SKILLS REQUIRED: Examining King County Middle-Wage Opportunities in STEM

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I. Introduction

Local and regional economies are only now beginning to recover from the deleterious effects of the Great Recession. As prospects for job and industry growth emerge, closer examination is called for to understand which industries have the potential to bring labor markets back to life. In addition, ongoing examination is needed to understand the potential opportunities available for low-income individuals to connect to this economic growth. Understanding the skills required—and training needed to gain those skills—in order to meet the demands of economic growth are essential for long-term economic success for both business and families.

While other areas of the economy have begun to show improvement in the wake of this Great Recession, there is consensus that it will take some time for meaningful job recovery to occur.[1] The bleak short-term jobs picture, however, does not alter the long-term reality that we face: a serious shortage of skilled workers, particularly of those with the middle range of skills. For the Puget Sound region, while the current economic situation and related high rate of unemployment have potentially provided businesses with a much larger pool of workers for fewer job openings, there continues to be a mismatch between the skills employers need and the skills the current workforce possesses.

Time and time again, employers report difficulty finding individuals with vocational certificates or degrees to fill their "middle-skill" occupational needs.[2] This shortage of workers with the right skills is further compounded by the reality that over half of the residents of King County have not earned a 4-year college degree.[3] This supply and demand issue presents potentially significant hurdles for employers as they rebuild from the Great Recession. On the positive side, with some training beyond high school, middle-wage career-track occupations can be attainable for many low-income and low-skill adults eager to work towards self-sufficiency, while answering the demands of this changing economy and supporting economic prosperity for the region and its residents.

Investigating and understanding middle-wage jobs as potential opportunities for low-income individuals as well as the foundation of local and regional industry employment has become a research and programmatic focus for Seattle Jobs Initiative (SJI). SJI's March 2008 report "Skills Required: Preparing Puget Sound for Tomorrow's Middle-Wage Jobs" supported recent findings that middle-skill jobs — those requiring some education and training beyond high school but less than a bachelor's degree — are and will continue to be abundant, making up roughly half of currently available jobs in the U.S.[4] and in Washington State.[5] SJI's research moved the conversation about middle-skill jobs one step further to consider those opportunities that can provide a middle-class income - what we term "middle-wage" jobs – while supporting Puget Sound economic growth in key industry sectors. SJI's findings confirmed that middle-wage jobs are a vital part of a healthy labor market, making up 20 to 25 percent of all jobs in the Puget Sound

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[11] Seattle Times. December 4, 2009 "Job Creation Near, But Likely to be painfully slow" http://seattletimes.nwsource.com/html/businesstechnology/2010414113_apuseconomy.html

[2] 2008 Employer Survey, Washington State Workforce Training & Education Coordination Board

[3] SJI calculations of 2008 Washington State Population Survey Data.

[4] Harry Holzer & Robert Lerman. November 2007. "America's Forgotten Middle-Skill Jobs: Education and Training Requirements in the Next Decade and Beyond". The Workforce Alliance: Washington DC.

[5] October 2009. "Washington's Forgotten Middle-Skill Jobs: 2009 – An Updated Look at Employment and Education Patterns in Washington." The Workforce Alliance: Washington DC.

region, providing opportunities for many low-income and low- to middle-skilled workers to find employment and a pathway to a livable wage.

As the nation begins to dig itself out from the fall of the Great Recession[6], energy is being devoted to understanding and supporting those industries and related occupations that are fundamental to the repair and growth of national and regional economic health. Science, Technology, Engineering and Mathematics (STEM) skills and the occupations and industries that rely on them have been an area of increased focus and energy. Washington State continues to forge ahead in these high-demand industries, increasingly positioning itself as a leader in promoting business expansion and job opportunities in these fields. Regionally, innovations in science, technology and information systems have made Puget Sound a focal point for these fields moving forward. Locally, many significant industries rely on this skill base - Aerospace, Information Technology, Biotechnology, and Clean Technology, to name a few. Further, STEM skills acquisition and training are a key focus area for many important systems – from K-12 and higher education to economic and workforce development, from national level policy conversations to regional innovations.

The combined influence of this activity and interest necessitate an understanding of what STEM skills and occupations are and how they can be accessed, their associated wages and skill gaps, current workforce dynamics and future workforce supply challenges. This work aims to create a foundation of understanding about the characteristics and value of STEM occupations to short-term recovery and long-term growth for the region, as well as identifying potential middle-wage opportunities or low-income adults to achieve livable wage careers in these areas.

II. STEM

STEM is categorized by those skills and occupations in Science, Technology, Engineering, and Mathematics. The Bureau of Labor Statistics has provided some definitional guidance in grouping occupations according to the following categories[7]:

> Science – Occupations where primary functions and responsibilities include designing, managing and conducting experiments, analyzing and interpreting results make up the core of this group. Subcategories within science can be broken out by natural sciences, physical sciences, and life sciences.
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> Technology – Many of this category's occupations are related to computers and information, and require skills in logic and mathematics to design and develop software, databases, and systems.
>
> Engineering – The occupations categorized under engineering are vast, but are linked together by the skills required to design, develop and test products, structures, processes, machines and systems.

[6] September 2009. "Bernanke Says U.S. Recession 'Very Likely' Has Ended." Bloomberg.com http://www.bloomberg.com/apps/news?pid=20601087&sid=aflWYD0hCPqA

[7] Terrell, Nicholas. Spring 2007. "STEM Occupations: High-tech jobs for a high-tech economy." Occupation Outlook Quarterly, Bureau of Labor Statistics. NOTE: Health care related occupations are not included in the official definitions of STEM, though it's important to note that there are health-related STEM occupations that are included, like medical scientists, biomedical engineers, and life scientists.

Mathematics – A variety of occupations use mathematics and associated skills, but only a handful focus on mathematics exclusively in a variety of situations.

Nationally, STEM represents a small portion of overall employment – roughly 5% in 2004.[8] These occupations, however, can be found in every industry category, increasing their impact and importance for both the local and national economy. Of the overall STEM occupations, almost 50% are in computer and mathematical science-related occupations, 23% in engineering, almost 21% in life, physical and social sciences, and the remainder in executive and management occupations.[9]

The majority of STEM occupations require some amount of formal training; on-the-job training is not enough. The skills required to perform occupations in STEM industries are both technical and non-technical. Fundamental skills include reasoning, mathematics, science and logic to identify and solve problems. Beyond the basics, the ability to perform job-specific technical skills related to operation, maintenance, design, and analysis is required. Science occupations include both traditionally thought of positions like physicists and biologists, but also includes a variety of technician and assistant opportunities. Technology occupations are generally related to computer engineering, programming, and systems management and administration. Engineering occupations are the most varied, with engineering technician covering many different industry sub-sectors. Mathematics positions are generally related to analytical positions in finance.

While many STEM occupations require formal training associated with a 4-year degree, roughly 1/3 of all STEM jobs created between 2003 and 2008 do not require a BA.[10] And with associated education increases, it's no surprise that many of these occupations also pay higher than average wages. The Bureau of Labor Statistics' research indicates that the majority of these occupations at the national level pay well above the national average of all occupations. BLS reports that all STEM workers in 2005 averaged earnings of $64,560 a year, about 70% more than the national average of $37,870 annually.[11] These higher-than-average wages are indicative of the high demand for workers in these areas, where employers are willing to pay for employees with the right skills.

Growth projections for STEM occupations are strong. IT professions lead the way in the largest share of occupations slated for growth in STEM arenas. One recent study points to the potential for IT to grow at almost 3 times the rate of worldwide general employment.[12] BLS estimates that STEM occupations, specifically in science and engineering, will grow 70 percent faster than the overall employment growth for the nation.[13]

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[8] September 2006. "STEM Workforce Data Project: Report No. 7: STEM Employment Forecasts and Distributions Among Employment Sectors." Commission on Professionals in Science and Technology.
[9] Ibid.
[10] Kenneth Poole. Fall 2008. Preparing Low-Skilled Workers for the Jobs of Tomorrow. The Working Poor Families Project.
[11] Nicholas Terrell. Spring 2007. "STEM Occupations: High-tech jobs for a high-tech economy." Occupation Outlook Quarterly, Bureau of Labor Statistics.
[12] Sharon Pian Chan. October 4, 2009. "IT jobs will grow faster than general employment, according the Microsoft study." Seattle Times.
[13] Nicholas Terrell. Spring 2007. "STEM Occupations: High-tech jobs for a high-tech economy." Occupation Outlook Quarterly, Bureau of Labor Statistics.

STEM in King County

A strong base of STEM industries and occupations—and a workforce with the skills to support these—are key to economic growth, competitiveness and security, both for the region and the nation as a whole. A strong STEM workforce is therefore essential to support innovation industries and emerging technologies, including those related to a growing green economy[14], to maintain U.S. global competitiveness.[15] Washington State ranks 2nd in the nation for having an economy that is innovative, globalized, information-based and technology-driven.[16] "Washington scores high due to its strength in software (in no small part due to Microsoft) and aviation (Boeing), but also because of the entrepreneurial hotbed of activity that has developed in the Puget Sound region and very strong use of digital technologies by all sectors." [17] Regionally, innovations in science, technology and information systems have made Puget Sound a focal point for these fields moving forward. Such an economy requires a labor market with an abundance of knowledge workers.

