Washington, Associate Dean, Undergraduate Academic Affairs

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Washington MESA, Executive Director

Dziko, Trish Milines
Achievement Gap Oversight & Accountability Committe, Executive Director/CEO, Technology Access Foundation

Estes, Jeff
Pacific Northwest National Laboratory, Manager, Science & Engineering Education

Fertakis, Mary
Washington State School Directors' Association, School Director, Tukwila School District

Field, Jane
Washington Department of Employment Security, Labor Market & Economics Analyst

Finch, Peter
Washington Association of School Administrators, Assistant Superintendent for Teaching & Learning/West Valley School District 208

Gering, Dave
Manufacturing Industrial Council of Seattle, Executive Director

Members of the STEM Work Group

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Association of Washington School Principals, Principal, Central Kitsap Junior High School

Kernan, Catherine
Washington Education Association, President, Mukilteo Education Association

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Partnership for Learning, Executive Director

Landel, Carolyn, Ph.D.
Washington STEM, Chief Program Officer

Lederer, John Ed.D.
Higher Education Coordinating Board, Associate Director of Academic Affairs

Lopp, Kathleen
OSPI Career & College Readiness, Assistant Superintendent, Career & College Readiness

Milliken, Dennis, Work Group Chair
OSPI Career & College Readiness, Supervisor, STEM Education

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State Board for Community & Technical Colleges, Policy Associate, Assessment Learning, Teaching

Moore, Mea
Professional Educators Standards Board, Director, Education Pathways

Pruitt, Wes
Workforce Training & Education Coordinating Board, Policy Analyst/Legislative Liaison

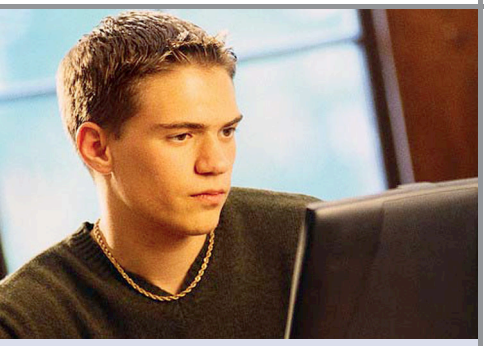
Representative Sharon Tomiko Santos
Washington State House of Representatives, 37th Legislative District, State Representative

Sullivan, James
Washington Education Association, Teacher, Brier Terrance Middle School, Edmonds School District

Taylor, Kathe, Ph.D.
Washington State Board of Education, Policy Director

Wheeler, Gilda
OSPI Teaching & Learning, Environmental & Sustainability Program Supervisor

Acknowledgements



All students develop the ability to identify and apply concepts from science, technology, engineering, and mathematics to prepare them for postsecondary education pathways that will lead to rewarding family-wage earning careers with options for growth and mobility.

The STEM Work Group's membership, as prescribed by the Proviso language, is very diverse in representation, and is composed of 26 members in addition to the chair and facilitator. The Proviso called for specific representation and "others with appropriate expertise." Associations appointed experts from their memberships, with a stated expectation that members will serve as future STEM resources to the associations.

Commendation and grateful appreciation is expressed to all STEM Work Group members, who graciously shared their expertise, talents, and passion for rigorous and relevant STEM education. Exceptional commitment was demonstrated through greater than ninety percent attendance at each of four day-long meetings and through considerable subcommittee work apart from formal meeting times.

Appreciation and acknowledgement is extended to Senator Rosemary McAuliffe for showing support for the STEM Work Group's endeavors and for her presence at meetings. Senator McAuliffe was very willing to clarify legislative intent when questions surfaced, allowing for greater focus and efficiency with the STEM Work Group.

Representative Sharon Tomiko Santos was invaluable to the STEM Work Group. As a member, representing the Achievement Gap and Oversight Accountability Committee, and as a state legislator, Representative Santos was adamant in her advocacy for effective STEM education for all students, with particular attention to those who are often unrepresented and/or under-represented. As a result, all goal areas of the Plan address the Opportunity Gap.

Legislative staff members were extremely helpful in providing guidance and information that contributed to greater efficiency of the STEM Work Group.

Jonelle Adams, Executive Director of the Washington State School Directors' Association, is appreciated for her skillful facilitation of the STEM Work Group.

Process

This view of STEM literacy is firmly rooted in a set of desired outcomes — engaged citizenry, postsecondary success, and an enhanced and diverse STEM pipeline — and aligned with a comprehensive career and college ready agenda.

The STEM Work Group was selected from a diverse group of experts from school administration, higher education, business and industry, state agencies and committees, school directors, nonprofits, representatives from communities of color and one state legislator. The group consisted of 26 members.

The Work Group met on four occasions in July, September, October and November 2010, and followed this process:

Review, agreements, exploration:

- Reviewed the current status of STEM education in our state and created an agreed upon definition to guide the work
- Explored data and information about STEM related employment and future career growth opportunities.
- Reviewed state produced plans and reports on STEM education including Race to the Top, Washington State Education Reform Plan Framework, SB 2776 and SB 6696 and Washington State Strategic STEM Plan.
- Engaged in presentations with Professional Educator Standards Board, Achievement Gap Oversight & Accountability Committee, Washington STEM Center, Washington Improvement & Implementation Network (WIIN) and OSPI.

Identifying components and goals

- Created four work groups to develop the various components of a Comprehensive STEM Plan which included goals, strategies, action items and progress indicators.
- Reviewed and discussed goals, strategies and action items and recommendations for the report.

    1. What are the high leverage goals and measurable outcomes to improve policies/practices to ensure a pathway (K-16) is established?
    2. What are the high leverage practices to improve recruiting, preparing, hiring, retraining and supporting teachers who can close the achievement gap?
    3. What are the high leverage practices to increase the graduation rate and prepare every student to be career and college ready?

Process

Recommendations

- Drafted recommendations for report.

    1. Finalized Comprehensive STEM Plan for shared vision, goals, strategies and target indicators and expected results.

    2. Identified high leverage actions to ensure K-16 pathways for STEM careers, teacher development, closing the achievement gap and boosting student success, and assuring that every student is career and college ready.

    3. Identify various ways to take these recommendations forward and get buy-in from stakeholders.

- Each member of the STEM Work Group completed a Commitment and Next Step Plan on how their organization will move forward to support the recommendations from this report.

Definition of STEM Literacy

America's capacity to innovate and compete in the global marketplace is directly tied to the ability of our public schools to adequately prepare all of our children in STEM.

STEM Work Group Members began their work by clearly articulating the definition of STEM.

> Is effective STEM preparation a matter of achieving competency in science, technology, engineering, or mathematics? OR -
>
> Is effective STEM education achieved when students and the workforce are able to apply and inter-relate the knowledge and skill of each content in a manner in which the whole of STEM is greater than the sum of its individual science, technology, engineering, and mathematics components, improving career preparation and college readiness?

STEM literacy is the ability to identify, apply and integrate concepts from science, technology, engineering, and mathematics to understand complex problems and to innovate to solve them.

To understand and address the challenge of achieving STEM literacy for all students begins with understanding and defining its component parts and the relationships between them.

Scientific literacy is the ability to use knowledge in physics, chemistry, biology, and earth/space science to understand the natural world and to participate in decisions that affect it.

Technological literacy is the ability to use new technologies, understand how new technologies are developed, and have skills to analyze how new technologies affect us, our nation, and the world.

Engineering literacy is the ability to use the systematic and creative application of scientific and mathematic principles to practical ends, such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.

Mathematical literacy is the ability to analyze, reason, and communicate ideas effectively through posing, formulating, solving, and interpreting solutions to mathematical problems in a variety of situations.

STEM literacy is achieved when a student is able to apply his or her understanding of how the world works within and across the four interrelated STEM disciplines to improve the social, economic, and environmental conditions of their local and global community. To achieve these ends students must have rich experiences that begin in preschool and are intentionally expanded and refined throughout their K-12 experience.

