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CRACKING THE CODE ON STEM

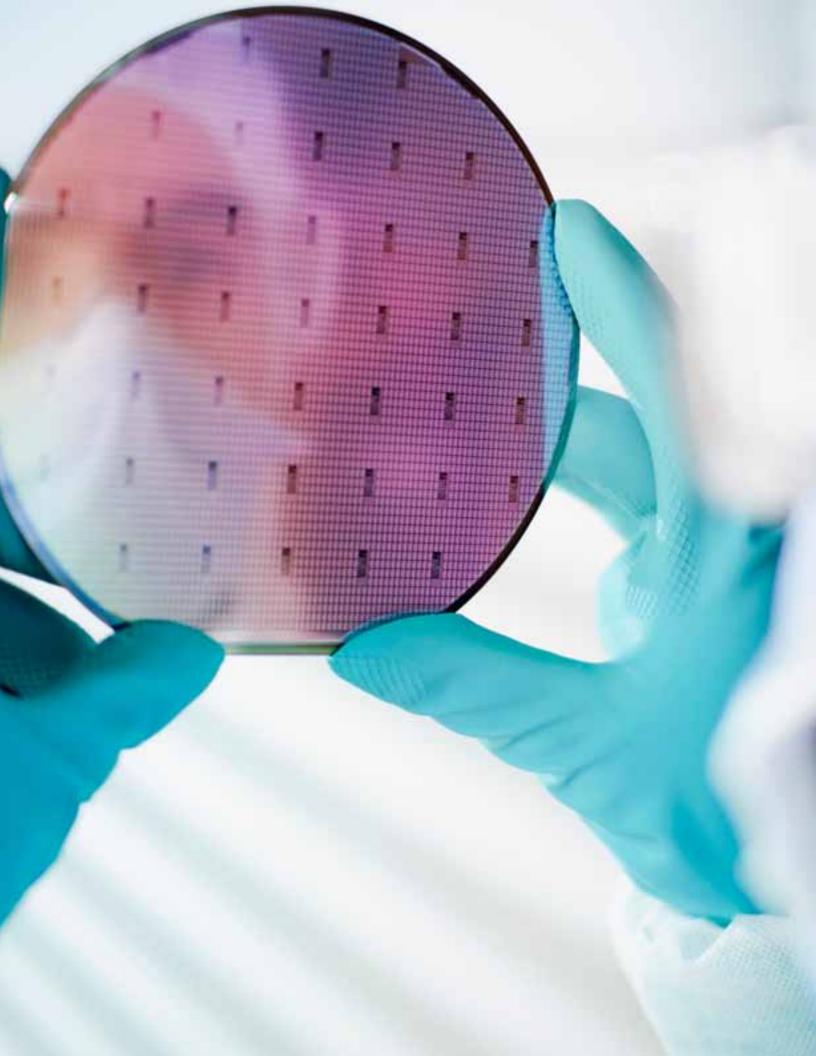
A People Strategy for Nevada's Economy

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CRACKING THE CODE ON STEM A People Strategy for Nevada's Economy

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Executive Summary

evada has in place a plausible economic diversification strategy-and it's beginning to work. Now, the state and its regions need to craft a people strategy.

Specifically, the state needs to boost the number of Nevadans who possess at least some postsecondary training in the fields of science, technology, engineering, or math-the so-called "STEM" disciplines (to which some leaders add arts and design to make it "STEAM").

The moment is urgent-and only heightened by the projected worker needs of Tesla Motors' planned "gigafactory" for lithium-ion batteries in Storey County.

Even before the recent Tesla commitment, a number of the more high-tech industry sectors targeted by the state's new economic diversification strategy had begun to deliver significant growth. Most notable in fast-growing sectors like Business IT Ecosystems (as defined by the Governor's Office for Economic Development) and large sectors like Health and Medical Services, this growth has begun to increase the demand in Nevada for workers with at least a modicum of postsecondary training in one or more STEM discipline.

However, there is a problem. Even though many available opportunities require no more than the right community college certificate, insufficient numbers of Nevadans have pursued even a little STEM training. As a result, too few Nevadans are ready to participate in the state's emerging STEM economy. The upshot: Without concerted action to prepare more Nevadans for jobs in STEM-intensive fields, skills shortages could limit growth in the state's most promising target industries and Nevadans could miss out on employment that offers superior paths to opportunity and advancement.

Which is the challenge this report addresses: Aimed at focusing the state at a critical moment, this analysis speaks to Nevada's STEM challenge by providing a new assessment of Nevada's STEM economy and labor market as well as a review of actions that leaders throughout the state-whether in the public, private, civic, or philanthropic sectors-can take to develop a workforce capable of supporting continued growth through economic diversification.

Accordingly, this report draws three conclusions:

1. Growth in some of Nevada's more STEM-oriented target sectors-such as Business IT Ecosystems and Health and Medical Services-is beginning to challenge the state's ability to deliver an adequate supply of both blue collar and professional STEM workers.

In this regard, growth patterns across the state's nine target sectors affirm the state's decision to adopt a structured economic diversification strategy. At the same time, they also highlight the growing importance of STEM-oriented industries and the increasing need for workers prepared for employment in these sectors.

Most notably, significant growth in a number of the state's target sectors is already ratcheting up the state's demand for both professional and middle-skill STEM-trained employees. Specifically, the frequently long duration of online postings of STEM-oriented job openings shows that the sharpening demand for STEM workers–combined with the relatively limited number of STEM-trained workers in Nevada–is beginning to create supply-side pinch points that could slow future growth.

Nevada's Business IT Ecosystems and Health and Medical Services sectors epitomize the opportunities and challenges. While 70 percent of job openings in these two sectors require STEM knowledge, less than half require a four-year degree (though the most in-demand positions in IT do tend to require one). And yet job posting data reveal that open positions take longer to fill in these two industries than in others, which suggests that employers are keen to hire but struggle to find qualified workers. Many IT and health sector job openings remain posted for a month or more, whether at the four-year or two-year training level.

This is important because Nevada's emerging STEM economy is larger and more important than may be appreciated. Using Brookings' definition of STEM, which encompasses both blue-collar STEM occupations for which sub-baccalaureate training is sufficient as well as professional occupations requiring a four-year degree or more, analysis shows that as of 2013 170,200 jobs in Nevada–a full 15 percent of all jobs in the state–require a high level of knowledge in at least one STEM field.

What is more, STEM jobs pay a substantial wage premium at all levels. Individuals with four-year degrees working in STEM occupations within the state's target industries earn on average almost \$77,000 per year, compared to roughly \$51,800 for similarly educated workers in non-STEM jobs in the same industries–a premium of nearly 50 percent. For those with just some college or an associate degree, the STEM wage premium is even higher, reaching 60 percent.

2. A number of significant challenges threaten to undercut the state's ability to cultivate the STEM-skilled workforce needed to advance Nevada's economic diversification.

Nevadans are beginning to recognize the shortcomings of the state's STEM education and workforce systems and respond to them. However, despite these often-impressive efforts, at least three challenges currently hobble the state's ability to deliver the strongest possible STEM workforce:

- Nevada lacks a cohesive, forceful vision for its STEM economy and the STEM-oriented workforce needed to achieve the state's economic goals. Nevada's STEM approach, like that of many other states, remains diffuse and low-profile. The state has not yet taken strong steps to articulate the importance of STEM education and STEM-intensive industries to Nevadans' future prosperity. And notwithstanding the many individually promising STEM initiatives that have been undertaken to date, the state has yet to coordinate and scale these activities.
- Nevada's education and workforce training systems are inconsistently aligned with the current and future needs of the state's STEM industries. Despite job growth that has begun to surface in STEM-intensive target industries such as Business IT Ecosystems and Health and Medical Services, the state's education and training ecosystems are not yet fully aligned with the state's economic goals. As a result, Nevada is struggling to maximize the impact of its efforts to produce competent, technically oriented workers.
- A STEM proficiency crisis affects all aspects of the state's education system. Threatening to subvert all other efforts, student outcomes at Nevada's educational institutions reflect a system in crisis that extends well beyond the realm of STEM education. Nevada's Pre-K through 12 (P-12) education system struggles to deliver basic STEM education-a fact that jeopardizes the state's ability to seize opportunities held out by its emerging STEM economy.

3. Nevada needs to create a people strategy to complement its economic strategy.

Economic diversification, in short, demands a new human capital approach. Where a forceful pro-STEM vision and strategy is missing, one needs to be put in place. To the extent that the state's STEM activities and actors are not now aligned, they should be aligned. And to the extent that a massive STEM proficiency crisis threatens to preclude real progress, its root causes must be addressed.

Along these lines, the state's public sector should work with other actors to **build a system for STEM education and training**. Meanwhile, civic entrepreneurs need to **change the dynamic in Nevada's regions** to promote STEM skills-building. (More detailed accounts of key recommendations summarized here can be found at www.brookings.edu/research/reports/2014/11/12-nevadastem-economy).

The Public Sector: Build a System

The public sector–working closely with business, civic, and philanthropic stakeholders–needs to do more to integrate the state's diffuse set of STEM education and training activities. To that end, the three major deficits of the state's current STEM activities–lack of a strong vision, shaky alignment of programming with state economic goals, and a persistent STEM proficiency crisis–each call for specific responses. See page 6 for a complete list of actions that the public sector can take to address these three major challenges.

Among the many actions needed to build a strong system for STEM education and training, the public sector should:

- > Deploy the governor's bully pulpit
- Appoint a dedicated STEM Champion in the governor's office and reconstitute the STEM Advisory Council to support the STEM Champion's work
- Create a P-12 STEM competitive grant program to support the creation and replication of effective STEM education strategies throughout the state
- Strengthen or recast industry sector councils to better deliver industry-led skills intelligence and inform workforce training efforts
- Establish a STEM workforce challenge grant competition to support industry-led workforce training initiatives

- Incorporate computer science into the P-12 curriculum
- Support high-quality, ongoing professional development for P-12 STEM educators
- Implement proven approaches to postsecondary remediation that speed students' time to degree

Civic Entrepreneurs: Change the Dynamic

Nevada's impressive network of business, civic, and philanthropic leaders also need to mobilize to strengthen the state's STEM economy. After all, Nevada's civic entrepreneurs can bring to bear tremendous initiative, clout, resources, energy, and expertise to the work of advancing STEM training and education in the state.

These leaders also have a major role to play in setting out a vision for STEM, aligning actors and activities, and fostering greater STEM proficiency among Nevada students. See page 7 for a full list of recommendations on how civic entrepreneurs can advance these three goals.

Of the many activities required to bring about this level of change, the civic sector should:

- Develop and fund a powerful statewide STEM marketing campaign
- Support promising applicants to the proposed P-12 STEM education and STEM workforce challenge grant competitions
- Create RDA-led regional STEM internship programs
- Support high-quality, ongoing professional development for P-12 STEM educators
- Recruit best-in-class charter management organizations (CMOs) to radically increase the number of charter schools in the state
- > Encourage "blue sky" thinking in STEM education

* * *

Highly distilled and broad-ranging, these recommendations represent the beginning of a STEM training and education agenda for Nevada.

By taking actions like these, Nevada can put in place a people strategy to match its economic strategy-and so link more Nevadans to a more prosperous, technically oriented future.

Strategies for Expanding Opportunity and Growth in Nevada's STEM Economy

PUBLIC SECTOR AGENDA

\$ = Little to no cost \$\$ = Low cost \$\$\$ = Moderate cost \$\$\$\$ = Higher cost

SET A VISION	
Deploy the governor's bully pulpit	\$
Appoint a dedicated STEM champion in the governor's office	\$\$
Reconstitute the Nevada STEM Advisory Council	\$
Craft clear guidelines for effective STEM education programs	\$
Create a P-12 STEM competitive grant program	\$\$\$\$
PURSUE ALIGNMENT	
Make industry sector councils more valuable forums for industry-led workforce training	\$
Enhance the exchange of market information within the sector councils	\$
Establish a competitive STEM workforce alignment challenge	\$\$\$\$
Update the public state college governance model	\$\$-\$\$\$
ESTABLISH PROFICIENCY	
Incorporate computer science into the P-12 core curriculum	\$\$-\$\$\$
Repurpose the computer literacy graduation requirement as a computer science requirement	\$\$-\$\$\$
Expand funding for high-quality STEM-related professional development	\$\$\$-\$\$\$\$
Expand UNR's Principals' STEM Academy into an Administrators' STEM Academy	\$\$-\$\$\$
Create and fund a public charter school strategic growth fund	\$\$\$\$
Encourage student excitement about STEM and the careers available to those with STEM knowledge	\$-\$\$
Design and implement STEM outreach efforts that are accessible to all students	\$\$
Develop a high-impact web portal to raise student awareness of STEM career pathways	\$\$
Implement proven approaches to postsecondary remediation that speed students' time to degree	\$\$-\$\$\$

Strategies for Expanding Opportunity and Growth in Nevada's STEM Economy

CIVIC SECTOR AGENDA

\$ = Little to no cost \$\$ = Low cost \$\$\$ = Moderate cost \$\$\$\$ = Higher cost

SET A VISION	
Join the governor in speaking out on the importance of STEM education and training	\$
Develop a powerful statewide STEM marketing campaign	\$\$\$-\$\$\$\$
Pledge matching funds for promising applicants to the proposed P-12 STEM competitive grant program	\$\$-\$\$\$
Create regional competitive grant programs to support P-12 STEM education	\$\$\$-\$\$\$\$
PURSUE ALIGNMENT	
Participate in the sector councils	\$
Engage in any STEM workforce challenge grant competitions	\$\$\$
Seek out opportunities to shape STEM programs	\$-\$\$
Expand student access to work-based learning opportunities	\$\$-\$\$\$
Develop a regional STEM internship program	\$\$\$
ESTABLISH PROFICIENCY	
Reinforce the connection between the CCSS and NGSS and the state's economic health	\$
Provide vocal and material support for P-12 computer science education	\$\$-\$\$\$\$
Support high-quality, ongoing professional development for P-12 STEM teachers	\$\$\$-\$\$\$\$
Provide signing and retention bonuses for hard-to-fill positions at high-need schools	\$\$\$-\$\$\$\$
Help identify, implement, fund, and scale up strong STEM approaches and practices	\$-\$\$\$\$
Recruit best-in-class charter management organizations into the state	\$\$\$\$
Create a regional charter school incubator	\$\$\$\$
Encourage "blue sky" thinking in STEM education	\$\$-\$\$\$\$
Host field trips and visit classrooms	\$-\$\$

CRACKING THE CODE ON STEM: A PEOPLE STRATEGY FOR NEVADA'S ECONOMY



Introduction

evada has in place a plausible economic diversification strategy-and it's beginning to work. Now, the state and its regions need to develop and implement a people strategy.

Specifically, Nevadans need to shape a workforce training system capable of preparing hardworking Nevadans for a higher-tech future.

The moment is urgent-and only heightened with the projected worker needs of Tesla Motors' planned "gigafactory" for lithium-ion batteries in Storey County.

Informed by the 2011 Brookings / SRI report "Unify | Regionalize | Diversify," Nevada has identified nine mostly high-tech industries that are essential to the state's economic diversification and set out to strengthen them.¹ Of these target sectors, Health and Medical Services and Business IT Ecosystems-along with high-tech manufacturing and others-hold out especially good prospects.