Table 1 illustrates the breakdown of STEM occupations for King County.[18] Out of 602 available occupation titles, 97 are classified as STEM, representing 15% of all workers. Compared to the national average for these occupations, King County has 3 times the rate of STEM-related opportunities. The largest portion of these occupations is in Technology, a thriving industry base for the region with major IT employers like Microsoft, Amazon, RealNetworks, and others calling King County home. Strong growth potential is slated for computer and network software engineers, analysts and programmers.

Table 1. King County STEM Occupations, 2007, WA ESD.

	# of Occupations	Est. 2007 Employment	
Science	26	13,638	7%
Technology	11	83,425	44%
Engineering	45	61,745	33%
Mathematics	15	29,917	16%
All STEM	97	188,725	15%
All Occupations	602	1,256,975	

Source: Calculations by author, based on data from WA ESD – Occupational Projections

King County is also rich in employers in other STEM fields, ranging from biotechnology leaders like Zymogenetics and Dendreon, to major science research universities like the

[14] For more information on opportunities in the growing green economy in Puget Sound, read "A Growing Green Economy: Opportunities of Tomorrow" April 2009, Seattle Jobs Initiative.
[15] Washington's Forgotten Middle-Skill Jobs: 2009 – An Updated Look at Employment and Education Patterns in Washington. October 2009.
[16] Robert D. Atkinson and Scott Andes. November 2008. "The 2008 State New Economy Index." The Information Technology and Innovation Foundation.
[17] Ibid. Pg. 16.
[18] For more detailed information on the methodology used to define and identify STEM occupations and middle-wage jobs, refer to Appendix A at the end of this report. Appendix B provides a detailed table of STEM occupations for King County.

University of Washington, to a host of engineering firms locally and across the state[19], all rounding out a vibrant STEM business environment with various occupational opportunities. Wages for these occupations can range from $12.98/hr for tax preparers to $62.51/hr for natural science managers. The median hourly wage for King County STEM occupations is $31.38, an amount comparable to the national wage rate for STEM industry employment.

Long-term growth for STEM industries and related occupations looks strong for the region. Table 2 reveals that the number of STEM workers in King County will grow 17% between 2007 and 2017, with Science and Technology occupations specifically estimated to significantly outpace total STEM occupation growth. Of the 50 occupations slated to grow the fastest in King County between 2007 and 2012, 11 are STEM occupations; between 2012 and 2017, 13 of the top 50 are STEM (not shown). It is no surprise that STEM occupations are already, and will continue to be, a significant contributor to the local economic vitality of this region.

Table 2. Growth Projections for King County Occupations, 2007-2017, WA ESD.

	2007	2017	Job Growth	Percent
Science	13,638	16,485	2,847	21%
Technology	83,425	105,412	21,987	26%
Engineering	61,745	65,665	3,920	6%
Mathematics	29,917	33,136	3,219	11%
All STEM	188,725	220,698	31,973	17%
All Occupations	1,256,975	1,384,297	127,322	10%

Source: Calculations by author, based on data from WA ESD – Occupational Projections

As regional and local economies move toward focusing on more knowledge-based industries, individuals are increasingly required to have a strong foundation in STEM-related skills in order to succeed. The success of STEM-based economic development very much relies on a strong research and analytical base, which is closely linked to a workforce heavy in Bachelors and more advanced degrees specializing in advancing associated fields. However, the power of a STEM economic development foundation is not solely reliant on these high-skill occupations. While many of the occupations associated with these industries require 4-year post-secondary attainment and beyond, opportunities exist for individuals with only some post-secondary training to gain access to career pathways in STEM occupations. These opportunities in the middle can be important gateways and trajectories for individuals seeking entrance and advancement in these key industries.

Middle-Wage STEM Occupations

Middle-wage jobs are a vital part of a healthy labor market, presenting opportunities for many low-income and low- to middle-skilled workers to find employment and a pathway to a livable wage. Accessible middle-wage jobs are identified as those jobs that do not require a 4-year college and pay a decent wage. Specifically, accessible middle-wage

[19] Progressive Engineer (online magazine) Directory of Engineering Firms and Consulting Engineers in Washington. http://www.progressiveengineer.com/firms/firmsWA.html

jobs in these analyses are identified as those paying at least $21 an hour in 2008[20] in occupations where no more than 40% of the present workforce pool has 4-year degrees.[21] Using these guidelines to identify accessible middle-wage jobs in growing industry clusters, along with information about current training opportunities for these jobs, creates a foundation for economic and workforce development strategies to bolster the essential middle core of regional employment.

To ensure that these middle-skill occupations provide livable wages is an equally important consideration in terms of the quality of opportunities available. The importance of identifying and strengthening industry clusters with a high proportion of middle-wage jobs cannot be overstated. These jobs not only supply a means of simply getting by, but an opportunity to get ahead. The availability and accessibility of middle-wage jobs ensures that the opportunities for low-income workers to enter and progress along career paths to the middle class remain open.

While emphasis is often placed on bachelor's degrees as requisite for long-term stable employment and economic success, the evidence shows that jobs in the middle requiring some training beyond high school but not necessarily a traditional 4-year degree make up roughly half of all employment, both for the nation and for Washington State.[22] These occupations are foundational for regional economic development efforts to ensure continued strength and competitiveness in many industry sectors. They are a vital part of a healthy labor market, and present potential opportunities for many low-income and low- to middle-skilled workers to find employment and a pathway to a livable wage.

The current economic climate, characterized by unemployment rates looming in the near double digits, has left many individuals across a range of skills and industries out of work. The skills required to access these middle-wage occupations are even more important in these situations, where employers have both the luxury and the need to be more selective. These occupations are and continue to be the core of productivity and prosperity, and can help both employers and individuals weather the ups and downs of these uncertain economic times.

Based on what we know about both the value of middle-wage occupations and of STEM occupations as vital to a thriving local economy, the intersection of middle-wage jobs and STEM occupations are expected to be some of the strongest opportunities, made up of jobs and skills that are both accessible and fundamental for local growth. Examination of middle-skill opportunities indicate that demand for STEM professionals with education and training beyond high school but below a BA are expected to grow significantly in the coming years.[23]

SJI's data analyses reveal that, despite the power of this potential combination of accessible opportunities and vital occupations in a knowledge-based economy, only a

[20] SJI's 2008 research used a minimum wage level of $17/hour, equaling $35,360 annually for 2004. The increase from $17 to $21/hr reflects the overall increase in the median annual wage for King County between 2004 and 2008.
[21] For more detailed information on the methodology used to define and identify STEM occupations and middle-wage jobs, refer to Appendix A at the end of this report.
[22] Harry Holzer & Robert Lerman, *America's Forgotten Middle-Skill Jobs: Education and Training Requirements in the Next Decade and Beyond,* November 2007, The Workforce Alliance: Washington DC., Washington's Forgotten Middle-Skill Jobs: 2009 – An Updated Look at Employment and Education Patterns in Washington. October 2009.
[23] Harry Holzer & Robert Lerman, *America's Forgotten Middle-Skill Jobs: Education and Training Requirements in the Next Decade and Beyond,* November 2007, The Workforce Alliance: Washington DC.

handful of jobs exist that fit the middle-wage criteria in STEM areas. Specifically, of the 94 STEM occupations identified in King County, only 12 of them are middle-wage jobs, providing a living wage while requiring some training or education beyond high school, but less than a college degree.[24] These 12 occupations rest entirely in Engineering, and call for technical skills for the service, repair, maintenance, and diagnostic functions of a variety of important systems including transportation (transportation inspectors), airplanes (aircraft mechanics and service technicians), and supporting technical processes in a variety of essential areas like industrial, civil, and mechanical engineering. Collectively, this group of middle-wage STEM occupations represents 7,636 workers in 2007, just 4% all STEM workers in King County. The same slice also represents roughly 4% of all middle-wage occupations in King County.

Across the board, the limited middle-wage STEM occupations that do exist require aptitude in basic logical and technical skills, and foundations of mathematics and scientific exploration to successfully perform the associated job tasks. Of those occupations identified as middle-wage STEM jobs, many are currently witnessing declines in the number of jobs, in part due to the current economic downturn. Long-term projections, however, show the reversal of this trend for some occupations, suggesting their potential in regard to the growth of STEM industries locally. More than sheer numbers, it is essential to understand the issues and challenges surrounding the STEM workforce in total to better assess the opportunities identified above as middle-wage STEM occupations.