Definition of STEM Literacy

STEM literacy is central to engaged citizenship, rewarding employment, and ultimately to improved social, environmental and economic conditions in our local and global community. Moreover, ensuring that individuals and communities that have historically been underserved and overlooked are STEM-capable can put an end to cycles of poverty and provide access to a brighter future. This means that now, more than ever, being well prepared in STEM is essential for all our nation's students — those seeking employment immediately following high school completion, those bound for community colleges or universities, as well as those pursing STEM professions.

To have a positive impact on all students STEM literacy must be viewed as a core component of a comprehensive career and college-ready agenda. For STEM, that agenda would work toward three key outcomes:

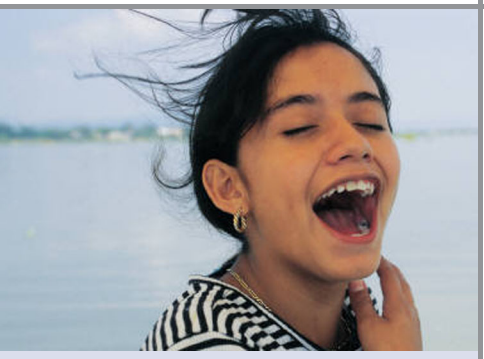
1. All students develop a core foundation within and across the STEM disciplines so that they can be active and engaged in a society that is scientifically and technologically rich, complex, and dynamic.

2. All students develop the ability to identify and apply concepts from science, technology, engineering, and mathematics to prepare them for postsecondary education pathways that will lead to rewarding family-wage earning careers with options for growth and mobility.

3. An increasing number and diverse group of students are motivated and encouraged to pursue STEM professions through challenging and relevant learning experiences throughout their P-12 experience.

This view of STEM literacy is firmly rooted in a set of desired outcomes — engaged citizenry, postsecondary success, and an enhanced and diverse STEM pipeline — and aligned with a comprehensive career and college ready agenda. Importantly, this view does not prescribe a single model or approach as the sole solution to achieving STEM literacy. Rather, it allows for schools and districts to build local ownership and support for models that draw upon their context and to mobilize their unique resources in flexible ways to achieve those outcomes.

Why P-16 STEM Education Matters

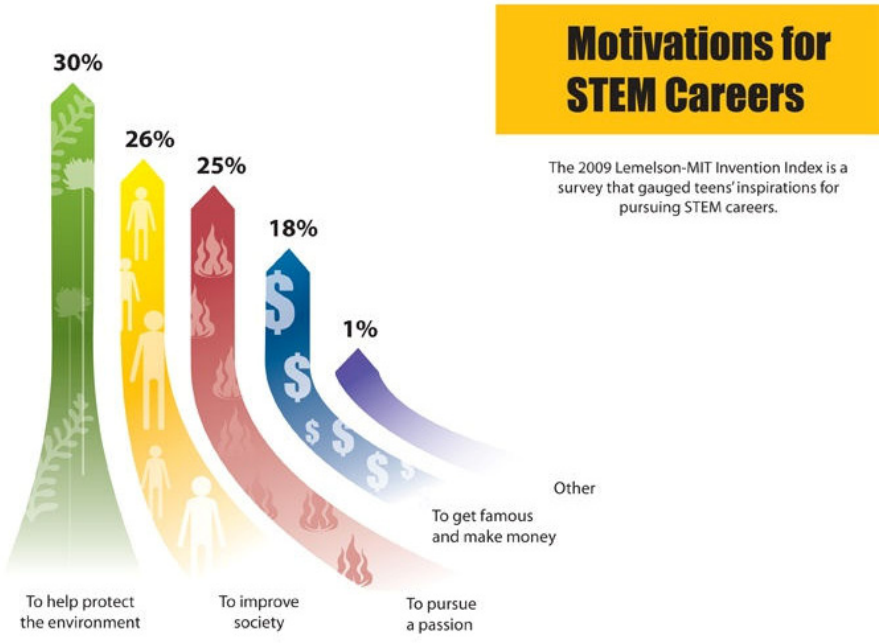


The United States' competitive edge within the STEM fields is heavily dependent upon our students' competitiveness with their international peers.

Washington's and America's economic growth in the 21st century will be driven by the ability to generate ideas and translate them into innovative products and services. A strong consensus is emerging among scientific, business, and education leaders that America's capacity to innovate and compete in the global marketplace is directly tied to the ability of our public schools to adequately prepare all of our children in STEM.

The saturation of technologies in most fields means that all students — not just those who plan to pursue a STEM profession — will require a solid foundation in STEM to be productive members of society and the workforce. When employers were asked to identify job applicants' common deficiencies, most industries reported a lack of mathematics, science, computer, and problem-solving skills. The United States' competitive edge within the STEM fields is heavily dependent upon our students' competitiveness with their international peers.

What students want in a career



*2009 Lemelson-MIT Invention Index includes a nationally representative survey sample size of 500 teens.

Why STEM education matters

What STEM occupations deliver

STEM-related occupations translate into opportunities for Washington students, regardless of their entry point. A student graduating from high school in the United States today has many different life options from which to choose: entering the workforce, apprenticeships, entering the military, entering a two-year community or technical college, and entering a four-year college. A student today also may choose among any of several pathways to the workforce. Some pathways include the aforementioned options, as shown by increasing numbers of students who are re-entering college at a later point in their life. Understanding that there are many different pathways to the workforce demonstrates that a student's high school diploma must include STEM competencies so as not to close them off from any of these options either right after high school or later in life. Opportunities in the Washington workforce exist for varying preparation entry points into STEM-related occupations and jobs are classified in "zones," based upon preparation required for entry.

Job Zone 1: In general, no previous work-related skill, knowledge, or experience is needed for these occupations. These occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license. Employees in these occupations may need anywhere from a few days to a few months of training. Usually, an experienced worker would show such an employee how to do the job.

Job Zone 2: In general, some previous work-related skill, knowledge, or experience may be helpful in these occupations, but usually is not needed. For example, a drywall installer might benefit from experience installing drywall, but an inexperienced person could still learn to be an installer with little difficulty. These occupations usually require a high school diploma and may require some technical training or job-related course work. In some cases, an associate's or bachelor's degree could be needed. Employees in these occupations need anywhere from a few months to one year of working with experienced employees.

Job Zone 3: In general, previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of technical training and often must have passed a licensing exam in order to perform the job. Most of these occupations require training in vocational schools, related on-the-job experience and informal training with experienced workers. These occupations usually involve using communication and organizational skills to coordinate, supervise, manage or train others to accomplish goals.

Job Zone 4: In general, a minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. Most of these occupations require a four-year bachelor's degree, but some do not. Employees

in these occupations usually need several years of work-related experience, on-the-job training, and/or technical training.

Job Zone 5: In general, extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. A bachelor's degree is the minimum formal education required for these occupations. However, many also require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree). Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training. These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required.

In some instances occupations such as those with apprenticeships transition from one level of training into other job zones. These occupations are represented separately as (multi) in the first charts. In the second chart, in the analysis of healthy green STEM occupations, the multis were assigned to the primary job zone. Furthermore, there are instances of new and emerging occupations that have been identified and are pending detailed analysis. These new occupations are added to those miscellaneous and all other occupations in the second chart.

All Others: There are instances of new and emerging occupations that have been identified and are pending detailed analysis. These occupations are added to the group of occupations considered "all others" in the second table.