Jobs created by these and other target industries promise more balanced growth, greater social mobility, and more broadly shared prosperity. Already, these sectors are beginning to deliver on that potential, as evidenced by exciting employment opportunities in the state's growing tech community and its fledgling unmanned aerial vehicle (UAV) economic cluster. More jobs will come with the opening of a medical school at the University of Nevada at Las Vegas (UNLV) and any drive toward Tier 1 research status there.

However, much work remains if Nevada hopes to sustain, expand, and accelerate its economic diversification and cultivate new opportunities for Nevada workers.

Of special concern are the skills possessed by Nevada workers, which still largely reflect the state's old economic model. For decades, Nevadans of all ages could find employment in one of the state's many hotels, casinos, or mines with little more than a high school diploma. Today, by contrast, virtually all of the state's faster-growing industries

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require at least some level of postsecondary training, particularly in the fields of science, technology, engineering, and math-the so-called "STEM" disciplines (to which some leaders add arts and design to make it "STEAM" given the growing importance of creativity and design thinking, particularly in the fields of technology and innovation).

These demands reflect the increased technical and innovative content of Nevada's growth industries. Exciting firms like Tesla, DroneAmerica, IGT, Ormat Technologies, Originate, and Sierra Nevada Corporation-not to mention the state's top hospitals and gaming companies-all require employees who are well-versed in STEM fields. Going forward, the opportunities available to individuals, firms, and regions will be determined more and more by the availability of abundant, well-trained STEM or STEAM talent at all levels of the skill ladder.

Unfortunately, too few Nevadans are ready to participate in the state's emerging STEM economy. Despite the fact that many available opportunities require no more than the right community college certificate, insufficient numbers of Nevadans have pursued even a two-year postsecondary STEM certificate. Meanwhile, despite modest gains on high school completion rates in the Washoe County School District this past year, high school graduation rates, dropout rates, and proficiency test scores throughout the state reveal an educational system in crisis.²

The implications are somber: Without concerted action to prepare more Nevadans for jobs in STEM-intensive fields, skills shortages could limit growth in the state's most promising target industries and Nevadans could miss out on employment that offers paths to opportunity and advancement.

Fortunately, Gov. Sandoval, key state legislators, and numerous civic-minded leaders in Nevada's regions have begun to understand the need to cultivate a STEMproficient workforce. Most notably, the passage during the 2013 legislative session of Senate Bill 345 establishing a state STEM Advisory Council suggests a new awareness of the importance of STEM education and training to the state's economic future.³

However, to bring about the kinds of change that will be needed to transform the economic status quo and improve the lives of Nevadans, state leaders will need to align state and local economic development, educational, and workforce training systems with a vision of a diversified STEM-intensive economy. This report speaks to this challenge by providing a new assessment of Nevada's STEM workforce needs and supply as well as a review of steps that leaders throughout the state-whether in the public, private, or civic and philanthropic sectors-can take to develop a workforce capable of supporting continued growth through economic diversification. The report begins by explaining the importance of STEM skills and introduces Brookings' novel approach to the topic, which stresses the importance of blue collar as well as professional STEM activity. The analysis that follows uses this approach to assess current trends in private-sector employment across industries and current supply and demand tensions in the state's labor



markets. (For more on the data and analytics underlying this report see the appendix.)

The report then turns to the implications of these trends and sets out a series of key recommendations designed to help bring the state's education and workforce development systems into alignment with its economic development efforts. The report contends that Nevada can achieve its goal of developing a strong, diversified, and resilient economy that works for more Nevadans if it sets a bold vision for a STEM-intensive economy and workforce; aligns the delivery of education and workforce training to industry needs; and promotes STEM proficiency from the earliest grades all the way through postsecondary training.

All Nevadans deserve a healthy, diversified economy that offers them opportunities for prosperity and advancement. Bolstering STEM knowledge in the state-from kindergarten through postsecondary and beyond-will help ensure that Nevada can make good on its potential.

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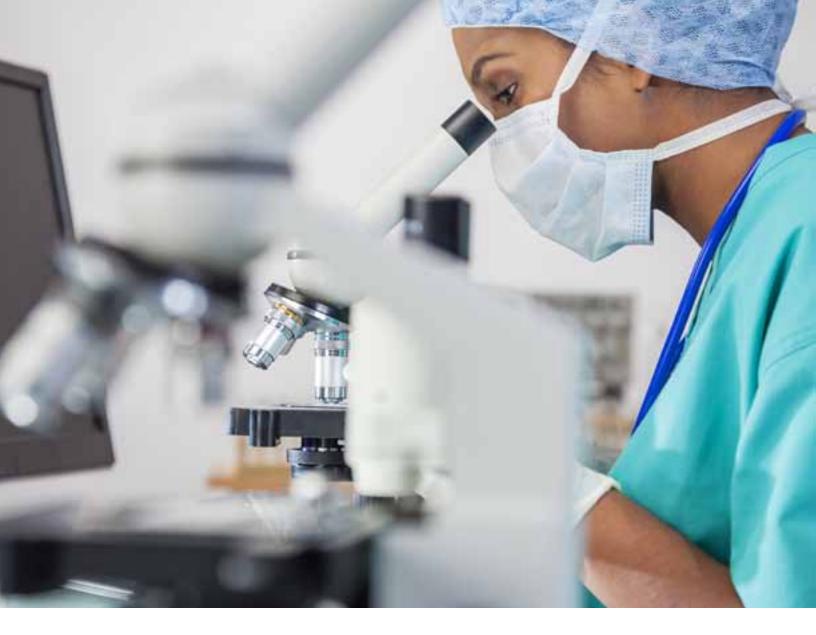
The STEM Economy: What It Is and Why It Matters

opular conceptions of STEM workers center on university-trained scientists, technologists, engineers, and mathematicians with advanced degrees-the Ph.D.-holding biochemist in a laboratory, the expert coder working on a new software program, the engineer designing an unmanned aerial vehicle.

And it's true that these highly educated workers, who comprise roughly 5 percent of the U.S. workforce, play a vital role in keeping the American economy on the cutting edge of technological development and deployment. They are more likely to invent new products and start new tech companies than those without STEM training, and they tend to be compensated extremely well, as recent studies have emphasized.⁴ Over the course of their lifetimes, STEM workers with post-baccalaureate training earn millions of dollars more than those with only a high school diploma and hundreds of thousands of dollars more than most liberal arts and social science majors.⁵

However, although professional STEM occupations represent a vital force in the U.S. economy, roughly half of all STEM jobs-some 13 million positions, or over 10 percent of all U.S. jobs-require some level of postsecondary training in a STEM field but not necessarily a bachelor's degree.⁶ In some cases, these sub-baccalaureate positions require more technical STEM knowledge than conventional STEM professions.⁷ For example, power plant operators, medical equipment repairers, HVAC technicians, and airplane mechanics all require a higher level of combined STEM knowledge than most computer workers, including software developers. Brookings calls this group of sub-baccalaureatelevel STEM workers the "hidden STEM economy" because the economic importance of these often blue-collar workers has to date gone largely unacknowledged.

The hidden STEM economy makes sizable contributions to the success of STEM-intensive industries. Though less likely to be directly involved in invention and innovation, subbaccalaureate-level STEM workers implement new ideas and advise researchers, engineers, and doctors on the feasibility of design options, software and programming needs, lab results, and practical aspects of product development and



service provision.⁸ For example, skilled technicians produce, install, maintain, and repair the IT infrastructure patented by professional researchers, allowing firms to enhance productivity and reach markets more efficiently.⁹ Similarly, in the health industry, nurses apply knowledge from medical research to advise and treat patients, and lab technicians provide critical services that help doctors determine the correct diagnosis.

Today's economy rewards STEM knowledge, even for those with sub-baccalaureate-level training, in large part because STEM training makes possible the technological gains and productivity increases that drive economic growth. The average STEM worker in a job requiring less than a bachelor's degree earns \$53,000 per year, compared to \$33,000 per year for non-STEM workers in jobs with comparable educational requirements.¹⁰ This sizable wage premium further underscores the positive effects that STEM-oriented industries can have on individual prosperity and regional economic health.

Furthermore, STEM-oriented companies and their workers have helped transform regions throughout the United States. From San Jose to Raleigh and Austin to Boulder, the high profits and wages of STEM-intensive firms flow back into the region, sparking economic growth that extends well beyond STEM-focused industries. The economic health of these regions reflects the fact that the presence of STEM workers at the sub-baccalaureate level and above is strongly associated with higher levels of regional innovation, productivity, and incomes.¹¹

Given the many benefits of STEM enterprises for regional economies and for workers, growing numbers of leaders in the public, private, civic, and philanthropic sectors-both nationally and in Nevada-increasingly stress the importance of STEM education and are working to encourage more people to pursue careers in STEM fields. In Nevada, stakeholders intent on strengthening STEM education in the state have joined together to form the Nevada STEM Coalition, which seeks to "increase student interest, excellence, competitiveness, and participation" in STEM.¹²

At the same time, interest in integrating STEAM education into P-12 curricula has also begun to grow. This shift from STEM to STEAM reflects a heightened awareness of the integral role that design thinking and creative problem-solving play in the advancement of science, technology, engineering, and math. By incorporating arts and design into STEM education initiatives, STEAM education advocates aim to strengthen students' creativity and design skills while at the same time improving their proficiency in the traditional STEM fields.

To further inform these burgeoning efforts, the next section offers a new look at the size, shape, and growth trends of Nevada's hidden STEM economy, with particular attention to the implications for the state's workforce.

STEM OR STEAM?

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Ithough emphasis on science and math education in the United States dates back to the start of the Space Race of the 1950s, the current push for STEM education has more recent roots. In 2007 the National Academies report "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future" declared that the United States would face declining economic competitiveness in an increasingly technology-oriented global economy unless it set out to improve student proficiency in STEM fields. This economic argument inspired a desire to strengthen educational outcomes in STEM disciplines, which in turn prompted educators at the P-12 and postsecondary levels to explore new approaches to teaching STEM-related curricula.

As these efforts have begun to take hold, some are highlighting the need for "STEAM" education–STEM plus art and design. Proponents of STEAM argue that arts education helps cultivate creativity and design thinking, both of which are critical to innovation. This more holistic approach allows students to experience firsthand the interconnections between the worlds of artistic creativity and logic-driven problem-solving. In addition, inclusion of art can help make STEM subjects more accessible by appealing to students with different learning styles and interests.

While the STEM vs. STEAM debate remains undecided, the benefits of high-quality arts education-including increased creativity, thoughtful problem-solving, and appeal to more artistically inclined students-suggest that schools would do well to bring the arts back into the classroom. Whether by formal integration as STEAM or through more informal incorporation of arts into STEM education, arts education can foster student engagement and promote the kinds of creative, inquisitive thinking that is needed to drive innovation.

Although this report is sympathetic to STEAM advocates' emphasis on creativity, a number of analytical considerations necessitate a focus on STEM skills and occupations. Perhaps most significantly, inclusion of arts-related occupations in addition to those in STEM fields would obscure the distinctive contours and contributions of STEM-intensive industries to Nevada's economic health and prosperity. With that said, the report endorses the relevance of high-quality arts and design training to the innovation economy and many of the recommendations offered-particularly with regard to P-12 education-could be adapted to a STEAM education agenda.

Source: Norman R. Augustine and others, "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future"; Heather B. Gonzalez and Jeffrey J. Kuenzi, "Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer."

Nevada's Hidden STEM Economy– Trends

he Great Recession hit Nevada hard, resulting in high levels of unemployment and a period of depressed economic growth. However, since the third quarter of 2010, when employment reached its lowest point, the state's economy has made modest but steady progress, particularly with regard to its target industries.

Now, a sharpening demand for middle-skill STEM workers is beginning to create supply-side pinch points that could complicate or slow future growth in some of the state's most critical emerging industries, potentially hampering the creation of accessible, quality job opportunities for Nevadans.

The nine industry sectors that Nevada has targeted as sources of quality growth are expanding and frequently require workers with STEM training

Growth patterns across the state's nine target sectors reaffirm the state's decision to adopt a carefully structured economic diversification strategy.¹³ They also highlight the importance of STEM-oriented industries and the increasing need for workers prepared for employment in these sectors.

Between the third quarter of 2010 and the second quarter of 2014, employment in Nevada's nine target sectors grew by an aggregate 10 percent. Although employment in the remainder of the economy increased by a slightly faster 11 percent, growth in the target sectors accounted for twothirds of all net job growth in the state during this period. The target sectors are now driving job creation in Nevada and in some cases are expanding rapidly, as in the cases of the sizable Business IT Ecosystems and Health and Medical Services sectors. (Sector names reflect the state's formal categorization and are capitalized, as noted in the previous endnote).

A closer look at current trends, meanwhile, reveals an important feature of the new growth: The target industries that rely the most on STEM workers are contributing disproportionately to the state's growth.

In aggregate, the target sectors look only slightly more STEM-oriented than the rest of the economy, given the enormous size of the very low-STEM Tourism, Gaming, and Entertainment sector. When that sector is included, 15.2 percent of workers in the target sectors hold STEM-oriented positions, compared to 14.6 percent in non-target industries. But that aggregate comparison understates the importance of STEM to the state's economic health. Even in the Tourism, Gaming, and Entertainment sector, STEM workers make important contributions in areas such as electronic game development and high-tech security system design, which include occupations such as software development and database administration.

Look beyond the world of tourism and gaming and the role of STEM workers emerges more sharply. Six of the state's nine target sectors are significantly STEM-oriented, including three of the four fastest-growing ones: Mining, Business IT Ecosystems, and Health and Medical Services. In these sectors between one-third and one-half of all workers possess significant STEM knowledge. Employment growth across these sectors has ranged from 5.4 percent a year in the Mining sector, 5.1 percent a year in Business IT Ecosystems, and 2.9 percent a year for Health and Medical Services–growth rates all higher than in non-target sectors.

A similar story plays out across the state's major metropolitan areas. In metro Las Vegas, which produced nearly three-quarters of the state's net job growth between the third quarter of 2010 and the second quarter of 2014, the highly STEM-intensive Business IT Ecosystems, Health and Medical Services, Logistics and Operations, and Clean Energy sectors produced some 16,800 jobs, or nearly onequarter of the metro area's growth over the period despite accounting for only 22 percent of total jobs at its outset. Las Vegas' STEM-oriented Business IT Ecosystems and Health and Medical Services sectors saw annualized growth rates of 5.7 and 3.3 percent, compared to the metro area's overall growth rate of 2.3 percent.

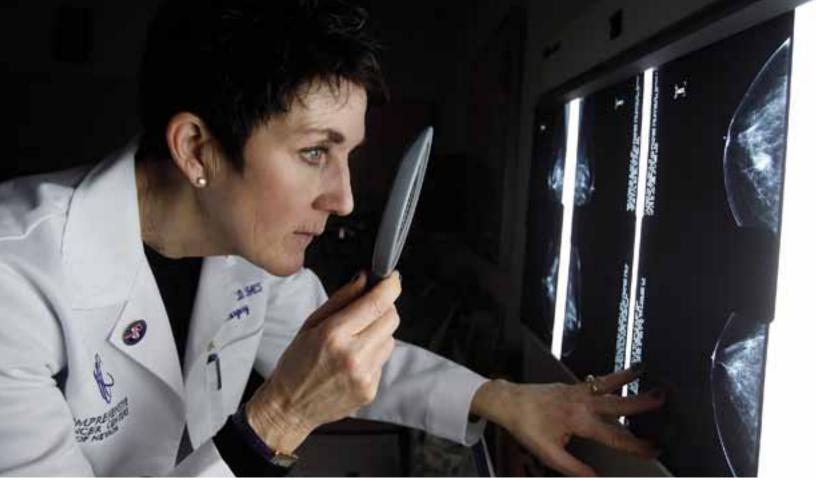
The target sectors have also led the recovery in metro Reno, with the higher-STEM Business IT Ecosystems and Health and Medical Services sectors contributing 33 percent of the region's job creation between the third quarter of 2010 and the second quarter of 2014 while accounting for only 19 percent of all jobs at the outset.