III. STEM Challenges

Demographics

STEM industries are not spared from the pending labor shortages expected in other areas like utilities, manufacturing and construction. Specifically, many of the existing workers in STEM occupations are slated to age out, leaving increasing demands for skilled labor ready to fill their positions. More than 50% of the current science and engineering workforce is nearing retirement age; 25% will reach it by 2010.[25] Between 2004 and 2014, employers are expected to hire about 2.5 million STEM workers who are entering their occupation for the first time.[26]

At the same time, there is a current lack of diversity and opportunity for access to employment and training in the STEM workforce. Women seem to be moving away from STEM occupations, and many subpopulations continue to be underrepresented, including African Americans, Latinos, Native Americans, and persons with disabilities.[27] There simultaneously exists a reliance on immigrants for meeting demands for workers equipped with the necessary skills for STEM employers.[28] Employers, reporting difficulties filling available occupations with individuals from the existing resident workforce, bank on talent from abroad. A significant point of conversation in the STEM

[24] See Appendix C for a detailed table of middle-wage STEM opportunities in King County.
[25] Cheryl R. Sturko Grossman. 2008. "Preparing WIA Youth for the STEM Workforce." LearningWork Youthwork Information Brief. Ohio Department of Job and Family Services, Office of Workforce Development, Bureau of Workforce Services.
[26] Terrell, Nicholas. Spring 2007. "STEM Occupations: High-tech jobs for a high-tech economy." Occupation Outlook Quarterly, Bureau of Labor Statistics.
[27] June 2005. "STEM Workforce Data Project: Report No. 3: Sisyphus Revisited: Participation by Minorities in STEM occupations, 1994-2004". Commission on Professionals in Science and Technology.
[28] Jobs for the Future. April 2007. "The STEM Workforce Challenge: the Role of the Public Workforce System in a National Solution for a Competitive Science, Technology, Engineering and Mathematics (STEM) Workforce." U.S. Department of Labor, Employment and Training Administration.

workforce debate is the prolific use of H1B visas, which allow foreign workers to take positions in specialty occupations in the U.S., many of which require engineering, mathematics and science capabilities and at least a 4-year degree. Dr. Lindsay Lowell, Director of Policy Studies at Georgetown University, has calculated that in the 15 fastest-growing occupations, immigrants would make up 45 percent of medical scientists, 27 percent of computer software engineers, 18 percent of personal and home care aides, 17 percent of database administrators, and 17 percent of postsecondary teachers. [29]

Supply Shortage/Skills Gap

The larger scale changes in the nature of the U.S. economy from an agrarian and industrial base to more technologically dependent translates into a different set of skill demands. Where once manual skills were largely required, now the technical, analytical and problem-solving skills that typify a knowledge-based workforce are in demand. This demand is surpassing supply, creating some concern that America's ability to compete globally will be hindered by its lack a sufficient number of students and workers with appropriate high-quality STEM skills.

The U.S. and King County region continue to struggle with growing education gaps, leaving economic progress at risk of stalling due to lack of knowledge and innovation associated with greater educational gains. In some cases, to fill this gap left by the current education and training system, employers are looking to other states and nations for the workforce they need. Lobbying efforts are being aimed at liberalizing immigration policies around H1B visas in order for STEM employers to be able to supplement the existing workforce and meet shortages through the importation of talent.

The facts about the current and future potential U.S. workforce pool tell why employers have been utilizing political efforts. Increasing numbers of high school students are graduating without the appropriate academic background to pursue STEM degrees. At the same time, roughly 30% of those individuals entering community colleges need some form of remedial mathematics. Skill shortages remain broad and deep. More than 80% of employers surveyed in a 2005 National Association of Manufacturing Institute survey indicated they continue to have difficulties finding individuals with the appropriate skills for the job, and these difficulties have the potential to hinder production levels, productivity, and meeting customer demands.[30]

It is equally vital to economic competitiveness in regional STEM industries to ensure that there are enough individuals being trained for the jobs that currently and will continue to exist here. Addressing this major supply issue can simultaneously address the skills shortage faced by employers while providing opportunities for low-wage workers to advance. As noted earlier, high skill workers are not the only ones in short supply, and at the same time many individuals in King County can, with some additional training, meet the needs of employers to fill those middle-skill vacancies. Pipelines to education and training opportunities exist, but there are multiple and intersecting career paths, making navigation difficult. A strong foundation of basic preparation is required, combined with clear transition points between available training and employment

[29] National Research Council. (2008). Research on Future Skill Demands: A Workshop Summary. Margaret Hilton, Rapporteur. Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies.

[30] Phyllis Eisen, Jerry J. Jasinowski and Richard Kleinert. December 2005. "2005 Skills Gap Report – A Survey of the American Manufacturing Workforce." National Association of Manufacturers, The Manufacturing Institute and Deloitte Consulting LLP.

opportunities. The potential exists for these middle-wage opportunities and associated training and education to link together to form pathways that can move individuals up a career pathway, providing increasing wages and skills in STEM fields along the way.

IV. Policy & Initiatives

Politicians, educators and employers alike recognize and are concerned about how these challenges facing the present and future STEM workforce can and should be addressed. Political and legislative movement has been taking place at both local and national levels to ameliorate these issues, recognizing the value of STEM as a part of ensuring economic competitiveness. Embedded in these policy conversations is the need to bolster STEM education as a foundation of economic development and competitiveness.

A notable achievement for STEM was the America COMPETES Act, marking a substantial step forward in terms of linking serious political action to the growing need to create a competitive STEM workforce. This legislation, signed into law in 2007, included a number of provisions aimed at improving the STEM workforce, authorizing an increased federal investment in STEM education as well as research in science and engineering.[31] Programs funded vary in emphasis from recruiting and retraining teachers in math and science to increasing a variety of programs across elementary, secondary, undergraduate and graduate education. Unfortunately, reauthorization of this bill in 2010 failed to pass[32].

In addition, in June 2009, the STEM Education Coordination Act (HR 1709) was passed by Congress. This Act aims to…

> …establish a committee under the National Science and Technology Council that will be responsible for coordinating all Federal programs and activities that support STEM education. As a result, the committee will be able to identify what best serves students, and be able to both focus funding accordingly, and help design teacher training programs that will better equip students with the STEM skills necessary to compete in the 21st century global economy.[33]

In November 2009, President Obama announced the "Educate to Innovate" campaign, which aims to improve the participation and performance of America's students in STEM by using a series of public private partnerships involving leading companies, universities, foundations, non-profits, and organizations representing millions of scientists, engineers and teachers to encourage young people to arm themselves with the skills necessary to pursue these much needed occupations. [34]

In addition to this recent action to address the needs of a current and future STEM workforce, multiple efforts are underway to simultaneously bring the country out of its economic downward spiral while addressing those industries and occupations already floundering. These activities hinge on both growing educational access and attainment of more Americans as well as creating job opportunities. Meshed into these discussions

[31] July 2008. "Gaining Momentum, Losing Ground." Tapping America's Potential: The Education for Innovation Initiative.
[32] Energy Collective. 5/19/2010 http://theenergycollective.com/TheEnergyCollective/66180
[33] STEM Education Coalition - www.stemedcoalition.org
[34] White House Website: http://www.whitehouse.gov/issues/education/educate-innovate; http://www.whitehouse.gov/the-press-office/president-obama-launches-educate-innovate-campaign-excellence-science-technology-en

about improving access and availability of education, training, and jobs is the priority that the U.S. remains competitive. STEM occupations and industries are a natural part of that competitive potential.

The American Recovery and Reinvestment Act of 2009 has aimed to simultaneously answer the immediate need of creating or saving jobs while spurring economic activity and investing in long-term economic growth. The Act has infused dollars into many programs and existing policies to support employers and provide family-wage job opportunities to those struck hardest by the economic downturn. In addition, the Act includes many investments in STEM, including additional National Science Foundation funding, Department of Education funding for enhanced school technology as well as recruitment of skilled STEM educators, and Department of Energy funding for increased research capacity.[35]

In July 2009, President Obama announced the American Graduation Initiative, which challenged the nation to add 5 million community college graduates by 2020, and invests $630 million annually for ten years in matching grants to community colleges and states to develop or strengthen innovation programs, improve community college completion rates, and focus on connecting these completers with skilled occupations in high-demand industries.[36] This initiative was included as part of HR 3221, the Student Aid and Fiscal Responsibility Act of 2009, passed by the House in September 2009. Taken together, these efforts signify a continuing recognition of the vital role education and training beyond high school play in maintaining a strong workforce to meet the demands of a growing economy.

Beyond the activities of the federal government, organizations like the National Skills Coalition (NSC, formerly The Workforce Alliance) are drawing attention to these middle-skill occupations as a vital part of the U.S. economy, and one that can be bolstered through closing existing skill gaps. NSC's *Skills2Compete* is a non-partisan campaign to ensure our workforce has skills needed to meet business demand, foster innovation, and grow broadly shared prosperity. NSC and its partners—including SJI—are working to encourage America to address U.S. competitiveness in a way that includes the vast majority of America's future workers—that is, adults already in the workforce—and the largest portion of jobs in the U.S. economy—that is, jobs in the middle of the skilled labor market which require some training past high school, but not a four-year degree.[37]

While much of the policy emphasis is about preparing tomorrow's workforce for the pressing needs of an increasingly knowledge-based economy, there must be an equally strong response to answering the more immediate challenges facing STEM industries and their workforce needs. Much of the discussion on STEM-related improvements is focused on providing youth with the foundation of math and science skills required to succeed in post-secondary opportunities. However, there remains a paucity of STEM policies aimed specifically at the training needs and career advancement of working adults. In many cases, the opportunities available to link this population to STEM-based opportunities are not specified, but linked to existing workforce programs. Department of

[35] STEM Education Coalition. Letter to Nancy Pelosi. Feb 10, 2009 http://www.stemedcoalition.org/content/documents/2009/STEM%20Ed%20Coalition%20to%20Leadership%20on%20Stimulus-Recovery%20Package.pdf

[36] Center for Law and Social Policy (CLASP) Website: "American Graduation Initiative and Other Higher Education Provisions of the Student Aid and Fiscal Responsibility Act of 2009." http://www.clasp.org/federal_policy/pages?id=0020

[37] National Skills Coalition Skills2Compete website – http://www.workforcealliance.org/the-issues/skills2compete.html

Labor policies and programs aim to generally connecting individuals with growing opportunities, through such efforts as the High Growth Job Training Initiative, as well as redirect workforce through training into STEM occupations through programs like the Community-Based Job Training Grants, Trade Assistance Act, WIA Rapid Response, WIA National Emergency Grants, or just general training through WIA Youth, Adult & Dislocated worker programs, or with support from the Wagner-Peyser Act. Finally, WIRED grants aim to encourage regional collaboration among public and private entities to develop a more highly skilled workforce in order to support economic development and job growth in the region, with STEM knowledge and skill training being part of many of these grant projects.