Employment in all Washington occupations

Job Zones	Number of SOC Codes	2Qtr2009 Estimated Employment	New Jobs	Avg Annual Openings	Average Annual Wage
1	92	667,025	6,074	30,057	$27,360
2	166	910,343	2,806	24,788	$36,900
3	170	678,278	2,399	15,571	$52,635
4	122	464,149	1,876	11,230	$76,746
5	92	165,101	1,365	4,529	$86,189
Totals	**642**	**2,884,896**	**14,520**	**86,175**	**$47,625**

*SOC – Standard Occupational Codes – Jane Field, Washington Department of Employment Security, 2010, *Note: Some technical limitations.*

Why STEM education matters

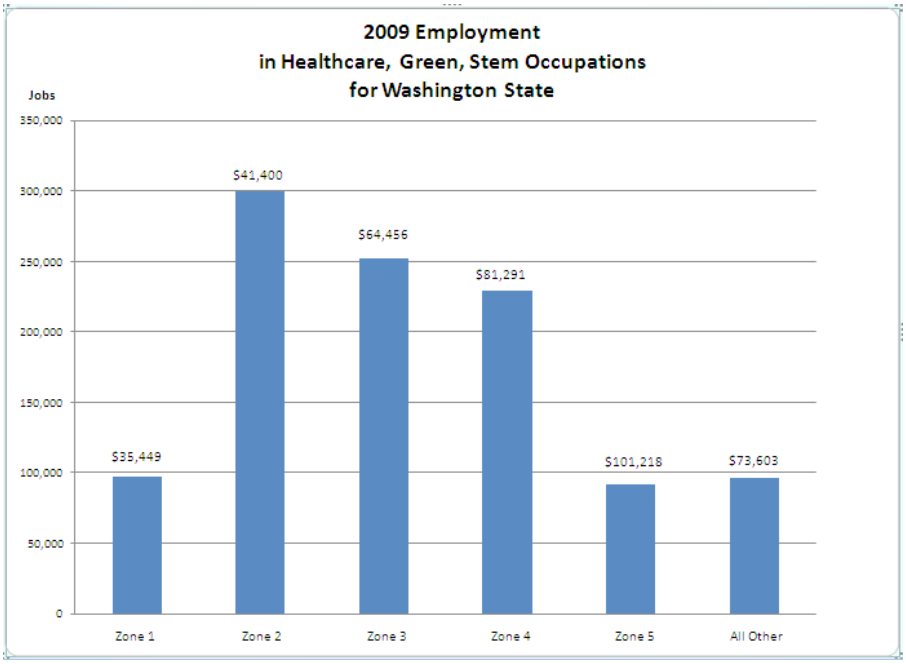
Employment in STEM — healthcare, green and STEM in Washington state

These STEM jobs in Washington account for 30% of all jobs. The good news is that STEM jobs generate average salaries of $76,993, compared to the average wage for all Washington occupations of $47,625.

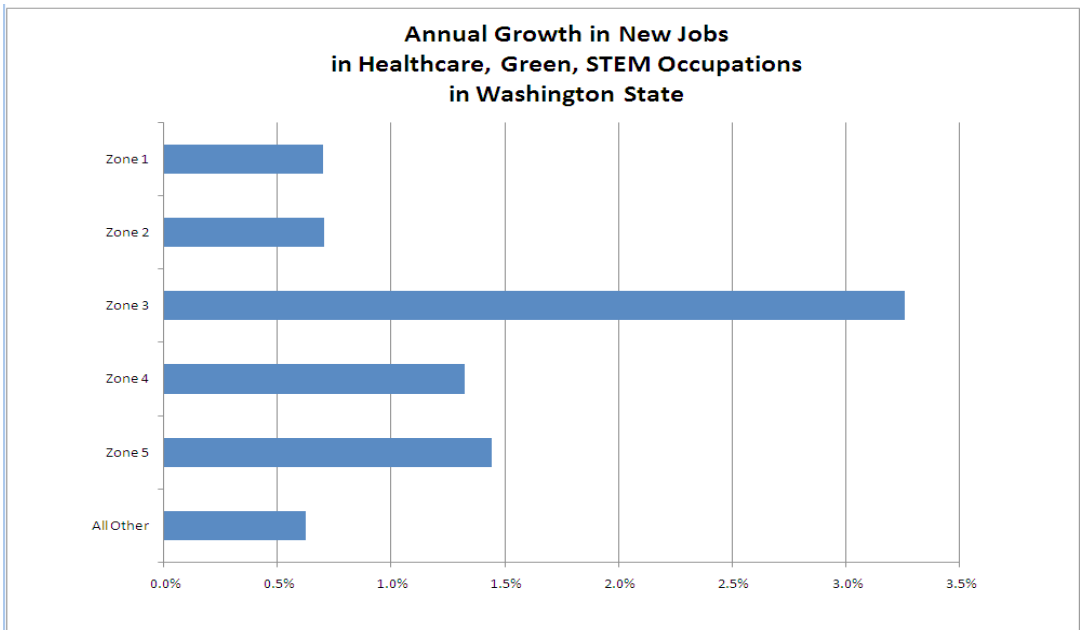
Job Zones	Number of SOC occupations	2Qtr2009 Estimated Employment	New Jobs (annualized)*	Average Annual Openings*	Average Annual Wage
1	9	97,328	681	3,460	$35,449
2	51	299,327	2,116	9,231	$41,400
3	61	251,974	1,891	8,026	$64,456
4	64	229,575	3,042	7,906	$81,291
5	60	92,009	1,326	3,416	$101,218
Multi	15	96,673	605	2,959	$73,603
Totals	260	872,474	9,646	35,101	$76,993

*Based on 2008-2018 forecast - Jane Field, Washington Department of Employment Security, 2010. *Note: Some technical limitations.*

STEM employment opportunities including healthcare and green jobs afford a wide range of choices for family level wage positions requiring varying levels of preparation, as demonstrated by the following two charts.



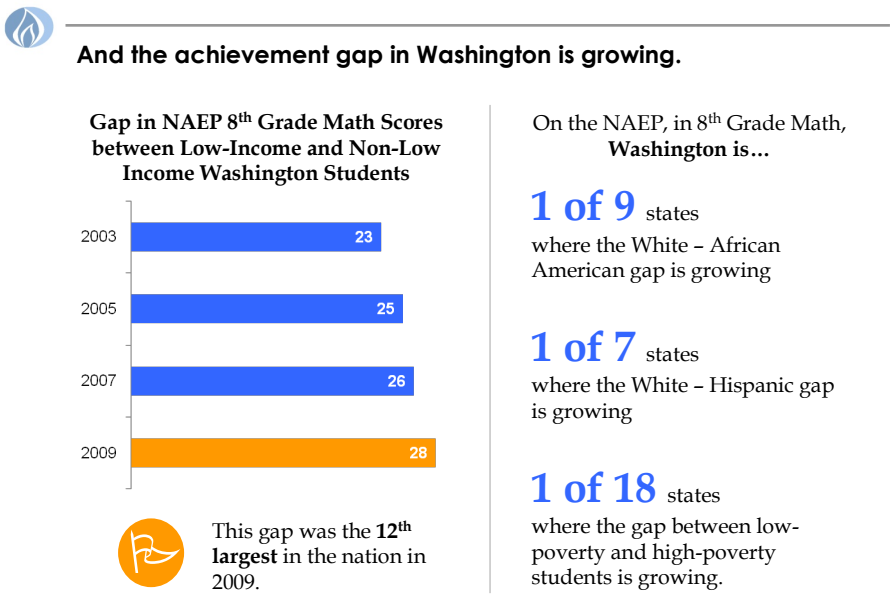
Jane Field, Washington Department of Employment Security, 2010



Jane Field, Washington Department of Employment Security, 2010

STEM matters in closing the opportunity gap

The "opportunity gap" classically refers to the difference in test scores between racial and ethnic students and their white counterparts. All students can succeed, but they need highly effective teachers, exemplary curriculum and materials, and appropriate academic and social support — resources that are often missing today for students of color. These "opportunity gaps" or "access gaps" make student success difficult or impossible.
(Achievement Gap Oversight & Accountability Committee, 2010)



Why STEM education matters

Recommendations provided by the 2010 report of the Achievement Gap Oversight and Accountability Committee, "Closing Opportunity Gaps in Washington's Public Education System," were incorporated into the five goal areas in the STEM Work Group's comprehensive plan. Four representatives of the committee were also members of the STEM Work Group.

- Supporting and facilitating parents and communities of color in involvement and outreach.
- Enhancing the cultural competence of current and future educators and the cultural relevance of curriculum and instruction.
- Exploring innovative school models that have shown success in closing the achievement gap.
- Expanding pathways and strategies to prepare and recruit diverse teachers.

STEM Education, as expressed in this STEM Work Group Plan to the Governor and the Legislature, clearly integrates direct attention to the opportunity gap. It is the firm belief of the STEM Work Group members that:

- An effective state plan will open doors of opportunity to all children, and target those considered to be traditionally underrepresented in STEM, such as minorities and women.
- All children can learn and deserve equal educational opportunities.
- Excellent teacher preparation and placement in areas of high need is critical.
- Education, students, parents, communities, business and industry must partner to provide and promote outstanding STEM role models and practices, respectful and understanding of the gifts of a diverse citizenry and workforce.
- There are numerous family level wage job entry points in STEM occupations; employees may advance through employer-provided professional development.