This new growth portends an important shift in the state's economy that is already beginning to drive changes in Nevada's needed workforce skills. Over time, continued growth in the target industries will generate a corresponding increase in the demand for STEM workers.¹⁴

Industry	Annual job growth rate 2010 Q3 - 2014 Q2	Number of jobs added, 2010 Q3 - 2014 Q2	Percent of jobs in STEM occupations, 2011	Jobs, 2014 Q2
Mining	5.4%	2,750	26.8%	15,010
Business IT Ecosystems	5.1%	10,570	34.4%	60,680
Agriculture	3.3%	1,340	5.8%	11,700
Health and Medical Services	2.9%	10,260	35.5%	98,640
Tourism, Gaming, and Entertainment	2.4%	35,660	3.4%	407,870
Manufacturing	2.0%	1,840	18.7%	26,080
Logistics and Operations	1.7%	3,950	10.5%	63,570
Clean Energy	1.3%	1,830	31.7%	39,880
Aersopace and Defense	1.2%	1,110	51.2%	24,340
Target sectors	2.6%	69,310	15.2%	747,770
Non-target sectors	2.8%	32,070	14.6%	321,610

TABLE 1. MANY OF NEVADA'S TARGET SECTORS DISPLAY BOTH STRONGER GROWTH AND GREATER STEM ORIENTATION THAN NON-TARGET SECTORS

Source: Brookings analysis of data from Moody's Analytics



Across the Nevada economy a surprisingly large proportion of jobs requires a high level of knowledge in at least one STEM field and pays high wages as a result

Although the state's STEM economy remains small at present, STEM knowledge is more important in Nevada than is commonly appreciated. Using the Brookings definition of STEM, which takes into account STEM occupations requiring a bachelor's degree or higher as well as those jobs for which sub-baccalaureate training is sufficient, analysis shows that as of 2013, 170,200 jobs in Nevada–a full 15 percent of all jobs in the state–require a high level of knowledge in at least one STEM field.¹⁵

Nevada's STEM jobs reside in multiple industries and in numerous occupational fields. The largest high-STEM occupations include nurses, accountants, and automotive service technicians and mechanics, as well as supervisors of mechanics, financial managers, and miscellaneous computer occupations. Among these largest occupations, Nevada has a relatively high percentage of workers (compared to the United States) in installation, maintenance, and repair work as well as computer occupations and construction managers. Furthermore, these occupations are distributed among sectors of the Nevada economy beyond Business IT Ecosystems and Manufacturing. For example, even though STEM workers make up a small percentage of workers in the Tourism, Gaming, and Entertainment sector, the sheer size of the sector means that it employs over 13,300 workers as software developers, computer systems analysts, and database administrators, among other high-STEM positions.

This sizable number of high-STEM jobs represents a boon for the state because STEM knowledge pays. STEM workers in Nevada earn a significant salary premium that ranges from 28 percent to 68 percent higher pay, at all levels of education. Individuals with four-year degrees working in STEM occupations within the state's target industries earn on average almost \$77,000 per year, compared to roughly \$51,800 for similarly educated workers with non-STEM jobs in the same industries–a premium of nearly 50 percent. For those with lower levels of educational attainment, the STEM wage premium is even higher, reaching 60 percent for people with some college or an associate degree working in a target industry STEM occupation.

Based on these findings, efforts to match current and expected growth in the target sectors with STEM-oriented training initiatives represent an opportunity for Nevada to support its STEM economy while helping Nevadans prepare for attainable high-quality jobs.

TABLE 2. THE 10 LARGEST HIGH-STEM OCCUPATIONS IN NEVADA AND EACH OF ITS MAJOR METRO AREAS OFFER WELL-ABOVE AVERAGE SALARIES TO WORKERS AT ALL LEVELS OF EDUCATION

	Occupation	Jobs (2013)	Average annual salary (2013)	Education typically required
Nevada	Registered Nurses	17,160	\$78,800	Associate's degree
	Carpenters	8,340	\$49,410	High School diploma
	Accountants and Auditors	7,670	\$62,180	Bachelor's degree
	Business Operations Specialists, All Other	6,230	\$67,620	Bachelor's degree
	Automotive Service Technicians and Mechanics	4,940	\$42,340	Postsecondary certificate
	Managers, All Other	4,750	\$97,260	Bachelor's degree
	Financial Managers	4,360	\$106,630	Bachelor's degree
	First-Line Supervisors of Mechanics, Installers, and Repairers	2,800	\$68,920	High school diploma
	Installation, Maintenance, and Repair Workers, All Other	2,560	\$48,080	High school diploma
	Computer Occupations, All Other	2,530	\$64,190	Bachelor's degree
Las Vegas	Registered Nurses	12,220	\$81,370	Associate's degree
	Carpenters	6,580	\$50,130	High school diploma
	Accountants and Auditors	5,790	\$62,560	Bachelor's degree
	Business Operations Specialists, All Other	3,950	\$70,630	Bachelor's degree
	Managers, All Other	3,300	\$99,220	Bachelor's degree
	Automotive Service Technicians and Mechanics	3,200	\$42,250	Postsecondary certificate
	Financial Managers	3,180	\$110,460	Bachelor's degree
	Installation, Maintenance, and Repair Workers, All Other	1,840	\$46,990	High school diploma
	First-Line Supervisors of Mechanics, Installers, and Repairers	1,770	\$68,070	High school diploma
	Construction Managers	1,580	\$86,630	Bachelor's degree
Reno	Registered Nurses	3,370	\$73,320	Associate's degree
	Business Operations Specialists, All Other	1,520	\$62,030	Bachelor's degree
	Accountants and Auditors	1,230	\$60,360	Bachelor's degree
	Carpenters	1,220	\$46,240	High school diploma
	Automotive Service Technicians and Mechanics	1,160	\$42,260	Postsecondary certificate
	Financial Managers	790	\$98,960	Bachelor's degree
	Managers, All Other	760	\$90,850	Bachelor's degree
	Software Developers, Applications	670	\$83,160	Bachelor's degree
	First-Line Supervisors of Production and Operating Workers	500	\$55,440	High school diploma
	First-Line Supervisors of Mechanics, Installers, and Repairers	490	\$62,030	High school diploma

Source: Brookings analysis of data from 2013 Bureau of Labor Statistics Occupational Employment Survey and O*NET

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And yet, despite the sizable number of STEM jobs in the state and the significant financial benefits that accrue to STEM workers, Nevada's STEM economy remains modest by national standards. At present Nevada has the least STEM-oriented state economy in the country. Nationwide, 21 percent of all jobs are in STEM occupations compared to Nevada's 15 percent. In addition, all other Mountain region states–Arizona, Colorado, Idaho, New Mexico, and Utah– have STEM employment shares of at least 19 percent.

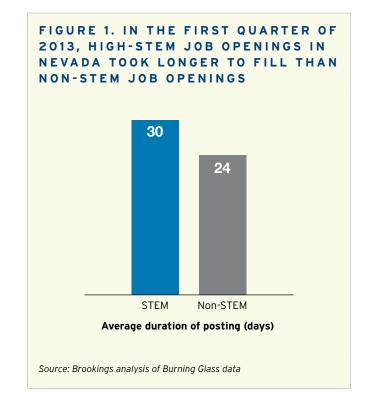
These deficits represent a huge missed opportunity for the state and its citizens.

Vacancies in Nevada's STEM occupations -including many requiring only subbaccalaureate training-take longer to fill than those in non-STEM occupations

Notwithstanding the opportunity held out by Nevada's modest but growing STEM economy, employers are struggling to fill STEM job openings, which represent an increasing number of employment vacancies in the state. Of those jobs advertised online during the fourth quarter of 2013, 27 percent-some 10,000 job openings-were in STEM occupations. Despite the fact that online postings tend to represent professional jobs better than other positions, this finding suggests that demand for workers in STEM-oriented occupations has begun to increase.

Compared to elsewhere in the United States, job openings in Nevada tend to be filled faster. This faster pace is to be expected in a place with high unemployment rates, where more people actively seeking employment makes it easier for companies to find willing workers.

However, a closer look at hiring trends reveals that certain STEM jobs in Nevada are advertised for long periods, suggesting hiring difficulty. Moreover, on average STEM jobs in Nevada take significantly longer to fill than non-STEM jobs. Taken together, these facts point to the existence of tight labor markets and higher demand relative to worker supply for at least some prominent STEM occupations. The average STEM job in the Silver State takes 30 days to fill, almost a week longer than the 24 days needed for the average non-STEM job vacancy. The most likely explanation for this difference is that employers with STEM job openings are having a more difficult time finding workers with the right set of skills.



Which is not to say that all positions requiring STEM knowledge are hard to fill. High unemployment in the Construction and Manufacturing sectors since the recession has increased the available pool of construction and production workers, making open STEM positions easier to fill. (Construction of the Tesla gigafactory will likely soon begin to reduce unemployment among construction workers.)

Construction and production notwithstanding, a disproportionate number of the occupations that are hardest to fill in Nevada are in STEM fields. Three of the five broad occupational categories that are most difficult to staff are almost entirely STEM-oriented (healthcare practitioners; life, physical, and social science workers; and architects and engineers). Management positions (28 percent of which are in STEM fields) and healthcare job vacancies tie for the longest median duration of online posting, while computer occupations take on average at least 30 days to fill.

Hiring challenges clearly exist in Nevada's target industries, where the average job takes 30 days to fill (compared to 27 days in non-target sectors). The greatest hiring difficulties are in Aerospace and Defense, where the average job vacancy lasts 45 days, though employers in Business IT Ecosystems as well as Health and Medical Services also must contend with long average posting times.

TABLE 3. THE 10 MOST FREQUENTLY ADVERTISED HARD-TO-FILL STEM JOB OPENINGS IN NEVADA REQUIRING A BACHELOR'S DEGREE OR HIGHER

Occupation	Number of job postings (2013 Q1)	Average duration of post- ings in days (2013 Q1)
Software Developers, Applications	90	42
Financial Managers	77	36
Civil Engineers	35	45
Electrical Engineers	34	41
Nurse Practitioners	34	49
Database Administrators	33	52
Physicians and Surgeons, All Other	32	66
Physical Therapists	27	37
Pharmacists	20	41
Mechanical Engineers	18	44

Source: Brookings analysis of Burning Glass database of company wesbite advertisements. Hard-to-fill occupation defined as one with average advertisement duration of 35 days or longer. Education requirement taken from minimum on ad.

TABLE 4. THE 10 MOST FREQUENTLY ADVERTISED HARD-TO-FILL STEM JOB OPENINGS IN NEVADA REQUIRING LESS THAN A BACHELOR'S DEGREE

Occupation	Number of job postings (2013 Q1)	Average duration of post ings in days (2013 Q1)
Installation, Maintenance, and Repair Workers, All Other	39	39
Medical and Clinical Laboratory Technicians	28	52
Electrical and Electronics Engineering Technicians	18	48
Pest Control Workers	12	37
Database Administrators	7	59
Electrical Engineers	7	48
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	7	42
Avionics Technicians	7	69
Web Developers	6	50
Medical Equipment Repairers	6	62

Source: Brookings analysis of Burning Glass database of company wesbite advertisements. Hard-to-fill occupation defined as one with average advertisement duration of 35 days or longer. Education requirments taken from ads.

More specifically, a number of STEM occupations in the state are both regularly advertised and difficult to fill. For STEM positions requiring at least a bachelor's degree– as advertised on the vacancy–the average ad is posted 33 days on company websites, though certain positions last considerably longer. For example, advertisements for software application developers (42 days), financial managers (36 days), civil engineers (45 days), nurse practitioners (49 days), and database administrators (52 days) all tend to be posted significantly longer than the average vacancy in the state.

At the same time, multiple blue collar STEM positions are also advertised for long periods in Nevada, including electrical and electronics engineering technicians (55 days), avionics technicians (65 days), medical equipment repairers (62 days), installation, maintenance, and repair occupations (45 days), and medical and clinical laboratory technicians (52 days). These hard-to-fill sub-baccalaureate positions point to areas where concerted efforts by Nevada's education and workforce training systems could produce near-term employment gains with solid earnings potential for workers who lack an undergraduate degree.

Not surprisingly, these opportunities play out differently across the state's metropolitan areas.

In Las Vegas, some of the most difficult-to-fill STEM occupations that require at least a four-year degree include software application developers (48 days), computer programmers (38 days), electrical engineers (40 days), nurse practitioners (50 days), and database administrators (60 days), and specialist physicians and surgeons (55 days). While slightly easier to fill, many jobs that require less than a four-year degree still have above average posting durations, including medical and clinical lab technicians (55 days), electronics engineering technicians (58 days), and network and computer systems administrators (58 days).

In the Reno area, STEM occupations common in the Health and Medical Service sector dominate among the most difficult-to-fill occupations for both college graduates and those without a four-year degree. Among the jobs that require a bachelor's degree and above, physicians and surgeons (98 days), nurse practitioners (45 days), and internists (134 days) tend to remain posted for months. Some job postings that require less than a four-year degree also tend to be posted for long periods, including registered nurses (55 days), cardiovascular technologists (74 days), respiratory therapists (44 days), as well as some outside the healthcare sector, including bus and truck mechanics (36 days) and machinery maintenance workers (59 days).

Seventy percent of job openings in Business IT Ecosystems and Health and Medical Services require STEM skills, yet more than 60 percent of them do not require a fouryear degree

Nevada's sizable Business IT Ecosystems and Health and Medical Services sectors epitomize the opportunities and challenges presented by the state's growing STEM economy.

Representing some 60,600 and 98,000 jobs, respectively, the Business IT Ecosystems and Health and Medical Services sectors are both growing steadily and contain a number of the fastest-growing occupational categories in Nevada. Employment in business IT Ecosystems is increasing at an annual rate of 5.1 percent while employment in Health and Medical Services is growing at 2.9 percent a year.¹⁶

What is more, job openings in Business IT Ecosystems and Health and Medical Services offer important opportunities for individuals with only sub-baccalaureate training. While 70 percent of job openings in these two industries require STEM knowledge, less than half require a four-year degree– although the most in-demand positions in Business IT Ecosystems tend to require a four-year degree.¹⁷

Within the Business IT Ecosystems sector employers encounter some of their biggest hiring difficulties when they search for qualified hires in IT-specific occupations such as database administrators (where postings remain online an average of 53 days), web developers (44 days), software application developers (40 days), and information security analysts (29 days). All of these jobs are usually staffed by people with a bachelor's degree or higher but are broadly available to those who can demonstrate the right skills. For example, 26 percent of software developers in Nevada have less than a bachelor's degree. Other opportunities that require less than a bachelor's degree include computer user support specialists, network and computer system administrators, and web developers.