Washington State

For Washington, much of the policy and legislative action related to building the STEM workforce of tomorrow emphasize investment in improvement to the K-12 system and building trajectories into these occupations. Programs and initiatives to move Washington's STEM future forward are numerous:

- The Transition Mathematics Project (TMP) is designed to help students successfully progress from high school math to college-level math. TMP has identified the math skills and knowledge high school graduates need to meet minimum admission requirements, avoid remediation upon enrolling in college, and complete college-level work.

- The State of Washington's Office of the Superintendent of Public Instruction (OSPI) is working to promote and support the integration of technology into teaching and learning through programming, policy development, administrating state and federal funding, strategic planning and oversight of the K-20 Educational Network.[38]

- Washington MESA (Mathematics Engineering Science Achievement) is working to improve the numbers of underrepresented populations in STEM fields by encouraging opportunities to connect youth to enriching opportunities in mathematics, engineering and science for underrepresented students in grades K-12 using exemplary materials and instructional approaches. [39]

- Delta High School in Richland, Washington provides a first-ever Washington high school focused specifically on STEM education. Opened in Fall 2009, the school focuses on creating a college-ready and work-ready culture, with an emphasis on personalized learning plans and pathways to success, and views the student as a worker, teacher as a facilitator, and industry/community as mentors.

- AccessSTEM is a project funded by the National Science Foundation through the University of Washington aimed at increasing the participation of people with disabilities in STEM careers, aiming to link K-12 teachers, postsecondary educators, and employers to make classroom and employment opportunities in science, technology, engineering and mathematics (STEM) accessible to

[38] State of Washington Office of Superintendent of Public Instruction. "Educational Technology" http://www.k12.wa.us/edtech

[39] Washington State Mathematics, Engineering, Science Achievement Program (MESA) – http://www.washingtonmesa.org

individuals with disabilities, and share promising practices. Their efforts can help all students succeed in STEM courses and, for those with aptitude and interest, reach critical junctures on a path toward college studies and careers in STEM fields.[40]

- Washington STEM Initiative, a product of the Partnership for Learning[41], seeks to improve student achievement and opportunity in STEM by catalyzing innovation in the state's K-12 education system, increasing teacher effectiveness and student learning, and dramatically raising the number of Washington students graduating ready for college and work and succeeding in STEM degree programs, with a particular emphasis on accelerating the achievement of low-income and minority students.[42]

- The Life Sciences Skill Panel, convened by the Seattle-King County Workforce Development Council in 2005 with funding from the Washington State Workforce Training and Education Coordinating Board, worked to develop a strategic plan for workforce training and education in the Puget Sound region and to target specific short-term and long-term goals that result in rewarding, good paying jobs for current and future workers in life sciences

- Hundreds of various different certificate and degree programs exist in the King County region offering a variety of trainings for individuals related to STEM occupations and entry into STEM-related industries. These opportunities provide essential STEM skills training, and can be the necessary links to get individuals on track to educational attainment and advancement in STEM-based industry sectors that are crucial for economic development regionally. [43]

Finally, regional economic development efforts have recognized the workforce needs and skills shortages of their STEM industries, and are working to make sure the State invests in high-demand degrees, in order to guarantee that local business and local talent are strongly linked. For instance, the Prosperity Partnership[44], as part of its overall mission to grow high impact occupations and industries, has placed an emphasis on understanding these growing opportunities, and working with state legislature to continue to invest in high demand degrees at our state's higher education institutions.

V. Conclusions & Questions for Further Exploration

Science, Technology, Engineering and Mathematics skills are now more than ever being recognized as important for the short-term success of lifting the country out of its economic slump as well as for our long-term prosperity and competitiveness in an increasingly knowledge-based global economy. King County is particularly reliant on occupations in these fields to sustain its prominence as a center for Information

[40] AccessSTEM: The Alliance for Students with Disabilities in Science, Technology, Engineering, and Mathematics - http://www.washington.edu/doit/Stem/about.html

[41] Partnership for Learning is a non-profit organization focused on ensuring that all students graduate from high school ready for college and work and doubling the number of low-income students who earn post secondary degrees or certificates.

[42] http://www.partnership4learning.org/priorities/stem

[43] See Appendix D for a catalogue of various community college STEM-related programs in King County.

[44] The Prosperity Partnership is a coalition of over 300 government, business, labor and community organizations from King, Kitsap, Pierce, and Snohomish counties dedicated to developing and implementing a common economic strategy through long-term economic prosperity and the creation of 100,000 new jobs for the central Puget Sound region.

Technology and Life Science research and business. For states to have successful economic development efforts in a technology-based future, they must ensure that "businesses, non-profits, and government enterprises have access to skilled technical workers at all levels." [45]

At the same time, daunting worker supply shortages resulting from skills gaps in the existing workforce have the potential to seriously stall innovation and economic development efforts in STEM industries. While long-term success relies on a strong K-12 system providing the next generations of workers with the needed STEM skills and knowledge, the short- and even intermediate-term relies on making sure existing workforce participants have the opportunity to acquire the skills required to compete in these key industry fields. Post-secondary education is critical to meeting the current and future demands of a STEM workforce regionally as well as nationally.

That said, the primary purpose of this report is to identify those accessible middle-wage job opportunities available in STEM occupations that are accessible to the low-income, low-skill population—to see whether the skill gaps in the existing workforce present an opportunity for this population—with some additional training—to advance by meeting the skills demanded by STEM employers. The findings show that there are, in fact, only a limited number of middle-wage occupations in STEM in King County currently, and that many of these occupations are projected to decline over time. Many of the STEM jobs that pay median wage or better require a bachelors degree or higher, while many others requiring less than a B.A. do not meet the standard of offering a middle wage. In short, STEM industries and occupations in King County presently provide little opportunity for low-income, low-skill workers to advance into well-paying jobs with only limited additional education and training, short of a 4-year degree.

Given what we know about the supply of available workers and the seemingly small demand for workers with less than a BA for the majority of STEM occupations, there are still a variety of questions for researchers, policymakers and practitioners to address to help identify and nurture living-wage opportunities in STEM for low-income, low-skill individuals. A key question is how we can improve the pipeline of skilled workers in STEM industries for the middle-wage STEM occupations that do exist. While it is true that building a skilled local STEM workforce is primarily about producing enough BAs and advanced degrees in STEM fields, focus should also be placed on providing opportunities to current low-skill workers, both on the job and through additional training and education, to advance their foundational knowledge and skills. Improving the math and analytical skills of incumbent and future STEM and non-STEM workers alike provide the tools needed to advance on the job and/or continue on with further education in an increasingly knowledge-based economy.

One specific area for attention is improving educational pathways leading to STEM occupations at community colleges. How can we increase completion of developmental and college-level math requirements (by condensing and/or contextualizing) so that more low-skill individuals complete these programs and advance to further education? How can we create bridge programs that provide low-skill adults with necessary college-level skills in math, communications and STEM field-based knowledge to allow these students to articulate to one- and two-year college degree programs in STEM-based

[45] Kenneth Poole. Fall 2008. Preparing Low-Skilled Workers for the Jobs of Tomorrow. The Working Poor Families Project.

programs at local community colleges? How can we increase access to STEM course and degree programs in low-income communities and among low-skill STEM workers by creating partnerships between STEM employers, community colleges and community-based organizations?

Beyond thinking about preparing low-income and low-skill workers for the limited number of existing middle-wage STEM jobs, another question for exploration is how to support these individuals toward attainment of the BA. or higher degrees that most well-paying STEM occupations require. For example, can we support strategies to increase the number of STEM program transfers from the community college system to 4-year institutions? Forty percent of all bachelor's degrees awarded in Washington go to students who began their studies at a community or technical college.[46] Is there a way to highlight these educational opportunities as gateways for individuals to get good, family-wage occupations?

It is equally important to support policy options that build systems to support low-income, low-skill individuals in their pursuit of skills and education, providing links to career pathways towards family-wage occupations, specifically in STEM but also across the myriad of industries vital for economic growth and competitiveness. How are existing policies supporting low-income workers and students in their academic and career pursuits? How best can programs be expanded to serve populations typically underrepresented in certain industries, including STEM? All of these questions are vital in understanding how individuals are connected to opportunities through education and training.

The health and development of a competitive economy both locally and nationally requires a workforce armed with technical knowledge and skills to be successful. Industries and occupations that depend on these skills – Science, Technology, Engineering, and Mathematics – have the potential to provide a wealth of opportunities for living wage careers. These opportunities, however, depend on a workforce that is properly equipped with the skills required to progress. For King County, while few of these opportunities can be found in jobs that require less than a traditional 4-year degree but at least some training beyond high school – middle-wage jobs – there is opportunity, through policy and programs, to bolster the foundational skill base for all to succeed. For low-income, low-skill individuals, the road to family-sustaining employment can start with these key skills, and can continue to move the region and its residents into better economic times.