Comprehensive STEM Education Plan

A successful STEM strategy also requires greater connectivity between K-12 and postsecondary programs and better support for effective student transition upon high school graduation.

Vision:

All residents and communities benefit from effective science, technology, engineering, and mathematics (STEM) education when:

- ***All students regardless of cultural racial, ethnic, national or linguistic background are career and college ready.***
- ***Well educated students become citizens that support economic growth and provide a competitive advantage in a diverse and democratic society.***

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

1.1 Strategy

Increase the number of candidates, including those from underrepresented populations, seeking careers in STEM teaching.

Action items

- Expand efforts beyond the current programs in place to recruit underrepresented populations to the STEM teaching profession including students in middle and high school.
- Government and business share responsibility for scholarships that support recruitment of high-caliber candidates including those from underrepresented populations.
- Facilitate entry into educator preparation programs by supporting academic preparedness, access and opportunity for current and future middle and high school students by emphasizing STEM teaching as a career path opportunity.

Timeline 2016

Target indicators and expected results

Increased number of candidates, including those from underrepresented populations, seeking teaching certificates in STEM areas with an upward trend demonstrated over five years.

Comprehensive STEM Education Plan

1.2 Strategy*

Ensure regional access to teacher preparation programs that include Science, Technology, Engineering and Mathematics degrees and endorsements.

Action items

All state funded colleges and universities with teacher preparation programs will offer endorsements and degrees in Science, Technology, Engineering and Mathematics.

Target indicators and expected results

Increase university certification programs for Technology Education from one to three. (CWU, EWU and WWU).

1.3 Strategy

Ensure there are multiple pathways for professionals from Science, Technology, Engineering and Mathematics fields to enter teaching.

Action items

Government and business share responsibility for scholarships that support recruitment of high-caliber candidates including those from underrepresented populations.

Target indicators and expected results

Increased number of courses taught by teachers with appropriate mathematics and science certification and endorsements, and STEM training or experience.

1.4 Strategy

Increase the number of teachers that hold content endorsements in STEM areas at all grade levels 4-12.

Action items

Government and business should share the responsibility for funding to provide assistance for teachers to complete endorsements.

Timeline 2016

Target indicators and expected results

Increased number of teachers endorsed in STEM areas by 25 percent in 2016.

1.5 Strategy*

Establish process steps to create a K-8 Elementary STEM endorsement and corresponding WestEd teacher tests.

Action items

- Convene statewide stakeholder groups that include community members to verify need.
- After the need is verified, committee will recommend competencies for the endorsement.

*PESB is currently implementing these strategies.

**OSPI is currently beginning to implement these strategies.

Target indicators and expected results
By the end of 2011 statewide stakeholder recommendations would be completed and provided to OSPI and PESB.

1.6 Strategy
STEM Mentors will be available to teachers in the first three years of teaching in a new STEM area.

Action items
- STEM mentors shall be funded by the state.
- Current mentoring programs will be modified to support STEM teachers.
- STEM mentoring programs will be modified to support teachers of English Language Learners.

Target indicators and expected results
Increased evidence that mentor programs target student achievement.

1.7 Strategy
All teachers have access to job-embedded professional development to build teacher capacity in both content and pedagogy for STEM learning experiences.

Action items
Ensure STEM professional development includes: real-world applied learning, inquiry based strategies, project/problem based learning, cultural competency and Principles of Second Language Acquisition for secondary teachers.

Timeline 2018

Target indicators and expected results
Increased job-embedded development in STEM is available to all certified teachers by 2018.

1.8 Strategy
Increase retention rate for all STEM teachers.

Action items
Create robust mechanisms to support all STEM teachers that include professional development, targeted mentoring, increased internships/ fieldwork opportunities, reduced class size, adequate classroom resources and increased compensation for all teachers.

Timeline 2015

Target indicators and expected results
Retention of STEM teachers increased by 25 percent in 2015.

Comprehensive STEM Education Plan

1.9 Strategy

Build the capacity of principals and school leaders to monitor and improve student learning in STEM education and close the opportunity gap.

Action items

- Principals and school leaders will have access to STEM professional development that is relevant, experiential and culturally responsive.
- Principals and school leaders will be trained in the use of state and district student data to modify instructional practices designed to close the opportunity gap.

Target indicators and expected results

Increased number of principals who have access to and participate in STEM professional development and instructional practices, including language acquisition standards, cultural competency and student data analysis related to closing the opportunity gap.

1.10 Strategy**

Implement and support teacher evaluations that inform educator effectiveness, improved practice, professional development and assignment.

Action items

- Principals and school leaders will be trained in the use of new teacher evaluation programs.
- Assess the effectiveness of professional development and mentoring programs according to their impact on teacher effectiveness.
- Implement multiple measures of teacher effectiveness including student growth.

Target indicators and expected results

Increased number of in educators evaluated using multiple measures of teacher effectiveness (including student growth) as part of licensure, hiring, placement, tenure, and retention decisions.

1.11 Strategy

Create links to business communities to provide opportunities for teachers to participate in fieldwork or internships in applied STEM domains.

Action items

Develop a process to establish and monitor business partnerships that provide teacher internship and/or field work.

Target indicators and expected results

- Increased number of teachers that have access and opportunity to participate in fieldwork and internships in applied STEM domains.
- Increased number of STEM business/district partnerships.

*PESB is currently implementing these strategies.

**OSPI is currently beginning to implement these strategies.

Comprehensive STEM Education Plan

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.

2.1 Strategy

The state will ensure there is a culturally responsive process to review the math and science standards periodically to ensure that the standards are relevant and up-to-date with current innovation.

Action items

OSPI will ensure that the math and science standards are reviewed periodically through a process that actively engages representatives of diverse communities of stakeholders.

Target indicators and expected results

Annual review of math and science standards.

2.2 Strategy

School districts will provide the opportunity for all students to meet science and math learning standards through adequate time spent on standards-based mathematics and science courses of study, appropriate and culturally relevant formative and summative assessments, and high-quality instruction.

Action items

- Students will participate in mathematics and science assessments that are nationally and/or internationally normed.
- High school students will participate in science assessments that assess the science standards, including but not limited to life science, physical science, and Earth/space science.
- Create a metric consistent with the education reform plan. Disaggregate by sub-groups with the goal to improve learning for all and the elimination of achievement gaps in mathematics and science.

Timeline 2011-2016

Target indicators and expected results

- Increase student achievement on state and national assessments (such as MSP, NAEP, SAT, ACT, Sanford 10, PISA, TIMMS).
- Increase instructional time in mathematics and science.

2.3 Strategy**

Develop, implement, and update the state's academic learning standards and instructional frameworks for science, technology, engineering and mathematics, including continued connection and alignment with the state's Early Development Benchmarks.

*PESB is currently implementing these strategies.

**OSPI is currently beginning to implement these strategies.

Comprehensive STEM Education Plan

Action items **

- OSPI will implement the statewide Mathematics Systems Improvement Framework.
- OSPI will develop and implement a statewide Science Systems Improvement Framework.
- Both frameworks will promote engaging, research-based instructional/learning strategies in mathematics and science classes, such as: real-world, applied learning; inquiry-based strategies; project-based learning; problem-based learning; culturally relevant activities; and strategies for English Language Learners.
- Via the ESD mathematics and science coordinators, OSPI will provide professional development for the improvement frameworks. School districts will implement the improvement frameworks.

Timeline 2011-2020

Target indicators and expected results

- Increase the number of schools that implement the frameworks.
- Increase the overall performance levels, K-12, by disaggregated data in science, on state, national, and international assessments.
- Increases in high school students performing in the top quartile of SAT and ACT science scorers.
- Reduce the opportunity gap in mathematics and science.
- Increase the number of Washington high school graduates obtaining a science related post-secondary degree or certificate.