Among Health and Medical Services occupations, the hardest positions to fill in Nevada include occupational health and safety specialists (87 days), general practitioners with internal medicine specialty (72 days), surgeons (62 days), medical scientists and medical and clinical lab technicians (52 days), nurse practitioners (48 days), pharmacists (41 days), and registered nurses (32 days). Many of these positions require a four-year degree or more but a number do not. Many nursing jobs, medical records technician positions, and medical and lab technical positions require no more than an associate degree and sometimes less.¹⁸

TABLE 5. OVER ONE-FOURTH OF ALL JOB OPENINGS IN THE BUSINESS IT ECOSYSTEMS SECTOR IN NEVADA ARE AVAILABLE TO THOSE WITHOUT A BACHELOR'S DEGREE

IT and Business Services occupations	Number of job postings (2013)	Share of postings requiring less than a bachelor's degree (2013)
Software Developers, Applications	171	1.1%
Computer Occupations, All Other	158	14.7%
Computer User Support Specialists	132	57.6%
Computer Systems Analysts	93	20.8%
Managers, All Other	91	6.9%
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	68	4.5%
Financial Managers	62	5.6%
Database Administrators	53	11.1%
Network and Computer Systems Administrators	52	53.3%
Accountants and Auditors	46	3.8%
All Business IT Ecosystems Occupations	1,760	30.5%

Source: Brookings analysis of Burning Glass data

TABLE 6. NEARLY TWO-THIRDS OF ALL JOB OPENINGS IN HEATH AND MEDICAL SERVICES IN NEVADA REQUIRE LESS THAN A 4-YEAR DEGREE

Health and Medical Services occupations	Number of job postings (2013)	Share of postings requiring less than a bachelor's degree (2013)
Registered Nurses	4,615	78.7%
Physical Therapists	751	0.0%
Health Technologists and Technicians, All Other	335	80.3%
Physicians and Surgeons, All Other	293	0.0%
Respiratory Therapists	164	100.0%
Cardiovascular Technologists and Technicians	158	97.2%
Financial Managers	122	5.1%
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	112	16.0%
Medical and Clinical Laboratory Technologists	112	11.8%
Health Diagnosing and Treating Practitioners, All Other	112	0.0%
All Heath and Medical Services Occupations	8,795	67.3%

These patterns also play out locally as well. In Las Vegas during 2013, nearly one-third of all openings (32 percent of them, or 234 jobs), in the Business IT Ecosystems sector are accessible to applicants who lack a bachelor's degree. In Reno, the figure is 21 percent, or 50 jobs. In the Health and Medical Services sector, the share of jobs open to those without a bachelor's degree is even larger. Slightly over two-thirds of Las Vegas area jobs in the Health and Medical Services sector–some 3,200 jobs–are available to those without a bachelor's degree, and in Reno, 66 percent of jobs in this sector, or 530 jobs, require less than a four-year degree.

In both major metropolitan areas, then, Business IT Ecosystems and Health and Medical Services represent a growing source of accessible employment opportunities and employer demand for those with at least an associate degree and some solid STEM knowledge and skills. * * *

In sum, trend data on economic growth and employment in Nevada reveal clear opportunities for Nevadans with even modest postsecondary training in STEM fields. Much of the state's fastest job creation is now occurring in its newly defined target sectors, which have a distinct orientation toward technical employment. Moreover, many of the available positions are surprisingly accessible to workers with only sub-baccalaureate level STEM training. In order to match this growing demand, Nevada's education and workforce ecosystems will need to expand STEM-oriented program offerings and greater numbers of Nevadans will need to pursue pathways into STEM-focused careers.





Assessing Nevada's Workforce Training and STEM Education Ecosystem–Strengths and Challenges

evada's growing STEM economy represents an opportunity for the state, its regions, and its workers. If accompanied by the right training and education efforts, STEM-intensive industries offer significant potential for high-quality growth. Moreover, because these industries provide numerous jobs for workers with less than a bachelor's degree, connecting Nevadans to the STEM economy represents a solid strategy for supporting upward mobility. At the same time, however, Nevada's STEM economy could become a missed opportunity.

Should the size of the state's STEM workforce fail to keep pace with growth in the state's STEM-oriented industries, Nevada could find itself trapped in a Catch-22 that severely limits its ability to diversify its economy.

Nevadans, however, are beginning to recognize the state's STEM education and workforce challenges.

The Nevada System of Higher Education (NSHE) has for several years taken an interest in promoting the alignment of its activities, including STEM course provision, with the state's economic diversification strategy and Nevada universities are already taking steps to educate a more STEM-savvy Nevada workforce.¹⁹ UNLV's GEAR UP STEM program addresses a huge need by providing professional development for middle school STEM educators and hosting a variety of student outreach activities.²⁰ Likewise, the university's Tier 1 initiative aims to put the school within the top 5 percent of universities in terms of research quality, which will go a long way toward increasing the number of high-skilled STEM researchers in the state.²¹ In the north, the Raggio Research Center for STEM Education at the University of Nevada, Reno (UNR) conducts research on STEM pedagogy as well as outreach on STEM education issues and offers a year-long Principals' STEM Academy that helps administrators learn how they might support STEM education in their schools.²²

Several of Nevada's colleges are also making STEM proficiency a priority. In some cases, these efforts involve collaboration with area high schools, while other programs focus specifically on helping students succeed at the postsecondary level. For example, Truckee Meadows Community College's Success First program works with firstyear, first-generation students both in the months before they begin college and throughout the academic year to help them succeed in college-level courses and to raise student awareness about career opportunities in STEMintensive industries.²³

At the P-12 level, meanwhile, Nevada's adoption of the Common Core State Standards (CCSS) and the Next Generation Science Standards (NGSS) established clear expectations for academic achievement in math, reading, and the sciences at all grade levels. At the same time, a number of school districts and individual schools throughout the state are now taking steps to integrate STEM into their curricula. Computer science is receiving greater attention as well, as evidenced by the participation of over 17,000 southern Nevada students in Code.org's December 2013 Hour of Code, which provided elementary and secondary students an initial encounter with computer programming.²⁴

Urgency about STEM is also rising outside the world of education.

In the civic realm, the Nevada STEM Coalition has taken on the task of promoting stronger P-12 STEM education throughout the state. At the postsecondary level, Dream It Do It Nevada helps companies and state colleges work together to develop accelerated manufacturing skills training programs that combine classroom instruction with paid internships at area firms.²⁵

In the business community, corporate efforts ranging from IBM's support of the Nevada Center for Excellence in Water to GE's ongoing engagements with Western Nevada College and the Douglas County School District to the Las Vegas Metro Chamber of Commerce's support for the 2012 Nevada STEM Coalition Summit demonstrate these organizations' belief that Nevada can and should establish a strong foothold in the evolving STEM economy.

Nevada's regional development authorities are also stepping up to advance the STEM economy. For example, the Las Vegas Global Economic Alliance (LVGEA) has made improving southern Nevada's education and workforce training systems an organizational goal and now tracks the number of postsecondary STEM degrees and certificates conferred in the region.²⁶

Lastly, philanthropic initiatives have helped inspire greater attention to educational attainment throughout the state. For example, the Fulfillment Fund is working to increase the number of underserved students pursuing postsecondary education in Clark County, while other leaders working through Nevada Succeeds advocate for education reform.

And yet, despite these often-impressive efforts, at least three significant challenges threaten to undercut the state's ability to cultivate the STEM-skilled workforce needed to advance Nevada's economic diversification.

Nevada lacks a cohesive, forceful vision for its STEM economy and the STEM-oriented workforce needed to achieve the state's economic goals

To begin with, Nevada's STEM approach remains diffuse and

low-profile, both across state government and elsewhere. Notwithstanding the many individually promising projects that have developed throughout Nevada, the state has not yet taken steps to coordinate and scale these activities. Nor has the state strongly articulated the importance of STEM education and STEM-intensive industries to Nevada's economic health and Nevadans' prosperity.

In this regard, Nevada is similar to many states in that it has not effectively conveyed that STEM knowledge will be essential for the workforce of the future; that careers in STEM industries are stable and well-paying; and that STEM jobs are broadly accessible. Without clear signaling, the state will face great difficulty in developing and expanding the more diversified, higher-value industries it seeks.

In addition, because the state has yet to determine what exemplary STEM education looks like, it is presently unable to identify, support, publicize, and scale best practices. Absent clear guidelines for what constitutes high-quality STEM education, Nevada cannot collect and analyze educational data in order to track the performance of the many STEM-related initiatives currently underway.

The state also needs to do a better job of communicating the importance of STEM education and inspiring enthusiasm and demand for STEM programming in Nevada's P-12 schools, colleges, and universities. Too few students and families know about the exciting STEM career opportunities now available and too many still assume that STEM is just for those on a four-year college track. These problems are exaggerated among those groups traditionally underrepresented in STEM fields, including individuals from low-income families, people of color, and white women.

Nevada's education and workforce training systems are inconsistently aligned with the current and future needs of the state's STEM industries

A second issue is the inconsistent alignment of state and regional workforce and education development activities with the STEM needs of key target industries.

In this regard, while solid ties exist between especially the state's medical and manufacturing industries and its education and training organizations, the state's varied array of skills-building actors is not yet fully attuned to the STEM imperative implied by the state's objective of "align[ing] education, career training, and workforce development to targeted opportunities."²⁷ To begin with, sector-based collaborations between education / workforce development actors and industry to deliver aligned STEM training and education remain inconsistent, although strong collaborations on health care at UNLV and the College of Southern Nevada (CSN) and on manufacturing at Truckee Meadows and autonomous systems at UNR do exist.

Some progress has been made through the launch of the state's industry sector councils-formal hubs aligned with the target sectors and dedicated to surfacing industry intelligence to inform economic and workforce strategy in the state.²⁸ Created under the Governor's Workforce Investment Board (GWIB) within the Department of Employment, Training, and Rehabilitation (DETR), these councils have the potential to serve as useful bridges between Nevada's business community and its training and workforce systems. However, although the industry sector council approach is working well in several industries (such as Health and Medical Services), a number of the councils are struggling with blurry missions and waning participation.²⁹ Furthermore, while some of the councils have successfully identified workforce gaps and coordinated with regional entities to shore up training efforts, it remains unclear how DETR plans to scale such best practices across the state. In addition, weak communication and collaboration between the industry councils and DETR, the GWIB and local workforce investment boards (WIBs), and WIBs and nearby colleges, paired with private-sector doubts about the efficacy of the sector councils and WIBs, further exacerbate the challenges facing the workforce development system.

Similar inconsistencies characterize other types of interactions between the education and workforce development systems and industry. Numerous informants note that the industry advisory panels maintained by UNLV and UNR only sporadically result in more industry-relevant postsecondary programming. Others report wide variability in the nature of P-12 engagements with the private sector. Thus from the earliest grades all the way through the postsecondary level, the quality and intensity of interactions between the private sector and Nevada's education and workforce training systems fall well short of what will be needed to cultivate an appropriately trained workforce for the state's increasingly diversified economy.

At the same time, the structure of the postsecondary education system could be better aligned with the need for responsive skills development. For example, some analysts believe that centralized governance systems for state college management (such as Nevada's) may reduce colleges' responsiveness to their local communities.³⁰ That could reduce the nimbleness with which the colleges respond to employer STEM needs.

Likewise, the state's higher-education funding formula could do more to promote STEM education. Although the 2013 legislature's shift from an input-based to an outputbased formula marked a significant step forward that should incentivize alignment, STEM instruction is only weakly supported in the formula's new performance funding pool. Close monitoring of the results of the formula's operation will be necessary to ensure that STEM and workforce development goals don't fall by the wayside.

A STEM proficiency crisis affects all aspects of the state's education system

Finally, Nevada's P-12 education system struggles to deliver basic STEM education–a fact that jeopardizes the state's ability to seize opportunities held out by its emerging STEM economy. Addressing this challenge is especially critical given that students make decisions about whether to pursue careers in STEM as early as middle school.³²

Student outcomes at Nevada's educational institutions reflect a system in crisis that extends well beyond the realm of STEM education. Low rankings on national proficiency exams, persistently depressed high school graduation rates, and high dropout rates all reveal serious problems in P-12 public education that together pose sizable barriers to improving Nevada students' STEM proficiency.³³

Scores from the 2013 National Assessment of Educational Progress reveal serious challenges, with just 34 percent of fourth-grade students and 28 percent of eighth-graders scoring at proficient levels in math. By contrast, nationwide 42 percent of fourth-graders and 35 percent of eighthgraders attained proficiency on national math exams.³⁴ Among students of color and those from low-income households, proficiency levels and school completion rates are even more dire. Scores from state-designed math exams for public high schoolers show 83 percent of white students at proficiency, compared to 63 percent of Hispanic students, 62 percent of low-income students, and just 55 percent of black students.³⁵

Students in these lower performing groups are much more likely to attend Nevada's low performing schools. The

average school attended by white students scores 7 percent higher than the state average on proficiency exams, while the average school attended by Hispanic students scores 7 percent below, by low-income students scores 8 percent below, and by black students scores a full 11 percent below the statewide average.³⁶

The factors producing these outcomes are complicated and distressing. Poverty and lack of English language proficiency pose profound challenges to the achievement of general proficiency in Nevada–particularly for students of color from low-income families. Over half of all students in Nevada's P-12 system are eligible for free or reduced price school lunch, a common indicator of student poverty, and during the 2010-11 school year, nearly 20 percent of students in Nevada public schools participated in English language learner (ELL) programming (compared to just under 10 percent nationwide).³⁷ Any effort to strengthen STEM education in Nevada must also contend with these realities.³⁸

But beyond these two critical concerns, a number of academic considerations indicate that the state's system for teaching STEM subjects simply is not working.

Nevada's academic shortfalls begin in the earliest grades, where the lack of universal all-day pre-kindergarten and kindergarten results in uneven access to education for the state's youngest students.³⁹ Given the sizable positive effects that early exposure to numbers and basic math have been shown to produce, those students who are not able to attend pre-kindergarten and/or full-day kindergarten begin their academic careers at a significant disadvantage.⁴⁰

Meanwhile, prioritization of STEM education in Nevada classrooms has been slow to take hold, thanks in part to No Child Left Behind (NCLB), which prompted a shift away from science education in favor of a "teaching to the test" approach focused almost exclusively on math, reading, and test-taking skills. The influence of NCLB is still evident in the structure of the Nevada School Performance Framework, which focuses on changes in math and reading test scores.⁴¹ While the state's decision to adopt the CCSS and the NGSS represent important first steps toward greater STEM proficiency, these standards must now be implemented across all districts in order to ensure that every school makes student success in STEM subjects a priority.⁴²

Nevertheless, not all Nevada schools struggle with STEM education. A number of schools throughout the state have instituted STEM education programs and a handful of districts are working to bolster their STEM offerings. From the Walter Bracken STEAM Academy for grades P-5 and the STEM-oriented career academy high schools in Clark County to the Lemelson STEM Academy for elementary schoolers and the George L. Dilworth STEM Academy for middleschoolers in Reno and the STEM Center for Douglas High School currently under construction in Douglas County, schools are increasingly embracing STEM and its inquirybased approach to learning.