[46] Loretta Seppanen. December 2004. "Preparing students to be on the transfer path in community and technical colleges." Washington State Board for Community and Technical Colleges, Research Report No. 04-2.

APPENDIX A: Methodology

Identifying STEM Occupations
In order to identify those occupations that rely heavily on STEM skills, a variety of resources were used to cull a final list. Primarily, this list was derived from occupations flagged by O*NET, the nation's primary source of occupational information. The O*NET database contains information on hundreds of standardized and occupation-specific descriptors. Additional sources were used to verify and expand this list.

In order to reconcile any inconsistencies between sources, some additional steps were taken to modify the final list (see Appendix B).

- We chose to exclude occupations related to Health Care or Education for these analyses.
- Occupations in question were examined further using the O*NET database to understand knowledge and skills required for the job. If a particular occupation scored above 60 (out of 100) in regards to importance of skills related to STEM, the occupation was included in the final list.

Identifying Middle-Wage Occupations
In order to identify the subset of those middle-skill occupations that simultaneously provide livable wages, a minimum median wage level for given occupations is set, based on the median annual wage for King County. Assuming full-time work throughout the year, this results in $21/hour, a wage equivalent to annual earnings of $43,680. At $21 per hour in 2008, a two-earner family with both workers employed in jobs at this wage would have family earnings at about the median family income for King County.[47] This wage is commensurate with levels identified in other studies[48] as a livable wage for a single earner with two children, and recognizes the fact that in high-cost areas of Washington, two earners are often necessary to reach an adequate income. Lastly, it is important to note that the $21 per hour wage represents a minimum, and most occupations included as "accessible middle-wage" occupations have higher median wages. [49]

Based on the findings from SJI's 2008 report *Skills Required*, middle-wage jobs – those paying a livable family wage and requiring some education and training beyond high school but less than a bachelors degree - make up 20 to 25 percent of all jobs in the Puget Sound region. Table A1 presents an overview of the jobs projected for specific industry clusters by wage and skill level for the Puget Sound region. The findings reveal varying degrees of middle-wage job growth for particular industry clusters of interest.[50] Strong prospects for these accessible occupations exist in key industries for Puget Sound – Construction, Health Care and Aerospace. At the same time, sizeable proportions of middle-wage jobs exist in areas that rely heavily on STEM skills and knowledge, including Aerospace, Health Care, and Clean Technology. These findings

[47] Median Family Income in King County for 2008 was $87,903 (American Community Survey).
[48] Northwest Federation of Community Organizations, *Searching for Work That Pays: 2007 Northwest Job Gap Study, Seattle*, April 2007; NWFCO suggests a living wage of $17.54 for a single adult with one child at home, and $21.77 for a couple with one child and one adult in the workforce.
[49] For more detailed information on the methodology used to define and identify STEM occupations and middle-wage jobs, refer to Appendix A at the end of this report.
[50] Except for Professional & Business Services, clusters were selected by either the Puget Sound's regional industry cluster strategy, Prosperity Partnership, or the City of Seattle as key areas of interest, as outlined in Paul Sommers and Mark Gardner, *Accessible Middle-Wage Jobs in Seattle and the Puget Sound Region*, January 31, 2007, Seattle Jobs Initiative Working Paper.

confirm the idea that those jobs in the middle that pay family-sustaining wages in fact are and will continue to be a significant portion of many of the key existing and emerging industries in the Puget Sound region.

Table A1. Expected Direct Middle-Wage Employment Growth by Industry Cluster for the Puget Sound Region, 2004-2014

	*Projected 2014 New Direct Employment**	*New MWJs*	*% of All New Jobs*
TRADITIONAL INDUSTRIES			
Construction	21,398	17,474	82%
Aerospace	14,253	6,181	43%
Logistics & International Trade	7,757	3,959	51%
SERVICE SECTOR INDUSTRIES			
Health Care	28,671	7,739	27%
Professional & Business Services	12,481	2,063	17%
Leisure & Hospitality	6,850	978	14%
EMERGING INDUSTRIES			
Green Building†	2,139	1,747	82%
Clean Technology‡	306	168	55%

* Cluster totals are not the same as in Table 1 due to rounding errors and missing wage or education data.
† The Green Building Industry Cluster is assumed to represent roughly 10% of the total Construction Industry.
‡ The Clean Technology Industry Cluster is made up of the following industries, as identified by the Puget Sound Regional Council: Other Electric Power Generation; Environmental Consulting Services; Solid Waste Combustors and Incinerators; Air Purification Equipment Manufacturing; Materials Recovery Facilities; Environment, Conservation and Wildlife Organizations; and Hazardous Waste Treatment and Disposal.
Source: "Skills Required: Preparing Puget Sound for Tomorrow's Middle-Wage Jobs". March 2008. Paul Sommers, Mark Gardner, and Juliet Scarpa. Seattle Jobs Initiative. Calculations by authors on Washington State Employment Security Department long-term employment projections by industry.

In order to identify the subset of those middle-skill occupations that simultaneously provide livable wages, a minimum median wage level for given occupations is set, based on the median annual wage for King County.

We use Washington State employment and wage data, coupled with national data on the educational attainment of workers in various occupations, to provide a definition of middle-wage jobs that simultaneously measures wages and accessibility of jobs for those at different education levels. This report relies on occupational projections from the Federal Bureau of Labor Statistics (BLS) and the Labor Market and Economic Analysis (LMEA) unit of Washington's Employment Security Department (ESD), supplemented with educational attainment data from the Census Bureau.

BLS data on the educational attainment of incumbent workers in each occupation is derived from Census files. In this report, we define "accessible" jobs as those occupations in which no more than 40% of the incumbent workers nationally have attained a bachelor's or higher degree. The rationale is that if 60% or more of the workers in the occupation have gained these positions with less than a bachelor's degree education level, then the occupation is relatively accessible to those with a high

school diploma or some college. Using a cutoff of 60% or more without a BA helps correct for national educational levels within particular occupations that tend to be somewhat lower than Washington's levels, given higher-than-average education attainment of residents of this state. Second, while this method may not identify all promising occupations that could be accessible with less than BA training, it should provide a robust method of selecting those industry clusters with a large proportion of employment in accessible occupations.

The second component of the middle-wage jobs definition is a minimum wage level of $21/hour. On an annual basis, assuming full-time work throughout the year, this hourly wage is equivalent to annual earnings of $43,680. [51] At $21 per hour in 2008, a two-earner family with both workers employed in jobs at this wage would have family earnings at about the median family income for King County.[52] This wage is commensurate with levels identified in other studies[53] as a livable wage for a single earner with two children, and recognizes the fact that in high-cost areas of Washington, two earners are often necessary to reach an adequate income. Lastly, it is important to note that the $21 per hour wage represents a minimum, and most occupations included as "accessible middle-wage" occupations have higher median wages.

To highlight where these middle-wage occupations fall in relationship to other determinations of livable wages for King County, Table A2 details a variety of indicators of household income and how they compare.

Table A2. Comparison of Various Livable Wage Information for King County

	Wage	Household Composition
Northwest Living Wage (2008)	$12.27 - $26.56	Range
Self-Sufficiency (2009)	$8.95 - $26.26	Range
Middle-Wage (2008)	$21.00	2 FT earners
Median Family Income (2008)	$19.57	2 FT earners
200% Federal Poverty Level (2008)	$16.92	3-person HH

NOTE: Comparisons are difficult, as they range based on family size and composition for each measure. For instance, FPL is measured based on family size alone, while the Northwest Living Wage and Self-Sufficiency guidelines are additionally based on dependents and number of working adults.
Sources: Northwest Federation of Community Organizations, April 2007, *Searching for Work That Pays: 2007 Northwest Job Gap Study*; Diane Pierce. June 2009, *The Self-Sufficiency Standard for Washington 2009*. Workforce Development Council of Seattle-King County; U.S. Department of Housing and Urban Development FY 2008 Median Family Income for Seattle-Bellevue Metro Fair Market Rent Area; U.S. Department of Health and Human Services 2008 Federal Poverty Guidelines; author calculations.

As a proxy, this wage cut serves as a measure of job quality and an indicator of potentially secure employment connected to opportunities for advancement and growth along career pathways. The above analyses indicate that middle-wage jobs pay comparably well in terms of the spectrum of livable wage measures, more than the median family income and 200% of federal poverty for King County. Overall, this evidence confirms the definition of middle-wages for this examination as a decent proxy test for identifying quality occupations and opportunities for King County.

[51] SJI's 2008 research used a minimum wage level of $17/hour, equaling $35,360 annually for 2004. The increase from $17 to $21/hr reflects the overall increase in the median annual wage for King County between 2004 and 2008.
[52] Median Family Income in King County for 2008 was $87,903 (American Community Survey).
[53] Northwest Federation of Community Organizations, *Searching for Work That Pays: 2007 Northwest Job Gap Study, Seattle*, April 2007; NWFCO suggests a living wage of $17.54 for a single adult with one child at home, and $21.77 for a couple with one child and one adult in the workforce.