2.4 Strategy

OSPI and school districts will identify or develop interdisciplinary instructional modules that are culturally relevant for each grade level and are aligned with learning standards in all disciplines (STEM and other disciplines, such as literacy, art, and social studies). School districts will implement the interdisciplinary modules for Grades K-12.

Action items

OSPI will engage practitioners representing diverse communities to identify current "best practices" and develop additional interdisciplinary modules. OSPI will disseminate the modules to all districts.

Timeline 2011-2016

Target indicators and expected results

Increase the number of schools that implement STEM interdisciplinary projects.

*PESB is currently implementing these strategies.

**OSPI is currently beginning to implement these strategies.

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

3.1 Strategy

School districts 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).

Action items

Institutionalize a process that ensures student participation in advanced STEM-related academic and CTE programs and is representative of the overall student population of the school.

- Incentivize schools to add more dual AP/CTE courses.

Timeline 2011-2016

Target indicators and expected results

- Increase the number of students participating in advanced academic and CTE programs of study.
- Increase the number of post-secondary students' success.
- Increase the number of students, including underrepresented populations who complete post-secondary college, or certificate, apprenticeship, and/or other career training programs in STEM-related fields.

3.2 Strategy

School districts will ensure all K-12 students have access to a wide range of extended day and summer activities that are high-quality, culturally responsive and STEM-related.

Action items

Districts will partner with businesses and community based organizations to provide extended day and summer activities such as STEM contests, fabrication laboratories, summer school, school year internships and summer internships, after school programs, and similar activities.

Timeline 2011-2016

Target indicators and expected results

Increase the number of students participating in STEM-based extended day and summer activities (data disaggregated by underrepresented students).

Comprehensive STEM Education Plan

3.3 Strategy**

School districts will support innovative K-12 school models to find best practices in STEM education and bring them to scale with the focus on minority, high poverty and underserved communities.

Action items

- OSPI will develop pilot projects to promote innovative model K-12 STEM schools and programs.
- School districts will support innovative partnerships with private industries and apprenticeship programs to support and enhance the implementation of K-12 schools and programs based on STEM themes.

Timeline 2011-2020

Target indicators and expected results

- Increase the number of various school models that are based on STEM themes.
- Increase the number of schools based on STEM themes.
- Increase the number of schools based on STEM themes serving minority, high-poverty, and underserved communities.
- Increase the number of students, including low-income students and those from every ethnic subgroup, are completing post-secondary college, or certificate, apprenticeship, and other career training programs in STEM related fields .

3.4 Strategy

School districts will provide adequate academic and career guidance, curriculum, and support that engage all students and their families to ensure that all students take appropriate courses in middle school and high school to prepare students for successful participation in STEM-related post-secondary educational pathways.

Action items

OSPI will identify promising practices for ensuring that all students receive the academic and career guidance they need to be prepared for STEM-related post-secondary educational pathways. (All students include girls, minorities, English Language Learners, and students from poverty who are traditionally underrepresented in STEM careers.)

Timeline 2011-2020

Target indicators and expected results

Increase student participation in STEM-related courses, measured by student course-taking patterns over time (disaggregated by underserved students, first-generation college attendance students).

*PESB is currently implementing these strategies.

**OSPI is currently implementing these strategies.

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

4.1 Strategy

Engage communities, especially in underrepresented populations, in a discussion about what STEM education would look like in their community to achieve this goal (STEM education for every student, every day).

Action items

- Plan communication with stakeholders including church, community and business leaders, legislators, parents and students, school administrators, teachers and counselors, school board members and the media.
- Deliver target messages to the appropriate stakeholder group and include the following:

1. All students have equal access to STEM education.
2. STEM achievement is important for all students to prosper in the modern world.
3. Knowledge of science, technology, engineering, and mathematics is essential for a broad array of careers that will help people become successful and self-supporting community members.
4. A strong background in the STEM areas is necessary for people who will be called upon to understand scientific and mathematical concepts as workers, citizens and consumers.
5. There is a strong connection between STEM literacy and the well-being of our economy, environment, and overall health of our community, state and nation.
6. Knowledge of the STEM educational areas is a requirement for success in college, post-high school training, and the workforce.

Timeline 2011-2016

Target indicators and expected results

- Increase the number of community based meetings with target audiences.
- Increase the number of students, families, employers, and the general public who understand the importance of STEM and why improving STEM strategies and student outcomes are important at the individual, community,.and national levels.
- Increase the number of students, families, employers and the general public who understand what can be done to improve STEM .
- Increase numbers of champions and advocates (students, parents, employers, and community members) who demand increased quality STEM education for all students.

Comprehensive STEM Education Plan

- Increase actions (examples could be editorials, testimonies in Olympia, school boards, etc.) that indicate a commitment to quality STEM education for all students.
- Demonstrate attitudinal shift so STEM and STEM literacy/expertise becomes more highly valued across all sectors of individual communities.

4.2 Strategy

Conduct a set of community campaigns statewide using different types of media, including social network channels and entertainment media to deliver key STEM messages. (Examples include such events as a STEM Education Awareness Month, media campaigns, statewide summits on STEM education, regional community forums, STEM presentations at school board meetings, family STEM nights, and STEM career awareness presentations for youth in out-of-school programs.)

Action items

Create an advocacy plan for target audiences that includes the following: description of the community, identification of target audiences, messages, communications objective/measures, strategies/tactics, budget, calendar/timing.

Timeline 2011-2016

Target indicators and expected results

Increase participant knowledge and attitude toward STEM education and the state educational system as a whole.

4.3 Strategy

Support civic and parent organizations who can educate and inform parents to stay involved in STEM education.

Action items

Create funding or extend resources for school-based organizations that provide infrastructure for sustainability.

Target indicators and expected results

Increase involvement of organizations in educating and informing parent organizations.

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

5.1 Strategy

Enlist business and industry as active partners in STEM education by participating in meaningful engagement through diverse advisory committees, composed of management and labor that work with the schools to plan authentic experiences for all students and teachers.

Action items

- Minority and women owned businesses are proportionately represented.
- Advisory committees develop bylaws and operating procedures, articulate required skills and knowledge, and formulate recommendations to school partners.

Timeline 2012-2016

Target indicators and expected results

- Framework for advisory groups developed by January 2012.
- 20 percent annual increase in participating companies.
- 10 percent annual increase of diverse advisory committees.
- 10 percent annual increase of advisory committees recommendations that are implemented.

5.2 Strategy

Enlist business and industry as effective advocates to state government in support of STEM education.

Action items

- Deliver consistent message about importance of STEM to the state economy.
- Deliver consistent message about the importance of diversity in STEM fields.

Target indicators and expected results

Legislature briefed annually on the impact of STEM on state economy.

- Business and industry advocate in all relevant initiatives and bills.
- 20 percent annual increase of advisory committees' input to the Legislature.

Comprehensive STEM Education Plan

5.3 Strategy

Provide a structure for business and industry to help districts support teachers in integrating and applying STEM content across specific grades and disciplines.

Action items

- Industry partners create professional development opportunities dedicated to STEM.
- Utilize industry partners in the classroom.
- Provide teacher summer internships.

Timeline 2011-2018

Target indicators and expected results

- 10 percent annual increase of business to classroom partnerships.
- 50 percent of schools open a STEM program with a business partner that provides support.
- 10 percent annual demonstrated improvement in application of STEM content in classroom learning.
- 10 percent annual increase in teacher summer internships.

5.4 Strategy

Incentivize business and industry to help districts offer increased STEM K-12 applied learning opportunities and programs.

Action items

Industry partners provide consulting, in-kind materials, funding and volunteer mentor programs.

Timeline 2011-2016

Target indicators and expected results

- 10 percent annual increase in applied learning opportunities for students.
- At least an annual five percent increase in student performance on normed tests in science, mathematics, reading and writing.

5.5 Strategy

Provide a structure for business and industry to help districts offer increased STEM after school and summer programs that offer extended learning and career exploration with business and community partnerships.

Action items

- Industry partners help design programs, provide in-kind materials and volunteers.
- Schools recruit a diverse pool of volunteers in STEM fields to support learning.

Timeline 2011-2018

Target indicators and expected results

- Annual increase of 10 percent of extended learning opportunity at each partnered school.
- 25 percent annual increase in student understanding of available STEM careers and opportunities as demonstrated via student surveys.