However, although some Nevada schools have incorporated STEM education in creative ways that inspire, educate, and empower students, these academic exemplars tend to be the exceptions rather than the norm. At many Nevada schools, the STEM curriculum remains thin and the quality of instruction variable. Administrators and teachers alike often lack familiarity with STEM subject matter and pedagogy, making it difficult to provide Nevada students the quality STEM instruction that they deserve and that the health of the state's economy demands.⁴³ Teacher preparedness and subject-matter knowledge are also areas of concern, starting at the elementary level and extending throughout the entire P-12 system. STEM teachers must have deep knowledge of their subjects, but in Nevada-as in many other states-too few possess the requisite level of mastery.⁴⁴ Programs like UNR's Lemelson STEM master's cohort for elementary and middle school teachers are working to remedy this situation, but access to such programming remains limited at present.

Moreover, few high schools encourage students to pursue STEM-focused careers. In fact, by the time students reach high school, many have come to believe that they are "not good at" STEM subjects-and most schools do little to disrupt this notion.⁴⁵ As a result, Nevada high schoolers frequently fall victim to a series of academic and cultural setbacks.

To begin with, math and science proficiency problems have by this time begun to erode students' confidence; because all learning is cumulative, early failures to master

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TEM education involves far more than just offering courses in science, technology, engineering, and math. Rather, it works to integrate these subjects using a distinctive, interdisciplinary approach to student learning.

Effective STEM courses and programs employ cross-discipline, hands-on approaches to learning that help students gain confidence in their ability to solve problems and handle challenging academic material. Over time, these experiences can inspire student enthusiasm for learning and help prevent the fear of STEM subjects that often arises in later grades.

Cultivating student engagement with STEM content early on can also help disrupt entrenched gender and racial stereotypes that work to discourage young white women and students of color from pursuing advanced training in STEM subjects.

At the postsecondary level, students interested in STEM tend to specialize in one or more of its constituent fields. But even this demands a degree of interdisciplinary study. For example, students studying engineering need to have a solid grounding in the fundamentals of math, physics, and other key STEM subjects.

Source: National Governors Association, "Innovation America: Building a Science, Technology, Engineering, and Math Agenda"; Nancy Tsupros and others, "STEM Education: A Project to Identify the Missing Components"; Catherine Hill, Christianne Corbett, and Andresse St. Rose, "Why So Few? Women in Science, Technology, Engineering, and Mathematics"; "Missing From Science Class: Too Few Girls and Minorities Study Tech Subjects," New York Times, December 10, 2013; The National Academies, "Expanding Underrepresented Minority Participation"; Susan Rundell Singer, "STEM Education: Time for Integration," Peer Review 13(3)(2011): 4-7.



critical subject matter make proficiency even more difficult to achieve later on. $^{\rm 46}$

In addition, most students see little point in grappling with subject matter that in their view has little use outside the classroom. Like much of the general public, most students lack awareness of the job opportunities available to individuals with a STEM background, particularly at the subbaccalaureate level.⁴⁷ This is especially true for students who are low-income, of color, ELL, and/or female, given that cultural stereotypes tend to discourage the pursuit of STEM education and occupations by individuals in these groups.⁴⁸

Without proactive career counseling that maps out the many pathways to STEM employment in the regional economy, most students will not see a STEM career as an option. Unfortunately, high school career counseling in the state remains ad hoc at best, with the quality of advising highly dependent on the skill of individual guidance counselors and the financial resources of the school.⁴⁹

These many challenges contribute to a final dimension of the state's STEM proficiency crisis: large numbers of dropouts, low graduation rates, and high postsecondary remediation rates. Completing high school proves an obstacle for far too many Nevada students.⁵⁰ Of those students who are able to earn a diploma, almost one-third continue to face proficiency challenges after leaving high school.⁵¹ Despite this sizable need for remediation, the state's higher education funding formula only supports such courses at the colleges though such support–which is more costly than conventional postsecondary course provision-is also badly needed at the universities.⁵²

Furthermore, efforts to bring Nevada high school graduates up to the proficiency needed for college work have met with limited success. Low on-time degree completion rates at both two-year and four-year institutions suggest that many students needing remediation become discouraged by the additional credit hours of remedial courses required and choose to drop out.⁵³ Just 12 percent of undergraduates at UNLV and UNR graduate within four years. At UNLV, 39 percent of students finish within six years; UNR has a slightly higher six-year completion rate at 46 percent. Completion rates at the state colleges are also disappointingly low, hovering near the national average with only 24 percent of students finishing their degrees on time (within two years) and 36 percent completing their coursework within four years. While NSHE's Remedial Transformation Project has prompted a number of important changes to the ways that the state's postsecondary institutions handle remediation, further work will be needed to improve remedial education offerings and speed students' time to degree.

In short, Nevada's P-12 public education system and its universities and colleges must begin to ameliorate the state's existing proficiency crisis if Nevada hopes to prepare greater numbers of students for future opportunities in STEM occupations.



Strategies for Expanding Opportunity and Growth in Nevada's STEM Economy

ith economic growth now beginning to take hold, Nevada needs to create a people strategy to complement its economic strategy. Put simply, the Silver State must craft a more STEM-focused education and workforce development ecosystem with greater capacity to upgrade the technical skills of its current and future workers.

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Bringing about the needed level of change will require a sustained, cooperative effort that engages many actors on multiple fronts.

Where a forceful pro-STEM vision and strategy is missing, one needs to be put in place.

To the extent that the state's STEM activities and actors are not now aligned, they should be aligned.

And to the extent that a massive STEM proficiency crisis threatens to preclude real progress, its root causes must be addressed.

Meanwhile, any attempt to establish Nevada as a place where STEM-oriented firms can thrive will require substantial transformation within the state's public education system. This change must begin in the earliest grades, with fully funded pre-kindergarten and kindergarten for all eligible Nevada students and expanded support for English language learners, particularly in grades P-3. These interventions are prerequisites for long-term progress on STEM.

At the same time, districts, the state, and all regional stakeholders will need to work intensely with schools with high populations of low-income students to develop and implement effective strategies for addressing the consequences of poverty, which undermine basic academic achievement. When combined with an expansion of dropout prevention programs like Communities in Schools Nevada, such efforts can begin to address the critical basic education challenges that limit opportunities for far too many Nevada students.

Of course, not everything that needs to be accomplished can be achieved immediately. However, the work needs to start now and proceed urgently, with efforts that engage both the public sector and the state's civic entrepreneurs in the private and philanthropic sectors.

Along these lines, the state's public sector should work with other actors to **build a system for STEM education and training**. Meanwhile, civic entrepreneurs need to **change the dynamic** in Nevada's regions to promote STEM skills-building. (More detailed accounts of key recommendations summarized here can be found www.brookings.edu/research/reports/2014/11/12-nevadastem-economy).

The Public Sector: Build a System

The public sector-working closely with business, civic, and philanthropic stakeholders-needs to do more to integrate the state's diffuse set of STEM education and training activities. To that end, the three major deficits of the state's current STEM activities-lack of a strong vision, inconsistent alignment of programming with state economic goals, and a STEM proficiency crisis-each call for specific responses.

Set a vision

Strong state outcomes depend on the articulation of a strong vision that can then drive high-level organizing. Accordingly, Nevada's top leaders should work hard to promote STEM education and training while at the same time putting in place basic mechanisms for coordinating and advancing STEM activities in Nevada.

To start with, Gov. Sandoval and his team should **deploy the bully pulpit** to actively and personally explain the importance of STEM training and education. In this connection, the governor and other high officials need to mobilize the state on STEM and so must regularly communicate an exciting, forward-looking vision of the STEM economy and the opportunities it holds. Critical here will be a steady effort to make STEM accessible and compelling by highlighting exciting STEM enterprises, workers, and training opportunities. Such showcasing will help Nevadans better understand what STEM is and why it matters for the state and its residents.

At the same time, the state needs to get organized. To begin with, the wide array of varied stakeholders implicated in delivering strong STEM outcomes-both inside government and outside it-argues for the identification of a single point person in state government whose sole preoccupation is strengthening STEM workforce training and education in the state. Accordingly, Gov. Sandoval should appoint a dedicated STEM champion to spearhead the development and execution of an urgent state STEM agenda. This individual would work with the governor, the STEM Advisory Council, and the Nevada STEM Coalition to craft and convey a clear vision for Nevada's STEM economy. Then she or he would translate it into a decisive action plan. In addition, the STEM champion would be responsible for coordinating STEM-related activities across the Governor's Office of Economic Development (GOED), DETR, GWIB, NDE, NSHE, the nine industry sector councils, and the Regional Development Authorities (RDAs). In this way a single focused point person will help jump start the state's currently diffuse efforts.

SPEARHEADING ACTION TO IMPROVE WORKFORCE READINESS: TENNESSEE'S SPECIAL ADVISOR TO THE GOVERNOR FOR HIGHER EDUCATION

mproving coordination, cooperation, and alignment among key stakeholders is a full-time job. Unfortunately, such efforts frequently fall short for the lack of a central point person who can set a clear agenda and make it a reality.

When Tennessee set out to rethink its postsecondary education and workforce development systems, Gov. Haslam recognized that the state would have a much greater likelihood of success if a single person were responsible for keeping all parties on track. With this in mind, he appointed a special advisor for higher education to improve the "affordability, access, and quality of state programs" related to postsecondary education and workforce development. Residing within the governor's office and working on a full-time, volunteer basis, the special advisor took on the task of determining how Tennessee could increase its postsecondary attainment from 32 percent of the population in 2012 to 55 percent by 2025. The governor also created a formal working group composed of himself, the special advisor, and leaders from the Tennessee Higher Education Commission, the Tennessee Board of Regents, and the University of Tennessee to support the special advisor in his efforts.

During the special advisor's one-year term, Tennessee launched the Drive to 55 Alliance, which brings together stakeholders from the private, public, and nonprofit sectors to work toward meeting the goal of having 55 percent of Tennesseans hold a postsecondary certificate or degree by 2025. In the past two years, Drive to 55 launched three signature initiatives designed to advance toward this goal. Tennessee Promise gives all Tennessee high school graduates the opportunity to attend a state community college or a Tennessee College of Applied Technology (TCAT) tuition-free for two years. Tennessee Reconnect lets adults pursue a certificate at one of the state's TCATs free of charge. Lastly, the Tennessee Labor Education Alignment Program (Tennessee LEAP) aims to improve the alignment of the education and workforce training systems with industry through a grant competition for regional consortia working to close critical skills gaps.

The efforts of the special advisor helped make Drive to 55 a success. Working with the full and active support of the governor, this individual was able to bring the appropriate stakeholders to the table and develop solutions within a short time span. Although the Drive to 55 initiatives are still in their early stages, together they represent a significant step toward preparing Tennesseans for future job opportunities.

The governor-appointed special advisor approach employed in Tennessee offers one model for how Nevada might take action on STEM education and training.

Source: Office of the Governor of Tennessee, "Haslam Announces Higher Education Initiative: Corporate Leader to Spearhead Effort in Coordination with State Leadership"; Drive to 55, "About the Alliance."

And there is more to be done to organize for success. For one thing, the Legislature needs to reboot the state's STEM advisory panel. Specifically, the Legislature should revise the panel's authorizing legislation to **reconstitute the Nevada STEM Advisory Council** to improve its ability to inform the state's STEM efforts and to ensure that its membership better represents the many stakeholders involved in Nevada's STEM education and workforce development systems. Currently, an overly broad mandate combined with infrequent meetings and an all-volunteer membership limit the council's ability to make headway on developing a P-12 STEM education agenda for the state. Therefore, the purpose of the reconstituted panelwhich should be composed of economic development, workforce development, and education professionals as well as private-sector actors from all of the state's economic regions-should be clarified to include the provision of critical advice and expertise to the proposed STEM champion as s/he develops a statewide strategy for strengthening Nevada's STEM education and workforce development systems. In addition, council meetings would serve as a forum for improving regular communication both within state government and between the public and private sectors.

Beyond that, the state has an important role to play in helping shape a clear consensus about what high-quality STEM teaching and training looks like. Given the relative newness of the concept, no such consensus currently exists. As such, the proposed revamped STEM council should work with STEM education experts and advocates, NDE, Nevada educators and administrators, industry, and other key stakeholders to craft clear guidelines for effective STEM education programs that can inform and guide the state's school districts and teachers as they design new programming. This shared vision will ensure consistency across the state while also making possible collaboration among schools and districts as they move to incorporate STEM education into their curricula. The guidelines will also make possible more stringent assessment of the performance of STEM education programs.

Finally, the state should put some skin in the game to aid and abet creative STEM initiatives in Nevada's regions. Such investment would reflect the fact that the state's STEM employers hire locally and that the most creative educational initiatives will be crafted there too. Given that, the state should **create a P-12 STEM competitive grant program** that awards \$5 million in funds each year to regional entities or consortiums seeking to create or scale up outstanding STEM education programs. Recipients would be required to secure a 1:1 cash and/or in-kind match from private and philanthropic sources for these one-time grants in order to leverage public funding for maximum effect. This match would create a strong incentive for collaboration among school districts, industry, philanthropies, and civic organizations as well as for industry-relevance.

Pursue alignment

The shakiness of the connections between Nevada's workforce and education communities and the state's economic goals-which depend on strong STEM education and training-also requires a public-sector response. Specifically, Nevada needs to better align its workforce training and education systems with the needs of the STEMoriented industries targeted by the state economic strategy.

To begin with, DETR and GOED should begin now to make the industry sector councils more valuable forums for the shaping of dynamic industry-led, sector-based **STEM workforce training**. At present, the councils lack the direction, tools, and local relevance to fully engage the state's regional business and workforce development communities and deliver solutions. Given that, it is becoming clear that over time the state should rework the council system-most likely by transferring their activities in stages to the local Regional Development Authorities (RDAs) (at least in the major metropolitan areas) around which more of the regions' other training activities should also cohere. In this fashion, a more regionalized set of industry forums could shape and organize a more compelling set of skills development interventions at the regional level. Eventually, the reinvented regional forums could knit together regional industry strategy setting, regional workforce development planning, and even the distribution of job training grants such as from the Train Employees Now (TEN) program and Silver State Works into a cohesive new push for relevant skills-building in the STEM era.

Of course, such a transition will likely need to occur in stages. In the meantime, the state should get started with reform by undertaking two important steps to improve workforce system alignment. First, DETR should improve the relevance of the present sector councils by moving to enhance the exchange of market information within the **councils** so as to better inform the design and delivery of STEM and other training initiatives. Currently, information flow through the sector councils remains spotty. Going forward, therefore, DETR and GOED should work to increase the relevance of the councils by delivering to them much more and better labor market information-a crucial basis of tight workforce-system alignment with firm needs. Along those lines, DETR and GOED should work closely with the councils to inform regular knowledge-exchange meetings between industry and the workforce training system with much more detailed, timely, and varied industry intelligence

on hiring trends, occupational demand and supply trends, present and projected job openings, duration of postings, and the like. DETR should serve as the central repository for information obtained by the sector councils while also working to help the councils address revealed training needs. Getting this basic information exchange right will improve the councils' operation and, by extension, foster alignment.