Unlike some studies looking at the growth of industries or occupations providing a middle class standard of living, we do not include an upper wage cutoff for occupations. However, in practical terms the presence of an education standard means that there are few jobs that meet the education limit that fall within the very highest reaches of the wage spectrum. Since the purpose of this research is to identify occupations and associated industry clusters offering good paying jobs to those with less than a BA, there is no practical reason to add an upper wage cutoff.

APPENDIX B

SCIENCE OCCUPATIONS – KING COUNTY

		Estimated Employment			2007-2012		2012-2017	
		2007	2012	2017	Growth Rate	Growth Count	Growth Rate	Growth Count
19-1042	Medical scientists, except epidemiologists	3,045	3,386	3,782	10%	341	10%	396
19-2041	Environmental scientists and specialists, including health	1,821	1,996	2,219	9%	175	10%	223
19-4021	Biological technicians	1,623	1,784	1,983	9%	161	10%	199
19-1023	Zoologists and wildlife biologists	876	960	1,050	9%	84	9%	90
19-1029	Biological scientists, all other	704	754	820	7%	50	8%	66
19-2031	Chemists	673	722	799	7%	49	10%	77
19-4099	Life, physical, and social science technicians, all other	591	633	722	7%	42	12%	89
19-2042	Geoscientists, except hydrologists and geographers	589	643	711	8%	54	10%	68
11-9121	Natural sciences managers	542	608	689	11%	66	12%	81
19-4061	Social science research assistants	492	528	571	7%	36	8%	43
19-3099	Social scientists and related workers, all other	410	441	475	7%	31	7%	34
19-4091	Environmental science and protection technicians, including health	261	288	324	9%	27	11%	36
19-4031	Chemical technicians	256	276	307	7%	20	10%	31
19-1022	Microbiologists	232	245	262	5%	13	6%	17
19-1099	Life scientists, all other	181	192	229	6%	11	16%	37
19-1021	Biochemists and biophysicists	178	195	218	9%	17	11%	23
19-1041	Epidemiologists	172	183	200	6%	11	9%	17
19-2099	Physical scientists, all other	157	162	166	3%	5	2%	4
19-2021	Atmospheric and space scientists	145	154	165	6%	9	7%	11
19-2012	Physicists	137	147	160	7%	10	8%	13
19-2043	Hydrologists	137	148	163	7%	11	9%	15
19-4093	Forest and conservation technicians	136	138	140	1%	2	1%	2
19-3094	Political scientists	103	114	126	10%	11	10%	12
19-4011	Agricultural and food science technicians	66	68	74	3%	2	8%	6
19-1032	Foresters	60	62	66	3%	2	6%	4
19-2032	Materials scientists	51	56	64	9%	5	13%	8

TECHNOLOGY OCCUPATIONS – KING COUNTY

		Estimated Employment			2007-2012		2012-2017	
		2007	2012	2017	Growth Rate	Growth Count	Growth Rate	Growth Count
15-1031	Computer software engineers, applications	20,043	22,991	26,605	13%	2,948	14%	3,614
15-1032	Computer software engineers, systems software	13,905	15,830	18,382	12%	1,925	14%	2,552
15-1051	Computer systems analysts	8,731	9,524	10,568	8%	793	10%	1,044
15-1021	Computer programmers	8,441	9,298	10,509	9%	857	12%	1,211
15-1041	Computer support specialists	6,778	7,181	7,850	6%	403	9%	669
15-1071	Network and computer systems administrators	6,451	7,076	8,023	9%	625	12%	947
15-1081	Network systems and data communications analysts	5,621	6,536	7,816	14%	915	16%	1,280
15-1099	Computer specialists, all other	5,355	5,664	6,031	5%	309	6%	367
11-3021	Computer and information systems managers	5,225	5,540	6,075	6%	315	9%	535
15-1061	Database administrators	1,766	1,852	2,010	5%	86	8%	158
15-1011	Computer and information scientists, research	1,109	1,301	1,543	15%	192	16%	242

ENGINEERING OCCUPATIONS – KING COUNTY

		Estimated Employment			2007-2012		2012-2017	
		2007	2012	2017	Growth Rate	Growth Count	Growth Rate	Growth Count
17-2051	Civil engineers	5,722	6,025	6,572	5%	303	8%	547
47-2111	Electricians	5,283	5,400	5,615	2%	117	4%	215
11-9021	Construction managers	4,747	4,599	4,946	-3%	-148	7%	347
49-3023	Automotive service technicians and mechanics	4,317	4,275	4,325	-1%	-42	1%	50
17-2011	Aerospace engineers	3,618	3,522	3,608	-3%	-96	2%	86
17-1011	Architects, except landscape and naval	3,015	3,272	3,620	8%	257	10%	348
17-2141	Mechanical engineers	2,735	2,775	2,892	1%	40	4%	117
13-1041	Compliance officers, except agriculture, construction, health and safety, and transportation	2,446	2,483	2,534	1%	37	2%	51
11-9041	Engineering managers	2,445	2,409	2,515	-1%	-36	4%	106

17-2072	Electronics engineers, except computer	2,440	2,359	2,495	-3%	-81	5%	136
13-1081	Logisticians	2,150	2,107	2,092	-2%	-43	-1%	-15
49-3011	Aircraft mechanics and service technicians	2,104	2,027	1,968	-4%	-77	-3%	-59
17-3011	Architectural and civil drafters	1,849	1,975	2,189	6%	126	10%	214
17-2071	Electrical engineers	1,406	1,446	1,506	3%	40	4%	60
17-3029	Engineering technicians, except drafters, all other	1,239	1,195	1,129	-4%	-44	-6%	-66
41-9031	Sales engineers	1,179	1,213	1,325	3%	34	8%	112
19-3051	Urban and regional planners	1,147	1,181	1,256	3%	34	6%	75
47-4011	Construction and building inspectors	1,105	1,138	1,226	3%	33	7%	88
17-3023	Electrical and electronic engineering technicians	934	910	997	-3%	-24	9%	87
17-3031	Surveying and mapping technicians	848	935	1,041	9%	87	10%	106
17-3013	Mechanical drafters	773	765	763	-1%	-8	0%	-2
17-3027	Mechanical engineering technicians	745	743	779	0%	-2	5%	36
17-2081	Environmental engineers	721	771	839	6%	50	8%	68
17-3026	Industrial engineering technicians	714	699	692	-2%	-15	-1%	-7
17-1012	Landscape architects	690	750	830	8%	60	10%	80
49-2094	Electrical and electronics repairers, commercial and industrial equipment	689	674	671	-2%	-15	0%	-3
17-3022	Civil engineering technicians	667	689	734	3%	22	6%	45
17-2061	Computer hardware engineers	649	685	793	5%	36	14%	108
53-6051	Transportation inspectors	638	613	666	-4%	-25	8%	53
51-2023	Electromechanical equipment assemblers	602	543	551	-11%	-59	1%	8
17-3012	Electrical and electronics drafters	501	501	500	0%	0	0%	-1
17-1022	Surveyors	456	493	546	8%	37	10%	53
49-2091	Avionics technicians	433	425	475	-2%	-8	11%	50
17-2031	Biomedical engineers	329	368	416	11%	39	12%	48
49-2097	Electronic home entertainment equipment installers and repairers	311	301	312	-3%	-10	4%	11
17-2121	Marine engineers and naval architects	277	294	314	6%	17	6%	20
49-2096	Electronic equipment installers and repairers, motor vehicles	267	271	277	1%	4	2%	6
49-2093	Electrical and electronics installers and repairers, transportation equipment	234	236	242	1%	2	2%	6

49-2095	Electrical and electronics repairers, powerhouse, substation, and relay	233	256	263	9%	23	3%	7
17-3024	Electro-mechanical technicians	213	203	187	-5%	-10	-9%	-16
17-3025	Environmental engineering technicians	213	218	245	2%	5	11%	27
17-2041	Chemical engineers	209	224	248	7%	15	10%	24
17-1021	Cartographers and photogrammetrists	164	173	189	5%	9	8%	16
17-3021	Aerospace engineering and operations technicians	151	143	132	-6%	-8	-8%	-11
17-2111	Health and safety engineers, except mining safety engineers and inspectors	137	138	150	1%	1	8%	12

MATHEMATICS OCCUPATIONS

		Estimated Employment			2007-2012		2012-2017	
		2007	2012	2017	Growth Rate	Growth Count	Growth Rate	Growth Count
11-3031	Financial managers	5,993	6,034	6,387	1%	41	6%	353
13-1051	Cost estimators	2,049	1,960	2,086	-5%	-89	6%	126
13-2011	Accountants and auditors	13,286	14,034	15,258	5%	748	8%	1,224
13-2031	Budget analysts	1,724	1,727	1,723	0%	3	0%	-4
13-2051	Financial analysts	1,697	1,792	1,978	5%	95	9%	186
13-2081	Tax examiners, collectors, and revenue agents	414	414	409	0%	0	-1%	-5
13-2082	Tax preparers	608	649	682	6%	41	5%	33
13-2099	Financial specialists, all other	2,344	2,443	2,614	4%	99	7%	171
15-2011	Actuaries	186	193	211	4%	7	9%	18
15-2031	Operations research analysts	549	560	601	2%	11	7%	41
15-2041	Statisticians	489	528	577	7%	39	8%	49
19-3011	Economists	144	152	160	5%	8	5%	8
19-3022	Survey researchers	82	92	103	11%	10	11%	11
43-9111	Statistical assistants	127	133	140	5%	6	5%	7
51-4012	Numerical tool and process control programmers	225	217	207	-4%	-8	-5%	-10