5.6 Strategy

Provide a framework for local businesses and community partners to offer jobs and internships to students and teachers to extend classroom learning and mobilize advocacy in support of STEM education.

Action items

- Actively recruit low income and students of color for jobs and internships.
- Districts, schools, and teachers partner with business and community to implement successful internships.
- Advocate for continued support of partnerships offering internships.

Timeline 2011-2016

Target indicators and expected results

- Annually add at least one sustained teacher internship per school.
- Businesses annually add 10 percent student internship opportunities.
- 25 percent of students participating in partnered schools are employed in STEM occupations or pursuing post secondary STEM education.

5.7 Strategy

Partner with business community to create grants for rigorous new middle and high school courses of study in high-demand STEM areas.

Action items

- At least 50 percent of schools with high poverty, high ELL, or high minority student populations.
- Ensure at least 40 percent female participation in new rigorous STEM courses to receive grants.

Timeline 2011-2018

Target indicators and expected results

- 10 percent annual increase in number of grants to schools that meet target.
- Annual increase of female participants to reach 50 percent within five years.
- 25 percent annual increase in number of grants.
- 10 percent annual increase in grant dollars.

Recommendations

Recommendations regarding recruiting, preparing, hiring, retraining and supporting STEM teachers and instructors.

1. Teachers and leaders ensure all students receive effective STEM instruction.

2. Expand efforts beyond the current programs in place to recruit underrepresented populations to the STEM teaching profession including students in middle and high school.

3. Facilitate entry into educator preparation programs by supporting academic preparedness, access and opportunity for current and future middle and high school students by emphasizing STEM teaching as a career path opportunity.

4. Ensure there are multiple pathways for professionals from science, technology, mathematics, and engineering fields to enter teaching.

5. Increase the number of teachers that hold content endorsements in STEM areas at all grade levels 4-12.

6. Ensure STEM mentors will be available to teachers in the first three years of teaching in a new STEM area.

7. Create robust mechanisms to support all STEM teachers that include professional development, targeted mentoring, increased internships/ fieldwork opportunities, reduced class size, adequate classroom resources, and increased compensation.

8. Build the capacity of principals and school leaders to monitor and improve student learning in STEM education and close the opportunity gap by engaging instructional packages including language acquisition standards, cultural competency, and student data analysis.

9. Create links to business communities to provide opportunities for teachers to participate in fieldwork or internships in applied STEM domains.

Recommendations on creating STEM pathways for elementary, middle and high schools that boost student success.

1. Establish STEM based K-12 educational programs that prepare all students for careers and college.

2. Continue implementation of the statewide Mathematics Systems Improvement Framework and support the development and implementation of a statewide Science Systems Improvement Framework.

3. Ensure OSPI frameworks will promote engaging, research-based instructional/learning strategies in math and science classes, such as: real-world, applied learning; inquiry-based strategies; project-based learning; problem-based learning; culturally relevant activities; and strategies for English Language Learners.

4. Ensure school districts 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).

5. Ensure districts partner with businesses and community based organizations to provide K-12 extended day and summer activities such as STEM contests, fabrication laboratories, summer school, school year internships and summer internships, after school programs, and similar activities.

6. Support pilot projects to promote innovative model K-12 STEM schools and programs through various grant opportunities.

7. Support innovative partnerships with private industries and apprenticeship programs to support and enhance the implementation of K-12 schools and programs based on STEM themes.

8. Engage communities, especially in underrepresented populations, in a discussion about what STEM education would look like in their community to achieve this goal (STEM education for every student, every day).

9. Enlist business and industry as active partners in STEM education by participating in meaningful engagement through diverse advisory committees with minority and women owned business, composed of management and labor that work with the schools to plan authentic experiences for all students and teachers.

10. Provide a structure for business and industry to help districts support teachers in integrating and applying STEM content across specific grades and disciplines.

11. Incentivize business and industry to help districts offer increased STEM K-12 applied learning opportunities and programs.

12. Provide a framework for local businesses and community partners to offer jobs and internships to students and teachers to extend classroom learning and mobilize advocacy in support of STEM education.

13. Partner with business community to create grants for rigorous new middle and high school courses of study in high-demand STEM areas.

Recommendations on STEM's role in closing the opportunity gap to prepare all students to be career and college ready.

1. Support best practice K-12 school STEM models that focus on minority, high-poverty and underserved populations.

2. Ensure STEM professional development includes real-world applied learning, inquiry based strategies, project/problem based learning, cultural competency and Principles of Second Language Acquisition for secondary teachers.

3. Identify promising practices for ensuring that all students receive the academic and career guidance they need to be prepared for STEM-related post-secondary educational pathways. (All students include girls, minorities, English Language Learners, and students from poverty who are traditionally underrepresented in STEM careers.)

4. Provide adequate academic and career guidance, curriculum, and support that engage all students and their families to ensure that all students take appropriate courses in middle school and high school to prepare students for successful participation in STEM-related post-secondary educational pathways.

5. Increase the number of principals who have access to and participate in STEM training in instructional practices, including language acquisition standards, cultural competency and student data analysis related to closing the opportunity gap.

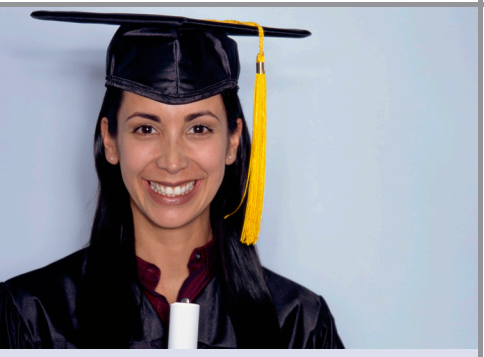
Recommendations

6. Provide the opportunity for all students to meet science and mathematics learning standards through adequate time spent on standards-based mathematics and science courses of study, appropriate and culturally relevant formative and summative assessments, and high-quality instruction.

7. Recruit a diverse pool of volunteers in STEM fields to support learning, appropriate internships, and mentoring.

8. Provide a structure for business and industry to help districts offer increased STEM after school and summer programs that offer extended learning and career exploration with business and community partnerships.

Conclusion



Every young person should possess deep knowledge and strong skills in mathematics, science, technology, and engineering — and be excited and ready to use that knowledge in the real world.

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 that knowledge in the real world.

Washington is not fully prepared to offer students the opportunities they require for success. The state needs more adequately prepared mathematics and science teachers. While the state benefits from some promising STEM education programs, these efforts must be evaluated, integrated, and replicated. Evidence about what works to improve teaching and learning must be connected to classroom practices and policy decisions.

There is important work ahead. Only 43 percent of Washington's 4th graders and 39 percent of 8th graders scored proficient or above on the most recent National Assessment of Educational Progress, and only 29 percent and 33 percent, respectively, scored that well in science. Approximately 50 percent of community and technical college students must take remedial courses. Less than five percent of STEM postsecondary degrees awarded in the state are earned by students of color. Washington ranks fourth in the country in technology-based corporations, but 46th in participation in science and engineering graduate degree programs. Too many young people do not have the skills required to fill the family wage jobs available in Washington. We need to engage and ignite the imaginations of young people, educators, and the public to achieve dramatic improvements.

We urge you to endorse and support STEM Education as outlined in the Comprehensive STEM Education Plan.

Appendices

Entry points for Washington State

Summer 2010

If you have never worked before, or if you have worked for only short periods, you may want to know ... Where are the employment opportunities? What occupations serve as entry points to the workforce?

Let's put the spotlight on occupations with high hiring potential and rank those with the most potential for recent graduates.

Review this information in light of your own interests, your own skills, and your own ambitions for employment. Where do you want to enter the labor market? What occupations have the highest demand for new staff?

These key ideas were spotlighted using employment data for Washington state prepared by Labor Market and Economic Analysis (LMEA), the research arm of the Department of Employment Security. The data was the most current as of May 2010. New forecasts are made yearly at this time of the year.

Looking at the big picture first, what was the profile for employment for Washington state?