At the same time, the state should here too catalyze bottom-up problem-solving with a challenge grant. In this case, the state should **establish a competitive STEM** workforce alignment challenge to be administered by the RDAs that would award significant funds on a competitive basis to regional consortiums that have strong plans for delivering industry-led, sector-specific skills training aligned with the workforce needs of local STEM firms. Such a program will help knit together STEM workforce development at the regional level. By requiring a one-toone cash and/or in-kind match by the private sector and/ or philanthropies, such a program would encourage and fund active collaboration among stakeholders that need to engage with each other–including industry, the sector

USING COMPETITIVE GRANTS TO FOSTER REGIONAL COLLABORATION ON WORKFORCE TRAINING: WASHINGTON AND TENNESSEE

mproving the alignment of workforce development and economic development is a top priority in states and regions throughout the United States. However, given the many stakeholders involved in building a strong workforce, it's not an easy task. More often than not, communication and coordination problems undercut the needed cooperation of local companies and nearby postsecondary institutions, economic development organizations, and workforce development entities, resulting in a disjointed system that fails to produce appropriately trained workers when they are most needed.

A few state governments have developed strategies to help regions overcome this major challenge, however. Washington State's 2008-10 **High Skills High Wages Strategic Fund** represents one promising approach. This competitive grant program awarded planning and implementation grants to regional consortiums working to establish industry-led work-force training programs in target industry clusters such as manufacturing and renewable energy. Criteria in competition's request for proposals (RFP) ensured a high level of cross-sector collaboration and a clear focus on addressing skills gaps in middle-skill jobs as determined by regional industry demand. The competition required applicants to develop evidence-based strategies as well as metrics to track performance over time. A matching requirement let the state maximize the impact of its investment while also guaranteeing that grantees had "skin in the game."

More recently, the state of Tennessee launched its **Labor and Education Alignment Program (LEAP) Grant Competition**, which will provide up to \$10 million in competitive grants to support local cross-sector collaboration on efforts to develop industry-led career pathways in Tennessee regions. The RFP for the LEAP Grant Competition affirmed that "the primary goal of this program is to create long-term relationships between employers and area community colleges or Tennessee Colleges of Applied Technology to identify and address the challenge of job candidate 'skills gaps' in the local workforce pool."

States interested in strengthening their regions' economies would do well to consider how a competitive grant program like the High Skills, High Wages Strategic Fund or the LEAP Grant Competition can provide sufficient incentive to foster greater alignment of workforce training and education with industry labor needs.

Source: Washington Workforce Training & Education Coordinating Board, "2008-10 High Skills, High Wages Strategic Fund Request for Proposals"; Tennessee Higher Education Commission, "Labor Education and Alignment Program (LEAP) Grant Competition Request for Proposals and Guidelines for Submission." councils, training entities, the state colleges, and the universities. The programs funded by the grant competition could take a variety of forms. For example, in the Las Vegas region, state college and university leaders could work with the local IT industry to create a "Cloud College" that offers certificates in fast-moving cloud computing disciplines. Likewise, in the Reno area stakeholders could apply for a grant to establish programs and certifications for occupations that will be demanded by Tesla's lithium-ion battery production. By requiring regional consortiums to compete for grant support, the skills challenge would allow the state to maximize its return on public investment while calling forth and supporting strong education and skills training initiatives developed in the state's regions, the front lines of the Nevada economy.

At the same time, the state should work to improve the general responsiveness of the state colleges to the workforce development needs of local industry. While creation of a workforce challenge grant should help on this front, NSHE, the Legislature, and other stakeholders should explore ways to update the public state college governance model to promote greater regional engagement. Already, an interim committee of the Legislature has affirmed the importance of greater college connection to their regions, prompting initial higher-ed system responses.⁵⁴ However, stronger, more structural changes may well need to be considered, including several possible models proposed by UNLV's Lincy Institute.⁵⁵ Whatever institutional design the state ultimately adopts, it should place much greater emphasis on state college engagement with local labor markets. To bolster these efforts, the state should also consider how the colleges might secure funding outside of and in addition to general fund appropriations.

Lastly, it remains to be seen if the state's new higher education funding formula will promote STEM and workforce development objectives. If it does not, a few additional changes to the recently revised formula may be in order. For one thing the state could **increase the performance pool portion allocated to STEM degrees** so as to give Nevada's institutions of higher education a stronger incentive to bolster their STEM-related offerings. Likewise, the state could **augment STEM discipline weights in the formula** to provide an added nudge toward greater alignment with Nevada's economic goals as well as **establish specific performance metrics for state colleges** that would encourage schools to support programs that lead to industry-relevant credentials.

Establish proficiency

Finally, the state must ensure that its P-12 education system can impart a basic degree of STEM proficiency to all Nevada students. At present, the system is failing on this task, which calls into question the state's aspirations to expand opportunity by expanding its STEM economy.

Therefore, the state's education system should focus on implementing relevant STEM education standards, improving STEM teaching, expanding students' education options, and better engaging students in the study of STEM fields. Provisions will also be needed to strengthen postsecondary remediation and speed students' time to degree.

Integrate computer science into P-12 education standards

Academic standards set out clear goals for what students should know at each grade level and thus are critical to fostering greater STEM proficiency. Nevada's decision to adopt the CCSS and NGSS will help ensure that all Nevada students are working toward proficiency in reading, math, and the sciences-key building blocks for STEM education.

Yet Nevada should go one step further: It should recognize the rapidly increasing importance of computer coding in the labor market and actively encourage all districts to incorporate computer science into the P-12 core curriculum. Familiarity with the basics of computer science would position Nevada students ahead of the curve as the "digitization of everything" sweeps through every corner of the STEM economy. The Board of Education could take a first step in this direction by moving to **repurpose** the existing half-credit computer literacy graduation requirement as a computer science requirement that introduces students to the basics of computer programming. Then, as schools adopt courses that fulfill this new requirement, district administrators should also explore ways to integrate computer science into all grade levels. These two actions together would position Nevada as a national leader on P-12 computer science education, which is only now beginning to take hold in school districts throughout the United States.

INTRODUCING STUDENTS TO COMPUTER SCIENCE: CODE.ORG

amiliarity with the basics of computer science will continue to grow in importance as the Nevada economy becomes increasingly technology-driven. This imperative is already evident in Nevada's IT sector, which faces difficulty in finding workers possessing the requisite training to succeed. Providing P-12 students the opportunity to learn computer science can help address this critical need. Regardless of whether students go on to pursue further training in computer science, this baseline knowledge will give them an ability to understand and participate in conversations about technology as the innovation economy evolves.

Code.org's district partnerships offer one promising approach to delivering computer science education at the elementary, middle, and high school levels. This model combines in-class instruction and hands-on activities with online tutorials that students complete at their own pace. Partner districts receive access to the curriculum and online courses, ongoing professional development and stipends for teachers, support for all grades (K-12), and outreach materials targeting students and parents–all at no cost to the district.

To date, 30 school districts have partnered with Code.org, including some of the nation's largest, such as the New York City Department of Education, Chicago Public Schools, and Broward County Public Schools in Florida. Although Code.org only recently launched its district partnership program, the organization plans to expand in the coming years.

By applying to partner with Code.org, Nevada school districts can take the first step toward ensuring that all students have the opportunity to learn the fundamentals of computer science.

Source: Code.org, "Partner with Code.org to Bring K-12 Computer Science to Your District;" Code.org, "Code.org District Partnership Model: Bring Computer Science Courses to Your District!"

Implement STEM education at all grade levels

The quality of STEM education, like all forms of education, depends heavily on the knowledge and skill of the educator. STEM teachers must possess both strong content knowledge and the ability to engage students in the handson, interdisciplinary learning that is a signature feature of P-12 STEM education. Consequently, improvements in teacher training programs and ongoing professional development will be essential as Nevada's schools work to bolster their STEM education offerings. To start, the legislature should explore ways to expand funding for high-quality STEM-related professional development. Additional funds will create more professional development opportunities for educators, who can immediately put their learnings to work in the classroom. Meanwhile, sharp performance management of professional development offerings will help ensure that Nevada provides only the

best in continuing education for its teachers.

Advancing STEM education will also require engagement on the part of school administrators. However, all too often school principals do not have a solid understanding of STEM education, particularly with regard to its interdisciplinary and inquiry-driven approach. At the same time, teachers selected to be STEM coordinators may be highly effective educators but often lack experience serving in an administrative capacity. To remedy this shortcoming, the reconstituted STEM Advisory Council should work with the proposed STEM champion as well as faculty and administrators at UNR and UNLV to expand UNR's Principals' STEM Academy into an Administrators' STEM Academy that serves all 17 districts in the state. This year-long professional development program helps administrators acquire greater familiarity with STEM education pedagogy, the disciplines that comprise STEM,

and the mechanics of implementing STEM programs in a school. The program could be adapted to meet the needs of both principals and STEM coordinators, with pull-out sessions to discuss issues of particular concern to each group. Scaling up this program would have the added benefit of creating cohorts of administrators who can learn from one another as they work to bring STEM education into their schools.

Expand student options within the public education system

Nevada students need more high-quality learning options within the public education system. Providing greater choice within the public school system allows students and their parents to pick the school best suited to their individual learning styles and interests. In addition, nontraditional schools can provide learning environments that focus in on a particular subject area, such as STEM or STEAM. Currently, magnet schools and themed career and technical academies (CTAs) around the state offer important tuitionfree public school alternative for many Nevada students. Lengthy waitlists attest to the popularity of these schools, and suggest the need to establish more of them. However, those waitlists also highlight a sizable unmet demand for alternatives to conventional public schools. In addition, district transportation zoning plans effectively preclude many students-particularly those from high-need, lowincome families whose parents cannot provide transport to and from school each day-from attending CTAs outside their assigned zone.

High-quality public charter schools can provide another option, particularly in high-need, underserved areas. These independently-run public schools receive greater flexibility on curricular decisions, teaching approaches, school-day length, and other matters in exchange for a high level of accountability for student achievement in math, science, language arts, and other critical academic fields. Furthermore, because these schools have the freedom to design their own curricula, they may have an easier time of implementing STEM education programming.

However, access to capital and appropriate facilities continue to make it hard to start charter schools in Nevada. To help address this challenge, the state legislature should **create and fund a public charter school strategic growth fund** to catalyze the emergence of quality charter schools in underserved communities. This fund would provide much needed capital investments for new charters, which often struggle to secure adequate facilities funding, and would likely speed the emergence of truly outstanding education options for Nevada students.

Stimulate student interest in STEM, particularly among underrepresented populations

Schools and districts-working with all stakeholders-will need to contend with low student interest in STEM courses and careers. Too few students express interest in STEM. and many believe STEM-focused careers to be out of reach. This is especially true for students in groups traditionally underrepresented in STEM courses of study and STEMintensive industries. Therefore, engagement of varied student populations must become a high priority. Although STEM teachers will have the primary responsibility for inspiring students' enthusiasm, schools can take additional steps to encourage student excitement about STEM and the career opportunities available to those with STEM knowledge. From field trips and class speakers to robotics competitions and "maker faires," teachers and schools can together work to increase their students' interest in STEM learning. These activities could be funded through a combination of state P-12 STEM challenge grant proceeds, philanthropic donations, and/or private-sector support.

Throughout all of this, it is critical that schools and districts design and implement STEM outreach efforts that are accessible to all students, especially people of color and white women. In order for students to view STEM-focused employment as a potential career option, they must be able to see themselves in the role models presented to them. However, because white and Asian men tend to be overrepresented in STEM occupations, many students have never had the opportunity to see and engage with STEM professionals who look like them. STEM engagement initiatives specifically designed to engage women students-including women students of color, who must contend with the intersection of gender and racial stereotypes-can begin to close STEM's persistent gender gap. Likewise, schools should also provide STEM outreach programming that focuses on inspiring young men of color to pursue STEM education and careers in STEMoriented industries. Carefully targeted outreach efforts can help greater numbers of students imagine themselves succeeding in STEM courses and careers.

CULTIVATING THE NEXT GENERATION OF WOMEN IN STEM

istorically, women-and especially women of color-have been underrepresented in STEM-intensive occupations. This persistent disparity not only deprives STEM fields and firms of critically important perspectives but also places women at an economic disadvantage given the sizable wage premiums offered by STEM careers.

Recently, a number of organizations have embarked on efforts to close the STEM gender gap by providing young women opportunities to engage with STEM professionals and learn about STEM fields.

One such effort is the **Girls Inc. Eureka!** program for young women in grades 8 through 12. This five-year program uses summer camps, regular meetings during the school year, internships, and college prep activities to help participants gain confidence, develop strong proficiency in STEM subjects, and aspire to postsecondary education and careers in STEM fields. The majority of participants are young women of color from lower-income families. Although the program only launched in 2012, Eureka! affiliates throughout the country already report important gains in participants' interest in STEM subjects and careers as well as their academic self-confidence.

Other programs focus on specific aspects of the STEM landscape. For example, Los Angeles-based **DIY Girls** is working to get larger numbers of girls excited about technology and engineering. Founded in 2011, DIY Girls offers afterschool programs, summer technology camps, and short workshops that give participants the opportunity to learn more about technology and engineering in part by designing and creating toys, video games, and other innovations. The program serves young women in grades 5 through 12, many of whom come from low-income families of color. Over the next five years, DIY Girls aims to engage 3,000 girls in the Los Angeles area.

Another organization with a similar subject area focus is **Girls Who Code**, a nonprofit organization that works to advance gender parity in technology and engineering. To achieve this vision, the group has set a goal of delivering computer science education to 1 million young women by 2020. Girls Who Code leverages the expertise and experiences of women professionals in tech, who serve as mentors and instructors for participants. The organization provides both curriculum and pedagogical assistance so that instructors can get a course up and running within a short timeframe. Since its 2012 launch in New York City, Girls Who Code now also operates programs in Boston, Chicago, Detroit, and San Francisco and aims to expand to other cities in the near future.

These three initiatives suggest how communities can take action to boost STEM interest and proficiency among young women. Dismantling stereotypes about STEM occupations will take time, but the efforts of organizations like Girls Inc., DIY Girls, and Girls Who Code will help hasten a much-needed demographic shift in the STEM workforce.

Source: Girls Inc. Research Department, "Girls Inc. Eureka Evaluation Report," January 2014; DIY Girls, "What We Do"; Girls Who Code, "Our Mission + Vision."

NDE, for its part, could augment these efforts by developing a high-impact web portal that high schools could use to raise student awareness of STEM career pathways. One possible model is the Illinois Pathways website, which gives students the opportunity to explore different STEM-related fields and careers and provides information on the coursework needed to pursue those careers. Combined efforts to boost student interest in STEM subjects and careers, raise awareness of STEM-focused career possibilities, and help students start planning for their futures well before high school graduation will help put more Nevada students on pathways to promising careers in the state's STEM industries.

Improve postsecondary outcomes

At the postsecondary level, students' failure to complete their degrees represents one of the greatest challenges facing Nevada's state colleges and universities. Extensive remediation needs combined with non-academic considerations such as child care and transportation prove insurmountable obstacles for too many Nevada students. To improve student completion rates, institutions of higher education should seek out and **implement proven approaches to remediation to speed degree completion**, including wraparound services such as child care and financial assistance where appropriate. Such efforts would help improve educational attainment for all students,

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IMPROVING POSTSECONDARY STUDENT OUTCOMES: CUNY ASAP

Substituting the postsecondary level depends on a number of factors. Academic preparedness for college-level work is a major concern, but many students must also contend with part-time or full-time job schedules; lack of childcare; limited funds for tuition, books, and other incidentals; difficulties navigating the postsecondary system; and other challenges. Without adequate support systems that address both academic and non-academic needs, college students facing these barriers are far more likely to drop out.