APPENDIX C

Middle-Wage STEM Occupations - King County

Occupation	Education (BLS Survey of Employees 25-44) Less Than High School	Some College	Bachelors Degree	Est. Employment 2007	Est. Employment 2012	Est. Employment 2017	Med. Wage
Electrical and electronics drafters	13%	62%	25%	501	501	500	$ 31.73
Mechanical drafters	13%	62%	25%	773	765	763	$ 30.80
Aerospace engineering and operations technicians	27%	54%	18%	151	143	132	$ 28.19
Civil engineering technicians	27%	54%	18%	667	689	734	$ 25.71
Electrical and electronic engineering technicians	27%	54%	18%	934	910	997	$ 26.17
Electro-mechanical technicians	27%	54%	18%	213	203	187	$ 28.27
Environmental engineering technicians	27%	54%	18%	213	218	245	$ 25.91
Industrial engineering technicians	27%	54%	18%	714	699	692	$ 29.84
Mechanical engineering technicians	27%	54%	18%	745	743	779	$ 28.69
Engineering technicians, except drafters, all other	27%	54%	18%	1,239	1,195	1,129	$ 32.38
Surveying and mapping technicians	42%	51%	7%	848	935	1,041	$ 21.76
Transportation inspectors	45%	40%	15%	638	613	666	$ 28.56

Sources: Employment Projections Program, U.S. Department of Labor, U.S. Bureau of Labor Statistics; Washington Occupational Employment Projections, Washington State Employment Security Department Labor Market and Economic Analysis Branch; Occupational Employment Statistics Wage Survey, U.S. Department of Labor, U.S. Bureau of Labor Statistics

APPENDIX D – King County STEM-related training opportunities (*not exhaustive*)

Cascadia Community College

- Certificate - Computer Programming Foundations - 10 credits
- Certificate - Web Foundations - 12 credits
- Certificate - JavaScript Programming - 15 credits
- Certificate - Web Applications - 17 credits
- Certificate - PC Network Technician - 17
- Certificate - Database Development - 19 credits
- Certificate - Office Skills Integrated with ABE - 19 credits
- Certificate - Technical Support Specialist - 30 credits
- Certificate - Computer Applications Specialist - 39 credits
- Certificate - Solar Photovoltaic System Specialist - 51-57 credits
- Certificate - Network Specialist - 73-75 credits
- Certificate - Energy Management Specialist - 64-68 credits
- AS - Environmental Technologies and Sustainable Practices - 95-98 credits
- AS-T Track 1- Biological Sciences, Environmental/ Earth Sciences, Chemistry, and Geology – 90 credits
- AS-T Track 2 - Computer Science, Atmospheric Science, and Physics – 90 credits
- AS-T Track 2 - Engineering MRP:
  - □ Bioengineering and Chemical Engineering (BIO and CHEM E) Pathway (99-101 credits)
  - □ Computer and Electrical Engineering (Comp E and EE) Pathway (102 credits)
  - □ Mechanical, Civil, Aeronautical, Industrial, and Materials Science Engineering (Other Engineering) Pathway (108 credits)
- AS-T - Web Application Programming Technology- 98-99 credits
- AS-T – Network Technology – 99 credits

Shoreline Community College

- Certificate - Energy Auditor – Commercial – 4 credits
- Certificate - Energy Auditor – Residential – 4 credits
- Certificate – Solar/Photovoltaic Design and Marketing – 5 credits
- Certificate – Biotechnology Lab Specialist – 36-37 credits
- Certificate – CAD/Drafting – 53-55 credits
- Certificate – Accounting – 55 credits
- Certificate – Zero Energy Building Practices – 59-63 credits
- AAS-T Track 1 - Biological Sciences; Chemistry / Biochemistry; Environmental/Resource Sciences; Geology & Earth Sciences – Oceanography – 90 credits
- AAS-T Track 2 – Applied Math/Astronomy/Atmospheric Sciences/Physics; Computer Science & Computer Engineering; Engineering; Mechanical, Civil, Aeronautical, Industrial, Materials Science Engineering; Bioengineering & Chemical Engineering; Computer & Electrical Engineering - 90 credits
- AA-DTA Environmental Studies – 90 credits
- AA-DTA Mathematics – 90 credits
- AAAS – Accounting - 90-92 credits
- AAAS - Clean Energy Technology – 90-95 credits
- AAAS – Biotechnology Lab Specialist – 94.5-95.5 credits
- AAAS - CNC Technology – 115-117 credits

North Seattle Community College

Certificate - Architectural Engineering Drafting - 47 credits
Certificate - AAS-track Architectural Engineering Drafting - 53 credits
Certificate - Electronics Technology - 61 credits
Certificate - Computerized Accounting Technology - 63 credits
Certificate - IT Network Infrastructure and Security Support Specialist - 88 credits
AAS - Architectural Engineering Drafting - 93 credits
AAS - Electronics Engineering Technology –114 credits
AAS - Electronics Technology –116 credits
AAS - Biomedical Equipment Technology - 120 credits
AS-T Option 1 - Biological, Environmental, Resource Sciences, Chemistry, Geology or Earth Sciences - 90 credits
AS-T Option 2 - Engineering, Computer Science, Physics, Math or Atmospheric Science - 90 credits)
AAS-T - Nanotechnology – 92 credits
AAS-T - IT Network Infrastructure and Security Support Specialist – 118 credits

Lake Washington Technical College

Certificate - C#/C++ Programmer - 15 credits
Certificate - Energy Technology - 17 credits
Certificate - Bio-Energy Technology – 19 credits
Certificate - Industrial/Laboratory - 19 credits
Certificate - Landscape Design Graphics - 32 credits
Certificate - Network Support Technician - 60 credits
Certificate - IT Support Tech - 60 credits
Certificate - Web Applications Development - 65 credits
Certificate - Software Development - 65 credits
Certificate - Engineering Graphics Technician - 83 credits
Certificate - Architectural Graphics - 83 credits
Certificate - Civil Engineering Graphics - 83 credits
AAS-T - Information Technology Applications Development - 90 credits
AAS - Information Technology Applications Development - 90 credits
AAS - Energy & Science Technician - 91-99 credits
AAS - Video and Web Production - 97 credits
AAS - Multimedia Design & Production - 98 credits
AAS - Animation/Game Design - 102 credits
AAS - Architectural Graphics - 120 credits
AAS - Civil Engineering Graphics - 120 credits
AAS - Computer Security & Network Technician - 120 credits
AAS - Engineering Graphics, Mechanical Design Emphasis - 120 credits

Seattle Central Community College

Certificate - Network Design & Administration CISCO Alternative - 40 credits
Certificate - Business Information Technology - 49 credits
Certificate - Applications Support - 51 credits
Certificate - Computer Programming - 69 credits
Certificate - Database Design & Administration - 69 credits
Certificate - Network Design & Administration - 78 credits
AAS-T - Applications Support - 90 credits
AAS-T - Computer Programming - 94 credits
AAS - Business Information Technology - 94 credits
AAS-T - Network Design & Administration - 98 credits

Seattle Vocational Institute

Certificate – Computer Based Accounting – 990 hours
Network Technician – 990 clock hours

South Seattle Community College

Certificate - Computer-Aided Drafting & Design Technology – 46 credits
AS – Engineering Pre-major – 90 credits
AS - Aerospace Engineering – 90 credits
AS – Science Pre-major (Biology, Chemistry, Environmental Science, Geology, and Earth Science) – 90 credits
AS – Civil and Environmental Engineering – 90 credits
AS – Computer Engineering – 90 credits
AS - Mechanical Engineering – 90 credits
AS – Computer Science – 90 credits
AS - Electrical Engineering – 90 credits
AA – Computer and Software Systems – 90 credits
AAS-T - Computer-Aided Drafting & Design Technology – 92 credits
AAS - Computer-Aided Drafting & Design Technology – 93 credits
AAS – Drafting/Engineering Technology – 95 credits
AAS - Network Technician - 97 credits
AAS -T - Network Technician - 98 credits
AS - Bioengineering and Chemical pre-Engineering - 100 - 102 credits AS - Computer and Electrical Pre-Engineering - 101 credits
AS - Mechanical/Civil/Aeronautical/ Industrial/ Materials Science/ pre-Engineering (Other Engineering) - 107 credits
AAS – Network Administration – 112 credits
AAS-T – Network Administration – 118 credits