Job Zones	Number of SOC Codes	2Qtr2009 Estimated Employment	New Positions	Average Annual Openings	Average Annual Wage
1	74	526,556	4,943	25,407	$25,818
2	137	726,538	5,044	21,470	$34,548
3	147	609,575	2,645	14,233	$51,551
4	114	442,639	1,822	10,753	$74,903
5	93	165,101	1,365	4,529	$86,189
Multi	77	414,487	-1,299	9,783	$47,986
Totals	642	2,884,896	14,520	86,175	$47,625

Think about all those employed who were 16 years old and older. There were 2,884,896 employed in the Second Quarter of Year 2009. Local businesses were forecast to gain an average of 86,175 new positions each year over the next two years. Moreover, the staff needed to replace those leaving the various occupations, were estimated to be 86,175 each year for all occupations.

You can see that almost one out of five people worked in occupations that required little or no preparation as defined in Job Zone One. These occupations were paid an average annual wage of $25,818 and each successive job zone had occupations with better pay as the skills needed for the job increased. (See technical notes for definitions of wages; refer to the top of each panel for an explanation of each job zone.)

So what were the profiles for occupations in each job zone? The tables that follow feature these employment concepts:

- Occupations organized around common skill sets were based on the SOC-O*Net occupational coding system. The first two numbers in the code represent a job family.
- These SOC-O*Net occupations were organized into five levels of training called Job Zones, with Job Zone One requiring little or no training and each successive Job Zone requiring more training up to a maximum of five Job Zones. Occupations that crossed more than one job zone were grouped under Multiple Job Zones.
- The employment estimate represents the number of positions employers used in the Second Quarter of Year 2009.
- The data given in New Positions forecast the annual number of new positions that employers can be expected to create (or lose) in the coming year.
- The data given in Average Annual Openings represent the change in the number of positions employers use (both positive and negative changes) plus the total number of people who will fill positions left by others who have moved on to other occupations or left the workforce.
- Each chart displays an average annual wage based on March 2010 data. Some occupations offer work schedules that are seasonal or part-time; these work hours impact average annual wages. Tips were included where applicable. Wages for the self-employed were excluded.
- The minimum wage in Year 2010 was $8.55 per hour.
- Only the top twenty occupations in each job zone were ranked on these charts; these twenty occupations however represented a substantial amount of the employment opportunities, Average Annual Openings, for each job zone.

Job Zones	Percent of Average Annual Openings
1	90.4%
2	74.9%
3	65.7%
4	66.5%
5	62.0%
Multi	88.0%
Totals	77.7%

- Three tables in two databases were the sources of this analysis: the SOC-O*Net database for job zones, and the ALMIS database for occupational forecasts, and occupational wages. Some occupations may not be represented due to confidentiality standards, or other technical constraints.

To learn more about any occupation …

Check out the Workforce Explorer website **www.workforceexplorer.com**. Extensive information is available by clicking on the Career Center tab. As new data about the workforce becomes available, it is posted at this website. So take the challenge, and become a Workforce Explorer.

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Entry points for occupations requiring little or no preparation for Washington State

Summer 2010

Job Zone 1: In general, no previous work-related skill, knowledge, or experience is needed for these occupations. These occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license. Employees in these occupations may need anywhere from a few days to a few months of training. Usually, an experienced worker would show such an employee how to do the job.

SOC Code	Job Titles in Job Zone One	2Qtr2009 Estimated Employment	New Positions	Average Annual Openings	Mean Annual Wage
41-2011	Cashiers	67,653	335	4,553	$23,677
35-3022	Counter Attendants, Cafe, Food Concession	25,767	223	3,542	$20,484
35-3031	Waiters, Waitresses	43,114	679	3,245	$28,941
35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	63,075	850	1,899	$21,485
37-2011	Janitors and Cleaners, Except Maids and Housekeepers	44,099	574	1,352	$28,105
37-2012	Maids, Housekeeping Cleaners	41,110	389	1,056	$23,218
35-9031	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shops	6,912	111	896	$21,100
37-3011	Landscaping and Groundskeeping Workers	24,400	582	846	$30,313
35-2021	Food Preparation Workers	13,837	135	766	$23,131

35-9021	Dishwashers	9,632	139	740	$20,920
35-9011	Dining Room and Cafeteria Attendants and Bartender Helpers	9,306	129	715	$20,943
41-2021	Counter and Rental Clerks	16,873	61	600	$25,697
39-3091	Amusement and Recreation Attendants	6,448	60	537	$21,822
53-7064	Packers and Packagers, Hand	19,204	172	460	$24,175
53-3033	Truck Drivers, Light or Delivery Services	18,129	49	338	$32,823
53-7061	Cleaners of Vehicles and Equipment	7,190	31	337	$25,173
39-3031	Ushers, Lobby Attendants, and Ticket Takers	3,088	27	329	$21,668
33-9092	Lifeguards, Ski Patrol, and Other Recreation Protection Workers	2,521	11	304	$22,017
51-9198	Helpers--Production Workers	5,817	109	233	$28,063
35-2011	Cooks, Fast Food	5,847	49	220	$20,564

Entry points for occupations requiring some preparation for Washington State

Summer 2010

Job Zone 2: In general, some previous work-related skill, knowledge, or experience may be helpful in these occupations, but usually is not needed. For example, a drywall installer might benefit from experience installing drywall, but an inexperienced person could still learn to be an installer with little difficulty. These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate's or bachelor's degree could be needed. Employees in these occupations need anywhere from a few months to one year of working with experienced employees.

SOC Code	Job Titles in Job Zone Two	2Qtr2009 Estimated Employment	New Positions	Average Annual Openings	Mean Annual Wage
41-2031	Retail Salespersons	86,000	643	3,229	$27,044
43-4051	Customer Service Representatives	30,034	276	1,203	$33,376
43-9061	Office Clerks, General	57,797	393	1,138	$30,132
39-9021	Personal and Home Care Aides	28,580	740	1,038	$23,216
35-2014	Cooks, Restaurant	22,847	361	1,032	$25,707
43-4171	Receptionists and Information Clerks	23,547	343	1,018	$27,777
41-1011	First-Line Sprvsrs/Managers of Retail Sales Workers	30,477	162	774	$43,529
33-9032	Security Guards	15,526	359	673	$35,853
31-1011	Home Health Aides	13,224	561	668	$23,288
43-6013	Medical Secretaries	17,755	395	640	$36,754
31-1012	Nursing Aides, Orderlies, and Attendants	22,837	443	625	$27,559
41-4012	Sales Representatives, Wholesale and Manufacturing	31,698	-73	613	$62,368
35-3011	Bartenders	11,423	170	556	$28,079
43-6014	Secretaries, Except Legal, Medical, and Executive	32,062	79	516	$36,128
53-7051	Industrial Truck and Tractor Operators	13,040	76	459	$37,203
43-5071	Shipping, Receiving, and Traffic Clerks	16,547	5	413	$35,530
43-3071	Tellers	10,889	-117	392	$25,934
39-3011	Gaming Dealers	6,052	32	382	$29,276
31-9091	Dental Assistants	10,195	210	370	$37,949
35-2012	Cooks, Institution and Cafeteria	8,089	105	342	$29,300

Entry points for occupations requiring moderate preparation for Washington State

Summer 2010

Job Zone 3: In general, previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training and often must have passed a licensing exam in order to perform the job. Most of these occupations require training in vocational schools, related on-the-job experience and informal training with experienced workers. These occupations usually involve using communication and organizational skills to coordinate, supervise, manage or train others to accomplish goals.