To improve student outcomes-particularly for those requiring remedial education-the City University of New York (CUNY) system developed the **Accelerated Study in Associate Programs (ASAP) initiative**. This novel approach combines remedial coursework and an accelerated academic track with mandatory tutoring, intrusive academic advising, career planning services, and financial support (including free tuition and textbooks as well as a transit subsidy). Block-scheduled courses make it easier for students to balance work schedules and child care responsibilities, while smaller classes help ensure that students receive the attention and support they need. All ASAP students are required to take a full-time course load and are strongly encouraged to earn their associate degree within three years if not sooner.

A 2013 third-party evaluation by MDRC found that the CUNY ASAP program "had a dramatic effect on students' academic attainment." ASAP students earned more credits, persisted in their courses of study, and obtained their degrees faster than similar students who were not enrolled in the program.

The success of the CUNY ASAP program demonstrates that commonsense interventions that let students focus on their studies can produce significant positive results. This innovative approach to developmental education offers a promising model for colleges and universities looking to improve completion rates and reduce time to degree for low-income students with remediation needs.

Source: Susan Scrivener and Michael J. Weiss, "More Graduates: Two-Year Results from an Evaluation of Accelerated Study in Associate Programs (ASAP) for Developmental Education Students"; Donna Linderman and Zineta Kolenovic, "Results Thus Far and the Road Ahead: A Follow-Up Report on CUNY Accelerated Study in Associate Programs (ASAP)."

CRACKING THE CODE ON STEM: A PEOPLE STRATEGY FOR NEVADA'S ECONOMY

regardless of their course of study. Meanwhile, additional support for prospective STEM majors in their first and second years could help prevent students from switching out into non-STEM courses of study.

Civic Entrepreneurs: Change the Dynamic

Nevada's impressive network of business, civic, and philanthropic leaders also need to mobilize to strengthen the state's STEM economy. After all, Nevada's civic entrepreneurs can bring to bear tremendous initiative, clout, resources, energy, and expertise to the work of advancing STEM training and education in Nevada.

These leaders also have a major role to play in setting out a vision for STEM, aligning actors and activities, and fostering greater STEM proficiency among Nevada students.

Set a vision

To start, Nevada business and civic leaders should **join the governor in speaking out on the importance of STEM education and training**. Their voices matter. Business leaders in particular may be best positioned to develop and convey an inspiring vision of the future of Nevada's STEM

RAISING AWARENESS OF THE IMPORTANCE OF STEM: STEM UTAH

Building a STEM-proficient workforce involves more than just strong STEM education programs-it also requires individuals who are excited about STEM subjects and STEM careers. Unfortunately, uncertainty about what STEM is, why STEM is important, and what kinds of careers are available in the STEM economy leads too many students and families to conclude that a future in STEM is out of reach.

Statewide STEM marketing campaigns aim to dispel these misconceptions by sparking enthusiasm for and interest in STEM industries and STEM careers. Often funded by private-sector and philanthropic interests, these multimedia outreach initiatives raise public awareness of the importance of the STEM economy and the many job opportunities open to individuals with some level of postsecondary STEM education.

Utah's "STEM Utah: Curiosity Unleashed" campaign offers one example of what a strong, statewide STEM marketing effort might look like. Launched in January 2014, this \$2.5 million initiative was funded primarily by STEM-oriented firms operating in the state. These private-sector donors–which included Adobe, Boeing, Energy Solutions, Merit Medical, and Nelson Labs–recognized that their future economic prospects depended in large part on the quality of the Utah workforce and saw the campaign as a way to get more students thinking about careers in STEM. The campaign includes television, radio, print, and online outreach, including highly produced promotional videos featuring individuals from underrepresented groups that showcase different STEM occupations and the various companies that employ STEM-proficient workers. With the Curiosity Unleashed campaign in place, Utah is now well-positioned to build on the excitement generated by this outreach by investing in policies and programs that strengthen STEM education and training throughout the state.

The Utah campaign demonstrates how private-sector and philanthropic leaders can collaborate to inspire enthusiasm for STEM education and STEM careers. When paired with efforts to improve the quality of STEM education and training available, STEM marketing campaigns can help states and regions cultivate the STEM-proficient workforce needed to thrive in an increasingly STEM-oriented economic world.

Source: Utah Governor's Office of Economic Development, "More than \$2 Million Put Forward by the Private Sector for STEM Media Campaign." economy, the exciting employment opportunities it will create, and the value of STEM education at the P-12 and postsecondary levels.

Going further, the state-led by its tourism and gaming sectors-has a recognized genius for marketing and should apply it to the task of raising awareness about STEM. Specifically, Nevada business and civic leaders should work together to **develop a powerful statewide marketing campaign** to engage and inspire Nevada's next generation of potential STEM workers. This campaign should seek to foster awareness of and excitement about STEM education, STEM-oriented industries, and STEM careers by employing distinctive strategies for specific target audiences, including underrepresented groups, various grade levels, parents, and other key stakeholders. A vivid, sustained, and substantial campaign of this sort can begin to change the game in Nevada.

Meanwhile, as schools and districts work to bring STEM education into the classroom, the private and philanthropic sectors should be ready to **pledge matching funds for promising applicants** to the proposed state P-12 STEM competitive grant program. With the help of civic entrepreneurs, this program can become an important support for smart innovations and needed scale-up of P-12 STEM programs. Civic leaders should weigh in by supporting the proposals they deem likely to have the greatest positive impact on regional STEM education outcomes.

Moreover, if the state fails to establish grant support for the expansion of P-12 STEM education, regional business and civic leaders in the state's regions should act at the local level to create regional competitive grant programs to support new P-12 STEM programs and the scale-up of proven initiatives.

Pursue alignment

The business and civic sector also has a critical part to play in better aligning workforce development and education activities with industry needs.

Businesses in STEM-intensive industries matter enormously to this alignment because they are the state's STEM economy. They are the ultimate authority on the skills needed from Nevada's STEM workers. As such, Nevada's STEM businesses should actively shape and demand results from the state's training and education programs.

To that end, firms should **participate urgently in the sector councils** and push for them to deliver value by producing more aligned training programs. And they should **engage energetically in any STEM workforce challenge grant competitions** that the state launches and the RDAs run.

Businesses and civic entrepreneurs should also seek out opportunities to shape STEM programs at the state's universities, colleges, and P-12 schools. Using higher education institutions' advisory councils to send clearer and more precise signals about what graduates must know or be able to do in order to work in a STEM field is an obvious way to provide essential input. Another powerful option is to engage deeply to help design and fund specific programs. In addition, firms should consider how they might work with high schools and postsecondary institutions to expand student access to work-based learning opportunities. Structured, multi-week internships, apprenticeships, and courses that combine classroom learning with on-the-job training can help students acquire the work experience needed to succeed on the job market following graduation. To support such efforts, each RDA could **develop a regional** STEM internship program that connects interested students with STEM-intensive work-based learning opportunities. Given the RDAs' ongoing engagement with private-sector firms, these entities are well positioned to work with businesses and schools to provide high-quality internships for high school students.

EXPANDING STUDENT ACCESS TO INTERNSHIPS: THE MINNEAPOLIS-ST. PAUL STEP-UP ACHIEVE JOBS PROGRAM

lack of work experience poses a sizable problem for many young people in the job market. These individuals may possess the appropriate skills training and educational attainment, but without work experience they often face difficulty finding work in the fields for which they trained. Meanwhile, companies struggling to fill open positions effectively pass by a number of talented potential employees.

Regional internship programs offer one way to end this Catch-22. Successful programs conduct outreach to companies and schools, recruit prospective interns, facilitate the application and hiring process, and help firms and interns design individualized plans to ensure that both parties get the most out of the experience. Student interns gain hands-on work experience that can strengthen their resumes and improve their future job prospects following graduation. Firms also benefit from the presence of interns, who provide low-cost help as well as creativity and unique perspectives on the firm's work. In addition, internships can help firms build relationships with potential employees, which in turn can reduce the time required to fill open positions when they arise.

One strong model for a regional internship program is the **STEP-UP Achieve Jobs Program** in Minneapolis-St. Paul. Established in 2004 and administered by a nonprofit affiliated with the area public school district, this program offers six to 10 week internships for individuals aged 16 to 21. Students apply through a competitive process, with firms conducting interviews and making final decisions on hiring. Prior to the start of the internship period, each intern participates in a work readiness training program certified by the regional chamber of commerce to familiarize them with communication skills, professional conduct, problem solving, and other key workplace skills. Meanwhile, employers participate in a pre-internship orientation and receive a handbook and ongoing support over the course of the internship term.

At the start of the internship, the intern and her/his supervisor work together to create a training plan outlining the intern's responsibilities and expected learning outcomes. When the internship ends, the supervisor then uses this training plan to assess the intern's performance and progress. In addition to acquiring valuable work experience, students also earn high school credit and an hourly wage equal to or greater than the regional minimum wage.

Programs like STEP-UP Achieve make it easier for companies to offer internships by handling much of the administrative work involved. These programs also support student learning by providing a level of consistency in the quality and duration of internship experiences. By creating similar RDA-led programs to connect firms with prospective student interns, Nevada's regions can help ensure that the next generation of workers is well-prepared to succeed on the job market.

Source: STEP-UP Achieve, "Employer Toolkit Fall 2014."

Establish proficiency

Turning to the pressing need for basic STEM proficiency, Nevada's business, civic, and philanthropic leaders are uniquely well-positioned to advance the cause.

Provide support for stronger P-12 academic standards

To begin with, these business and civic leaders have an important role to play in supporting the state's strong new academic standards.

With adoption of the CCSS and NGSS already a reality, the state's P-12 educational system must now sort out how best to implement these standards. Implementation will likely prove rocky at first as teachers adopt new curricula and students grapple with new academic expectations. To ensure that the state stays the course and supports implementation efforts, civic leaders should regularly reinforce the connection between the CCSS and NGSS and the state's economic health so that Nevadans have a clear understanding of why such changes to P-12 education are necessary. Likewise, providing vocal and material support for P-12 computer science education will raise the profile of this issue and could help attract Code.org or a similar organization into the state to drive implementation of computer science curricula in particular districts. Private and philanthropic interests may also be able to expedite the arrival in Nevada of one of the top national providers of coding to help regions deliver on the need for code literacy.

Champion STEM education

Going beyond support for standards, civic leaders can help promote high-quality STEM teaching by helping schools and districts prepare educators to teach these new courses. Better and more dynamic STEM teaching is essential to deliver better outcomes. The limited funding available to districts for professional development suggests that the private and philanthropic sectors should **support** high-quality, ongoing professional development for incumbent STEM teachers at all grade levels. By working with schools, districts, and Nevada Regional Professional Development Programs (RPDPs) to identify STEM-related professional development needs, conferring with STEM education experts and RPDP staff to find best-in-class training, and providing funding to bring professional development opportunities to schools, private-sector firms and philanthropies can help their regions' schools adopt

Nevada's new STEM education agenda.

The private sector and philanthropies could also assist with much needed strategies to attract and retain strong STEM teachers. Creative new approaches will be needed. For example, local companies and philanthropies could help by **providing signing and retention bonuses for hard-tofill positions at high-need schools**. Although such bonuses alone cannot resolve the challenges facing Nevada's STEM educator talent pool, they can provide greater incentive for STEM-proficient individuals to consider careers as P-12 STEM teachers, and for current STEM educators to take positions at underserved schools.

The rising prominence of STEM proficiency is also opening up opportunities for civic entrepreneurs interested in instigating innovative P-12 STEM ventures in the state. Civic entrepreneurs should therefore **actively help identify**, **implement, fund, and scale up strong STEM approaches and practices** in the state, whether it be through recruitment campaigns to bring programs like Code.org's district partnerships to Nevada or the support of novel approaches to STEM education. By helping to put in place strong solutions to the challenges involved in expanding quality STEM education, Nevada's civic entrepreneurs can have a direct positive effect on thousands of students.

Expand students' educational options

Regional civic entrepreneurs can play a catalytic role in accelerating the scale-up of new approaches to public education such as charter schools, which appear to be a promising platform for the delivery of strong basic education, including in STEM subjects like math and science. While the state policy adjustments noted earlier should improve the environment for potential charters, regional consortiums of civic entrepreneurs and philanthropists could greatly accelerate the scale-up process by developing strategies to recruit best-in-class charter management organizations (CMOs) into the state to open multiple schools. To this end, regional civic entrepreneurs can actively market their region to national CMOs by highlighting regional demand, securing pledges of financial support, and demonstrating why their region would be a good choice for CMO expansion. Creating a regional charter school incubator capable of supporting new charters through their critical early development and startup could further heighten regions' attractiveness in the eyes of high-performing CMOs while also cultivating a pool

of talented leaders to launch and run charter schools in the region. One possible model is the Mind Trust Charter School Incubator for the Indianapolis region. This organization provides grants, ongoing support, and connections to area business and civic leadership networks as well as Teach for America and TNTP in order to help charter leadership teams get their schools off to a strong start.⁵⁹

And Nevada civic entrepreneurs may want to consider catalyzing the emergence of innovative STEM education

models, leadership, and teaching even more broadly by moving to **encourage "blue sky" thinking in STEM education** by supporting passionate entrepreneurs, technologists, teachers, and principals who want to develop bold new STEM solutions. Such encouragement might entail a set of one-year fellowships for smart educators to develop breakthrough education concepts. Alternatively, it might comprise the establishment of a STEM education incubator aimed at helping Nevada's most creative STEM teachers

INCUBATING EDUCATIONAL INNOVATION: 4.0 SCHOOLS AND THE MIND TRUST CHARTER SCHOOL INCUBATOR

n the tech industry, startup incubator programs help entrepreneurs get new companies up and running by providing expertise and access to potential funders, mentors, and partners at a key stage in a company's lifecycle.

Recognizing the value of this approach, advocates for innovation in education have repurposed the incubator model to support new educational endeavors. By offering targeted assistance for promising educational entrepreneurs, these incubator programs are helping develop the next generation of leaders in P-12 education.

One model for the educational incubator is **4.0 Schools**. Established in 2010, this nonprofit aims to provide support for entrepreneurs working to develop new solutions to the pressing challenges facing America's schools. The centerpiece of 4.0 Schools' work is its Launch program, a two-month course that helps entrepreneurs prepare to start new ventures. Teams selected for the Launch program participate in workshops and weekly pitch sessions and receive extensive coaching, work space in the 4.0 Schools' New Orleans lab, a \$6,000 startup capital grant, and stipends for housing and travel during the program. To date, 4.0 Schools has launched 23 ventures, which range from educational games to a charter school for grades 5-12. 4.0 Schools currently operates in New Orleans and New York City, but has plans to expand its work nationwide.

Other incubators focus exclusively on getting new charter schools off the ground. One prominent example is the **Mind Trust Charter School Incubator** in Indianapolis. Like other charter incubators, the Mind Trust incubator aims to develop the capacity for leadership, strong community connections, and regional partnerships needed to help a new charter school succeed. By selecting participants using a highly competitive process and then providing intensive support throughout the planning and launch phases, the Mind Trust incubator helps improve the likelihood that high-quality charters will not only survive, but thrive. The Mind Trust incubator's work with Rocketship and KIPP, two charter management organizations (CMOs) nationally recognized as best-in-class, also shows how incubation programs can help attract high-performing CMOs to a given region. Because charter school incubators can work with CMOs to establish a good rapport with stakeholders, tailor charter models to the particular realities of the region, and generally smooth the way for the opening of new schools, they can set a region apart in CMO decisions about where to locate next.