Bellevue College

Certificate – Database Test Engineer (noncredit)
Certificate - Software Test Engineer (noncredit)
Certificate - Software Test & Development Engineer (noncredit)
Certificate – Database User Specialist – 18-20 credits
Certificate - Relational Database Analyst – 30 credits
Certificate - Relational Database Developer -45 credits
Certificate - Microcomputer Support Specialist - 45 credits
Certificate – Business Intelligence Developer – 45 credits
Certificate - Database Administration Specialist – 45 credits
Certificate - Operating Systems Support Specialist -45 credits
Certificate - Programming for Web Development-45 credits
Certificate – Digital Gaming – 45 credits
Certificate – Cisco Support Technician – 46 credits
Certificate - Digital Video Production 48-50 credits
AA – Digital Gaming – 83 credits
AA - Business Intelligence Information Systems – 91 credits
AA - Database Administration Information Systems – 91 credits
AA – Software Development Information Systems – 91 credits
AA- Network Services & Computing Systems- 91 credits
AA - Digital Video – 93 credits
AA- Technical Support - 90-94 credits
AA - Web Multimedia Authoring – 93 credits
AAS - Astronomy, Computer Science, Fisheries/ Wildlife, Geology, Medical Technology, Medicine
AAS Track 1 - Biology, Botany, Chemistry, Ecology, Environmental Science , Microbiology, Oceanography/Marine Biology
AAS Track 2 – Engineering, Meteorology, Physics
AME-T - Associate in Math Education - Direct Transfer Agreement / Major Related Program – 90 credits
AS-T Track I - Biological, Environmental/Resources, Chemistry, and Earth Sciences (Life Sciences) – 90 credits
AS-T Track II – Physics, Atmospheric Sciences and Engineer (Physical Sciences) – 90 credits
AS-T Track II - Engineering/Master Related Program:
Chemical and Bio Engineering - 90-105 credits
Electrical and Computer Science - 90-108 credits
Civil, Mechanical and other Engineering - 90-106 credits

Renton Technical College

Certificate - Computer-Aided Drafting: Option I - 15 credits
Certificate - Computer-Aided Drafting: Option 2 - 21 credits
Certificate - Computer Programming Certificate – 24 credits
Certificate –Computer Applications - 31 credits
Certificate - Electronic Service Technician Certificate – 45 credits
Certificate - Land Survey Technician – 68 credits
Certificate - Field Survey Technician –69 credits
Certificate - Computer Science - 71 credits
AAS – Engineer Design Technology – 71 credits
Certificate - Applications Developer Certificate – 75 credits
Certificate – Computer Networking Technology – 75 credits
Certificate - Civil CADD – 81 credits
AAS – Land Survey Technician – 83 credits
Certificate – Engineer Design Technology – 91 credits
AAS - Computer Science – 91 credits
AAS - Technical Studies– 93 credits
AAS – Computer Networking Technology - 95 credits
AAS - Civil CADD – 101 credits
Certificate - Industrial Engineering – 127 credits
Certificate - Commercial Building Engineering – 128 credits
Certificate – Automotive Technology - 135 credits
AAS - Industrial Engineering – 147 credits
AAS - Commercial Building Engineering - 148 credits
AAS – Automotive Technology - 155 credits

Highline Community College

Certificate - Database Technologies – 10 credits
Certificate - 3D Graphics & Animation - 13– 15 credits
Certificate - Flash – 15 credits
Certificate - Client Side/Server Side Scripting – 15 credits
Certificate - Level 1 Gaming-General Education – 15 credits
Certificate - LAN – 15 credits
Certificate - Unix System Administration – 15 credits
Certificate - C++ Programming - 25 credits
Certificate - Data Recovery/ Forensics Specialist - 25 credits
Certificate - Drafting Design - 43 credits
Certificate - Network Skills Specialist - 43 credits
Certificate - Web/ Database Developer - 44 credits
AAS - Data Recovery/ Forensics Specialist - 91 credits
AAS - Drafting Design - 90 credits
AAS - Network Specialist - 92 credits
AAS - Web/ Database Developer AAS 90
AAS - Information System Project Coordinator -

- AAS - Web Developer - 90-94 credits
- AAS - Software Developer - 90-94 credits
- AAS - Networking - 90-94 credits
- AAS - Computer Forensics - 95-99 credits
- AAS - E-commerce - 93-97 credits
- AAS - Database Design & Developer - 95-99 credits

AS – Biology - 70 credits
AS – Computer Science 70 credits
AS – Chemistry – 70 credits
AS - Engineering – 71 credits
AS - Physics – 70 credits
AAS-T - Biology/Marine Biology – 70 credits
AAS-T - Chemistry – 70 credits
AAS-T - Computer Science – 70 credits
AAS-T - Engineering – 71 credits

Green River Community College

AS-T Track I - Biology – 90 credits
AS-T Track I - Biology Education - 104-105 credits
AS-T Track I - Environment Science – 90 credits
AS-T Track I - Chemistry – 90 credits
AS-T Track I - Chemistry Education - 101-102 credits
AS-T Track I - Geology – 90 credits
AS-T Track I - Earth Science – 90 credits
AS-T Track I - Biology Education – 104-105 credits
AS-T Track I - General Science Education - 93-97 credits
AS-T Track II - Astronomy (ASTR) – 90 credits
AS-T Track II - Atmospheric Sciences - 90 credits
AS-T Track II – Physics - 90 credits
AS-T Track II - Computer Science - 90 credits
AS-T Track II - Engineering - 90 credits
AS-T Track II - Aeronautical Pre-Engineering - 112 credits
AS-T Track II - Biological Pre-Engineering - 101-102 credits
AS-T Track II - Chemical Pre-Engineering - 101-102 credits
AS-T Track II - Civil Pre-Engineering - 112 credits
AS-T Track II - Computer Pre-Engineering - 96 credits
AS-T Track II - Electrical Pre-Engineering - 96 credits
AS-T Track II – Industrial Pre-Engineering - 112 credits
AS-T Track II - Material Science Pre-Engineering - 112 credits
AS-T Track II - Mechanical Pre-Engineering - 112 credits
AS-T Track II - Other Pre-Engineering - 112 credits
AS-T Track II - Engineering Technology- AS-T-Opt 2 – 90 credits
Aviation Technology (AVIA)
- Certificate - Basic Weather Observer - 5 credits
- Certificate - Basic Aviation Knowledge - 10 credits
- Certificate - Basic Airport Management - 15 credits
- Certificate - Intermediate Aviation Knowledge - 15 credits
- Certificate - Airline Dispatcher Completion - 20-25 credits
- Certificate - Advanced Aviation Knowledge - 20 credits
- Certificate - Advanced Air Traffic Control - 25 credits
- Certificate - International Flight Planning - 25-30 credits
- Certificate - Helicopter - 33 credits
- Certificate - Aircraft Dispatcher - 41-43 credits
- AAS - Airline Dispatch - 92 credits
- AAS - Helicopter Pilot - 93 credits
- AAS - Air Transportation - 95 credits
- AAS - Air Traffic Control - 97 credits
- AAS - Professional Pilot - 97 credits

Computer Reporting Technologies (CRPT)
- AAA - Captioning Sequence A (Day) - 144-209 credits
- AAA - Captioning Sequence B (Evening) - 98-135 credits
- AAA - Court Reporting Sequence A (Day) - 148-217 credits
- AAA - Court Reporting Sequence B (Evening) - 103-143 credits
- Certificate - Medical Stenoscriptionist - 43 credits
- Certificate - Scoptist/Text Editor - 44 credits
- Certificate - Text Entry - 42 credits

Green River Community College (cont'd)

Design Drafting Technology (DDT)
- AAS - Design Drafting Technology - 110-111 credits
- AAS - Construction Design Technology - 120 credits
- AAS - Manufacturing Technology - CIM - 110-113 credits
- AAS - Mechanical Design Technology - 120 credits
- AAS-T - Mechanical Design Technology - 120 credits
- Certificate - Architectural, Structural and Civil Drafting - 74 credits
- Certificate - Mechanical Drafting - 74 credits
- Certificate - Architectural Drafting Proficiency - 74 credits
- Certificate - Mechanical 3-D CAD - 43-44 credits
- Certificate - Mechanical CAD Proficiency - 35-36 credits
- Certificate - Structural Drafting - 38-42 credits
- Certificate - Civil Drafting Proficiency - 40-42 credits
- Certificate - Drafting Proficiency - 39-44 credits

Computerized Machining & Manufacturing Technology
- AAS - Computerized Machining & Manufacturing Technology – 90-102 credits
- Certificate - Computerized Machining & Manufacturing Technology – 39-44 credits

Forensic Technology
- AAS - Forensic Technology - 113-114 credits
- Certificate - Forensic and Fingerprint Technology - 40 credits

Geographic Information Systems
- AAS - Geographic Information Systems - 102-107 credits
- Certificate - Geographic Information Systems - 43 credits

Information Technology
- AAS-T - IT Computer Support Specialist – 90 credits
- APP - IT Computing and Software Systems - 90 credits
- AAS-T - IT Information Assurance - 105-120 credits
- AAS-T - IT Networking - 105-120 credits
- AAS-T - IT Networking Infrastructure - 103-113 credits
- AAS-T - IT Systems - 90-105 credits
- Certificate - IT PC Repair Technician - 26 credits
- Certificate - IT Help Desk Support Technician - 44 credits
- Certificate - IT Information Assurance Technician - 54-59 credits
- Certificate - IT Network Technician - 51-56 credits

Seattle Jobs Initiative is a nonprofit organization that creates opportunities for people to support themselves and their families through living wage careers. All of our work is designed to eliminate barriers to good paying, long-term work. We creatively align support services - including housing, childcare, transportation and counseling - with job skills training and job placement assistance. Our policy work supports legislative changes that improve access to training and services for low-income individuals. Through partnerships and innovative approaches, we help people chart a path to economic self-sufficiency.

www.seattlejobsinitiative.com

Seattle Jobs Initiative