SOC Code	Job Titles in Job Zone Three	2Qtr2009 Estimated Employment	New Positions	Average Annual Openings	Mean Annual Wage
29-1111	Registered Nurses	55,631	1,496	2,265	$73,101
25-9041	Teacher Assistants	34,604	95	745	$29,145
43-1011	First-Line Sprvsrs/Managers of Office and Administrative Support Workers	27,806	74	625	$52,614
43-3031	Bookkeeping, Accounting, and Auditing Clerks	49,216	11	586	$37,605
29-2061	Licensed Practical and Licensed Vocational Nurses	10,329	183	504	$44,796
15-1081	Network Systems and Data Communications Analysts	11,622	320	500	$83,660
15-1041	Computer Support Specialists	12,669	133	474	$50,067
49-9042	Maintenance and Repair Workers, General	23,954	103	416	$41,146
43-6011	Executive Secretaries and Administrative Assistant	20,118	107	381	$48,360
31-9092	Medical Assistants	10,963	251	352	$33,603
39-9031	Fitness Trainers and Aerobics Instructors	7,513	170	308	$37,701
21-1093	Social and Human Service Assistants	8,381	144	307	$29,750
39-5012	Hairdressers, Hairstylists, and Cosmetologists	16,891	79	299	$33,080
41-1012	First-Line Sprvsrs/Managers of Non-Retail Sale Workers	14,963	9	286	$77,657
25-2011	Preschool Teachers, Except Special Education	7,379	111	248	$28,912
39-1021	First-Line Sprvsrs/Managers of Personal Service Workers	6,630	66	233	$42,904

43-4111	Interviewers, Except Eligibility and Loan	4,485	108	218	$33,079
29-2021	Dental Hygienists	4,914	123	210	$90,945
43-3011	Bill and Account Collectors	5,445	95	199	$34,918
13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm Products	8,219	4	199	$62,652

Entry points for occupations requiring considerable preparation for Washington State

Summer 2010

Job Zone 4: In general, a minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. Most of these occupations require a four-year bachelor's degree, but some do not. Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.

SOC Code	Job Titles in Job Zone Four	2Qtr2009 Estimated Employment	New Positions	Average Annual Openings	Mean Annual Wage
25-2021	Elementary School Teachers, Except Special Education	29,867	70	693	$56,457
13-2011	Accountants and Auditors	25,427	306	680	$66,218
11-1021	General and Operations Managers	21,539	57	641	$132,768
15-1031	Computer Software Engineers, Applications	24,675	368	515	$94,484
25-2031	Secondary School Teachers, Except Special and Vocational Education	16,643	35	515	$58,613
15-1051	Computer Systems Analysts	13,915	155	427	$84,697
19-3021	Market Research Analysts	9,558	184	425	$87,413
15-1021	Computer Programmers	11,309	148	352	$91,631
15-1032	Computer Software Engineers, Systems Software	18,343	235	344	$99,966
17-2051	Civil Engineers	13,523	129	323	$81,411
25-2022	Middle School Teachers, Except Special and Vocational Education	14,022	29	321	$57,297
15-1071	Network and Computer Systems Administrators	11,726	129	301	$75,170
13-1111	Management Analysts	16,809	37	291	$83,076
11-2022	Sales Managers	7,459	70	225	$122,454
27-1024	Graphic Designers	6,108	41	223	$50,048

19-1042	Medical Scientists, Except Epidemiologists	4,644	110	188	$71,904
27-3031	Public Relations Specialists	6,006	52	188	$62,176
49-1011	First-Line Sprvsrs/Managers of Mechanics, Installers and Repairers	9,080	-24	182	$68,040
19-4021	Biological Technicians	3,703	29	165	$40,945
17-2141	Mechanical Engineers	6,081	8	154	$86,841

Entry points for occupations requiring extensive preparation for Washington State

Summer 2010

Job Zone 5: In general, extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. A bachelor's degree is the minimum formal education required for these occupations. However, many also require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree). Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training. These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required.

SOC Code	Job Titles in Job Zone Five	2Qtr2009 Estimated Employment	New Positions	Average Annual Openings	Mean Annual Wage
23-1011	Lawyers	14,846	136	380	$113,567
29-1051	Pharmacists	5,872	79	198	$106,791
27-2022	Coaches and Scouts	9,034	31	194	$35,570
11-3021	Computer and Information Systems Managers	9,063	67	176	$127,452
11-9032	Education Administrators, Elementary and Secondary	5,126	11	156	$95,838
21-1014	Mental Health Counselors	4,344	73	152	$44,732
29-1123	Physical Therapists	4,468	108	151	$74,344
19-2041	Environmental Scientists and Specialists, Including Health	4,094	38	147	$69,508
11-9111	Medical and Health Services Managers	4,410	77	143	$111,151
29-1021	Dentists, General	2,884	53	131	$179,266
17-1011	Architects, Except Landscape and Naval	4,232	57	118	$79,018
21-1022	Medical and Public Health Social Workers	2,793	49	115	$53,531

21-1012	Educational, Vocational, and School Counselors	5,605	11	111	$56,335
21-1021	Child, Family, and School Social Workers	3,018	38	110	$42,577
21-1023	Mental Health and Substance Abuse Social Workers	2,437	34	92	$42,138
29-9011	Occupational Health and Safety Specialists	2,175	25	90	$70,891
21-1011	Substance Abuse and Behavioral Disorder Counselors	2,188	49	89	$37,312
11-9041	Engineering Managers	4,925	-2	89	$126,343
13-2051	Financial Analysts	3,110	39	83	$80,524
25-4021	Librarians	3,884	-5	81	$60,742

Entry points for occupations spanning multiple job zones for Washington State

Summer 2010

SOC Code	Job Titles	Job Zone	2Qtr2009 Estimated Employment	New Positions	Average Annual Openings	Mean Annual Wage
53-7062	Laborers and Freight, Stock, and Material Movers	1 & 2	42,677	790	2,256	$27,381
39-9011	Child Care Workers	2 & 3	39,257	413	1,650	$22,783
43-5081	Stock Clerks and Order Fillers	1 & 2	36,472	240	1,126	$27,577
53-3032	Truck Drivers, Heavy and Tractor-Trailer	1 & 2	31,806	214	723	$42,689
43-3021	Billing and Posting Clerks and Machine Operators	2 & 3	11,682	171	339	$34,942
13-1071	Employment, Recruitment, and Placement Specialists	3 & 4	3,635	224	317	$61,168
49-3023	Automotive Service Technicians and Mechanics	2 & 3	14,087	56	297	$40,625
33-2011	Fire Fighters	2 & 3	9,710	-37	234	$63,742
41-4011	Sales Representatives, Wholesale and Manufacturing	2 & 3	10,420	5	231	$85,192
11-3031	Financial Managers	4 & 5	12,231	-6	180	$110,533
43-4031	Court, Municipal, and License Clerks	2 & 3	6,725	-38	153	$39,720
33-3051	Police and Sheriff's Patrol Officers	2 & 3	9,295	-67	149	$65,432
19-3031	Clinical, Counseling, and School Psychologists	4 & 5	3,254	38	135	$71,317

51-4121	Welders, Cutters, Solderers, and Brazers	1, 2 & 4	6,571	-60	134	$43,587
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	1 & 3 & 4	7,620	-8	124	$44,594
41-3031	Securities, Commodities, and Financial Services Sales	3 & 4	5,860	-57	121	$79,327
37-1012	First-Line Supervisors/ Managers of Landscaping, Lawn Services	3 & 4	4,038	90	120	$49,439
11-1011	Chief Executives	4 & 5	3,848	16	117	$191,117
27-3043	Writers and Authors	3 & 4	4,009	28	109	$61,182
33-1021	First-Line Supervisors/ Managers, Fire Fighting and Prevention	3 & 5	2,124	-13	98	$90,083

Key Reference Documents

- Washington State Education Reform Plan Framework
- SB 2776
- SB 6696
- Washington's Race to the Top Grant Application
- Washington State Stem Strategic Plan, March, 2010 – Washington State Education Coordinating Council (WSECC)
- Closing Opportunity Gap in Washington's Public Education System, January, 2010 (A report by the Achievement Gap Oversight and Accountability Committee)
- Mathematics Systems Improvement Framework, Washington State ESDs Math Counts and Science Matters, 2010
- Washington Performance Management Framework – WIN (Washington Improvement & Implementation Network)
- Ensuring Adequate Supply of Math and Science Teachers (2009) Professional Educators Standards Board

"Building a Science, Technology, Engineering and Math Agenda". National Governor's Association, 2009.

Bybee, Rodger. "What is STEM Education" Science. August 2010.

"The Opportunity Equation". Carnegie Corporation of New York and the Institute for Advanced Studies, 2009.

Sanders, Mark. "STEM, STEM Education, STEMmania". The Technology Teacher. December/January, 2009.