Education-oriented incubator programs can help P-12 entrepreneurs bridge the distance between idea and reality by providing much needed support and connections. Whether for educational innovation writ large or specifically for charter schools, incubators can help entrepreneurs launch new projects that will improve educational outcomes for STEM and STEAM or beyond.

Source: 4.0 Schools, "About | 4.0 Schools"; The Mind Trust, "Bringing Life-Changing Schools to Indianapolis."

and entrepreneurs make their ideas a reality. In any event, no one is better placed than Nevada's business, civic, and philanthropic sectors to invest in building a pipeline of top-flight STEM educators with the capacity to implement breakout ideas.

Cultivate student interest in STEM

As teachers and schools work to boost student interest in STEM subjects and STEM-related career paths, the private sector should call attention to the many fascinating, well-paying jobs available to those with some level of postsecondary STEM education. Business leaders should seek out opportunities to **host field trips** so that students can see STEM-intensive workplaces firsthand and **visit classes** to speak about their work. Such efforts will give students the chance to learn more about jobs in various STEM-oriented industries in the hopes of inspiring them to pursue careers in STEM fields.

* * *

Highly distilled and broad-ranging, these recommendations represent the beginning of a STEM education and training agenda for Nevada. Establishing a clear vision for the state's STEM economy and human capital priorities will catalyze action by showing how the growth of STEM-intensive industries can benefit all Nevadans. Greater alignment among state agencies, sector councils, institutions of higher education, and private-sector firms will foster much-needed collaboration and ensure that all stakeholders are working toward common goals. And perhaps most importantly, serious and sustained efforts to strengthen Nevada's educational system at all grade levels will lead to greater STEM proficiency, which is now a necessity for the next generation of Nevada workers. Through a combination of public-sector system-building and ongoing civic engagement, the public, private, civic, and philanthropic sectors can work together to transform Nevada's education and workforce systems in ways that improve Nevadans' economic prospects for years to come.

Greater STEM proficiency will be a necessity for the next generation of Nevada's workforce.

Strategies for Expanding Opportunity and Growth in Nevada's STEM Economy

PUBLIC SECTOR AGENDA

\$ = Little to no cost \$\$ = Low cost \$\$\$ = Moderate cost \$\$\$\$ = Higher cost

SET A VISION	
Deploy the governor's bully pulpit	\$
Appoint a dedicated STEM champion in the governor's office	\$\$
Reconstitute the Nevada STEM Advisory Council	\$
Craft clear guidelines for effective STEM education programs	\$
Create a P-12 STEM competitive grant program	\$\$\$\$
PURSUE ALIGNMENT	
Make industry sector councils more valuable forums for industry-led workforce training	\$
Enhance the exchange of market information within the sector councils	\$
Establish a competitive STEM workforce alignment challenge	\$\$\$\$
Update the public state college governance model	\$\$-\$\$\$
ESTABLISH PROFICIENCY	
Incorporate computer science into the P-12 core curriculum	\$\$-\$\$\$
Repurpose the computer literacy graduation requirement as a computer science requirement	\$\$-\$\$\$
Expand funding for high-quality STEM-related professional development	\$\$\$-\$\$\$\$
Expand UNR's Principals' STEM Academy into an Administrators' STEM Academy	\$\$-\$\$\$
Create and fund a public charter school strategic growth fund	\$\$\$\$
Encourage student excitement about STEM and the careers available to those with STEM knowledge	\$-\$\$
Design and implement STEM outreach efforts that are accessible to all students	\$\$
Develop a high-impact web portal to raise student awareness of STEM career pathways	\$\$
Implement proven approaches to postsecondary remediation that speed students' time to degree	\$\$-\$\$\$

Strategies for Expanding Opportunity and Growth in Nevada's STEM Economy

CIVIC SECTOR AGENDA

\$ = Little to no cost \$\$ = Low cost \$\$\$ = Moderate cost \$\$\$\$ = Higher cost

SET A VISION	
Join the governor in speaking out on the importance of STEM education and training	\$
Develop a powerful statewide STEM marketing campaign	\$\$\$-\$\$\$\$
Pledge matching funds for promising applicants to the proposed P-12 STEM competitive grant program	\$\$-\$\$\$
Create regional competitive grant programs to support P-12 STEM education	\$\$\$-\$\$\$\$
PURSUE ALIGNMENT	
Participate in the sector councils	\$
Engage in any STEM workforce challenge grant competitions	\$\$\$
Seek out opportunities to shape STEM programs	\$-\$\$
Expand student access to work-based learning opportunities	\$\$-\$\$\$
Develop a regional STEM internship program	\$\$\$
ESTABLISH PROFICIENCY	
Reinforce the connection between the CCSS and NGSS and the state's economic health	\$
Provide vocal and material support for P-12 computer science education	\$\$-\$\$\$\$
Support high-quality, ongoing professional development for P-12 STEM teachers	\$\$\$-\$\$\$\$
Provide signing and retention bonuses for hard-to-fill positions at high-need schools	\$\$\$-\$\$\$\$
Help identify, implement, fund, and scale up strong STEM approaches and practices	\$-\$\$\$\$
Recruit best-in-class charter management organizations into the state	\$\$\$\$
Create a regional charter school incubator	\$\$\$\$
Encourage "blue sky" thinking in STEM education	\$\$-\$\$\$\$
Host field trips and visit classrooms	\$-\$\$

CRACKING THE CODE ON STEM: A PEOPLE STRATEGY FOR NEVADA'S ECONOMY



Conclusion

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evada's ongoing efforts to increase its economic diversification are opening up new possibilities for the state and its residents. Modest but important growth in the nine target industries-most of which have a stronger STEM orientation than non-target sectors-suggests that the state is on the right track in its pursuit of an economic model that benefits all Nevadans.

A more prosperous, more technically oriented future is on the horizon– provided that the state takes action now to increase the STEM knowledge of its workforce. By readying more Nevadans for STEM-intensive job opportunities, Nevada can make its economic vision a reality.

Appendix

Methods and Data Sources

The analysis here draws from a variety of data sources. The industries identified as "target sectors" were developed in 2012 by the Nevada Governor's Office of Economic Development in response to previous Brookings research in collaboration with SRI International in the report "Unify | Regionalize | Diversify: An Economic Development Agenda for Nevada." This report employs the state's target sector names and definitions for its sectoral analyses.

Industry and sector level employment data for the United States, Nevada, and metropolitan areas come from Moody's Analytics, which combines data from government surveys.

Workers are classified into STEM occupations based on methods developed in previous Brookings research, summarized in "The Hidden STEM Economy." This method draws on the knowledge requirements of occupations, which is based on survey data from O*NET, to classify occupations as STEM if they require an extraordinary level of knowledge in any one STEM domain. Occupational data from O*NET was matched to the 2012 American Community Survey's microdata, which is made available from IPUMS. (See Ruggles and others, *Integrated Public Use Microdata Series: Version 5.0* [Machine-readable database]. Minneapolis: University of Minnesota, 2010). Data on occupational employment and salaries comes from the 2013 Bureau of Labor Statistics Occupational Employment Statistics survey. Job vacancy numbers, educational requirements, and advertisement durations are based on data from Burning Glass, a labor market analytics firm. The universe of vacancies for gross numbers is all openings advertised online. For advertisement duration calculations, the universe is limited to vacancies posted on company websites. These data are described and analyzed in more detail in the Brookings report "Still Searching."

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- 8. Phillip Toner, "Tradespeople and Technicians in Innovation," in Penelope Curtin, John Stanwick, and Francesca Beddie, eds., Fostering Enterprise: The Innovation and Skills Nexus-Research Readings (Adelaide, Australia: Australian National Center for Vocational Education Research, 2012); Phillip Toner, Tim Turpin, and Richard Woolley, "The Role and Contribution of Tradespeople and Technicians in Australian Research and Development: An Exploratory Study" (Sydney: Centre for Industry and Innovation Studies, University of Western Sydney, 2011).
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approved-requests/nvamendreq081313.pdf (January 2, 2014).

- 43. Phone interview with David Crowther, November 12, 2013.
- 44. In 2012, the National Council on Teacher Quality gave Nevada a D- on "delivering well-prepared teachers" for the second year in a row. The same study found Nevada's licensure coursework prerequisites "too vague to ensure that teachers will be prepared to teach to the CCSS" and described the test required to obtain an elementary (K-8) teacher license as "not an adequate assessment of content knowledge." National Council on Teacher Quality, "2012 State Teacher Policy Yearbook: Improving Teacher Preparation in Nevada" (2013), 3, 7, 12, available at www.nctq.org/dmsStage/2012_State_Teacher_Policy_ Yearbook_Nevada_NCTQ_Report (December 17, 2013). Problems of teacher content mastery extend into the middle schools as well, where educators have the option of applying for a middle school/junior high license but need only possess the generalist K-8 license. Among other prerequisites, the middle school/junior high license requires specific preparation for teaching grades 7-9 as well as "24 semester credits in a major field of endorsement or area of concentration." Mathematics and science are the two endorsement areas most directly relevant to STEM education. Nevada Department of Education Teacher Licensure, "Middle School/Junior High, 7th-9th Grades," available at http:// teachers.nv.gov/Licenses/Middle_School/Middle_School_Final_11_13_12 (December 17, 2013).
- 45. In the United States, the idea that one is "not good at" STEM subjects is especially pronounced with regard to math. For more on math anxiety (which tends to spill over into science and related fields), see Miles Kimball and Noah Smith, "The Myth of 'I'm Bad at Math," *The Atlantic*, October 28, 2013, available at www.theatlantic.com/education/archive/2013/10/the-myth-of-im-bad-at-math/280914/ (January 2, 2014); "In a New Survey, Americans Say, 'We're Not Good at Math'" (Change the Equation, 2013), available at http://changetheequation.org/press/new-survey-americans-say-%E2%80%9Cwe%E2%80%9Prenot-good-math%E2%80%9D (January 2, 2014); and Erin A. Maloney and Sian L. Beilock, "Math Anxiety: Who Has It, Why It Develops, and How to Guard Against It," *Trends in Cognitive Sciences* 16(1)(2012): 404-406.
- National Research Council of the National Academies, A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas (Washington: The National Academies Press, 2012), 279.
- A number of studies cite lack of awareness of the broad spectrum of STEM-oriented employment opportunities as a key factor in students'

decisions to pursue non-STEM courses of study. See, among others, Anna Cleaves, "The Formation of Science Choices in Secondary School," *International Journal of Science Education* 27(4)(2005): 471-486; and Oliver W. Hill, W. Clinton Pettus, and Barbara A. Hedin, "Three Studies of Factors Affecting the Attitudes of Blacks and Females Toward the Pursuit of Science and Science-Related Careers," *Journal of Research in Science Teaching* 27(4)(1990): 289-314.

- 48. White women and people of color have long been underrepresented in STEM fields, both with regard to degree attainment and the pursuit of STEM-intensive careers. For more on how stereotyping and cultural bias discourage individuals in underrepresented groups from pursuing STEM careers, see Catherine Hill, Christianne Corbett, and Andresse St. Rose, "Why So Few? Women in Science, Technology, Engineering, and Mathematics" (Washington: AAUW, 2010), available at www.aauw.org/ files/2010/03/Why-So-Few.pdf (January 3, 2014); "Missing From Science Class: Too Few Girls and Minorities Study Tech Subjects," New York Times, December 10, 2013, available at www.nytimes.com/2013/12/11/ opinion/too-few-girls-and-minorities-study-tech-subjects.html (January 3, 2014); The National Academies, "Expanding Underrepresented Minority Participation" (Washington: 2011), available at http://grants. nih.gov/training/minority_participation.pdf (January 3, 2014). For more on the problem of underrepresentation in STEM fields, see National Center for Science and Engineering Statistics, Directorate for Social, Behavioral, and Economic Sciences, "Women, Minorities, and Persons with Disabilities in Science and Engineering: 2013" (Washington: National Science Foundation, 2013), available at www.nsf.gov/statistics/wmpd/2013/pdf/nsf13304_digest.pdf (January 3, 2014); "Missing From Science Class," New York Times; Ronald J. Burke and Mary C. Mattis, eds., Women and Minorities in Science, Technology, Engineering, and Mathematics: Upping the Numbers (Northampton: Edward Elgar Publishing, Inc., 2007); Hill, Corbett, and St. Rose, "Why So Few? Women in Science, Technology, Engineering, and Mathematics"; The National Academies, "Expanding Underrepresented Minority Participation."
- 49. Phone interview with Ray Bacon, November 26, 2013.
- 50. National Center for Education Statistics, "Table 126. Number and Percentage of 9th- to 12th-Graders Who Dropped Out of Public Schools, by Race/Ethnicity, Grade, and State or Jurisdiction, 2009-10," *Digest* of Education Statistics, available at http://nces.ed.gov/programs/ digest/d12/tables/dt12_126.asp (December 19, 2013). National Center for Education Statistics, "Table 125. Public High School Graduates and Averaged Freshman Graduation Rate, By Race/Ethnicity, Grade, and State or Jurisdiction: 2009-10," *Digest of Education Statistics*,

available at http://nces.ed.gov/programs/digest/d12/tables/dt12_125.asp (December 19, 2013).

- In the 2012-13 school year, over 31 percent of Nevada high school gradu-51. ates enrolled at one of the state's colleges or universities required at least one remedial course on entry. The need for remediation varies from one institution to the next, with four-year universities typically experiencing lower remediation rates than the state's colleges. During the 2012-13 school year, remediation rates for Nevada high school graduates attending UNLV and UNR were 30.1 percent and 26.7 percent, respectively. With the exception of the College of Southern Nevada, which had a remediation rate of 19.9 percent, colleges in the state saw far higher remediation needs among Nevada high school graduates enrolled (Nevada State College: 51.5 percent, Great Basin College: 53.1 percent, Truckee Mountain Community College: 58.2 percent, Western Nevada College, 62.2 percent). NSHE Office of Academic & Student Affairs, "Summer and Fall 2012: Remedial & Developmental Report," 1, available at www.nevada.edu/ir/Documents/RemedialEnrollment/ Remedial_Report_Fall_2012.pdf (December 19, 2013).
- SRI International, "States' Methods of Funding Higher Education." The state has not funded remediation at either UNLV or UNR since autumn 2006. NSHE Office of Academic & Student Affairs, "Summer and Fall 2012: Remedial & Developmental Report," 3.
- 53. SRI International noted that "less than 10 percent who get help in two-year colleges, and less than 40 percent who get help in four-year colleges, complet[e] their degree in a timely manner." SRI International, "States' Methods of Funding Higher Education."
- 54. In June 2014 the Interim Committee to Conduct an Interim Study Concerning Community Colleges expressed its strong desire for active college engagement in the communities around them and recommended a number of steps for enhancing that. In response to the committee's recommendations NSHE reports that it is moving to establish a committee on the Board of Regents focused on college issues, establish "locally empowered" advisory councils of key stakeholders, and name a vice chancellor for community colleges. See Committee to Conduct an Interim Study Concerning Community Colleges, "Summary of Recommendations" (Carson City: 2014) and Nevada Board of Regents, "Local Community College Advisory Council: Regent Standing Committee on Community Colleges."
- 55. Magdalena Martinez and others, "The Case for a New College Governance Structure in Nevada."

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