

# All Sy-STEMs a Go: States Leveraging Best Practices and Public-Private Partnerships to Advance STEM Education

By Jennifer Zinth

*While STEM education has captured policymakers' attention, few states have taken a systemic approach to STEM policymaking to ensure program coordination, reach, sustainability and return on investment. However, a few states have taken strides to establish statewide coordination, adequate and reliable funding, and evaluation. Those states have demonstrated results, including increased recruitment of female and minority students. Public-private partnerships and structures to formalize the role of business and industry in developing and implementing STEM programs are additional means to enhance these efforts and ensure alignment with employment trends.*

State-level policymaking in science, technology, engineering and mathematics, or STEM, education faces a challenge. The challenge is not a deficit of attention—on the contrary, many states have passed several pieces of STEM legislation and approved numerous STEM initiatives over the last decade. Nor is the challenge a lack of ideas—policymakers have acted on many facets of STEM education, impacting educators and students alike, from the early grades through postsecondary. The challenge, rather, is that all too often, states lack a systemic approach to STEM policymaking. The result? A state policy landscape littered with well-intentioned, yet uncoordinated, and frequently underfunded state activities, with little to no data demonstrating the impact of these efforts.

What does a systemic state approach to STEM policymaking entail? After an examination of STEM efforts across states, three critical—and interrelated—elements of a cohesive strategy emerge:

- **Statewide coordination:** Efforts are well-coordinated across agencies, or housed within a single state entity, with representation and buy-in across stakeholder groups (higher education, K–12, informal, nonprofit, local and state government, business and economic development, etc.).
- **Adequate, reliable funding:** States have committed adequate funding to assure broad, statewide reach of efforts across multiple years, and included funds to support one or more dedicated full-time employees, FTEs, to implement and evaluate efforts.
- **Quality assurance:** Reliable data are collected and analyzed to evaluate the return on investment of state efforts, and make course corrections as needed.

Many states are lacking at least one of these elements, if not two or all three. However, it is also clear that states need not fit a mold to effectively integrate these three elements in state STEM decision-making. States as diverse in their demographics and policymaking approaches as Iowa, Massachusetts and Utah have all demonstrated that students win when states take a systemic approach to STEM policymaking.

Massachusetts' STEM work is currently led by the STEM Advisory Council, established in its current form in 2009 and supported by the Executive Office of Education and three state agencies administering early learning, K–12, and higher education/workforce. Codified in statute in 2015, the Advisory Council is charged with coordinating STEM efforts across the public and private sectors, and more broadly leveraging its members and resources to accelerate the adoption of high-quality STEM education across the commonwealth.

Regional councils, called Regional STEM Networks, initially launched and funded in 2003–04, play a key role in bringing together diverse stakeholders in local communities to address regional priorities aligned with state goals. Overseen by a program manager at the Department of Higher Education, and closely aligned to the state's STEM Advisory Council, the networks are housed in a postsecondary institution or a regional employment board. In 2017, regional network grants included incentives for cross-regional collaboration and alignment of work with the STEM Advisory Council's current priorities of enhancing work-based learning opportunities in STEM fields, early college career pathways, and access to high-quality engineering and computer science education.

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The STEM Advisory Council draws primarily upon the STEM Pipeline Fund to fund initiatives aligned with its priorities. Developed by the legislature in 2003, the STEM Pipeline Fund has received sizable legislative appropriations in recent years—including \$1.5 million in 2012 and each year thereafter—to fund initiatives tied to the STEM Advisory Council’s priorities, including the regional networks and the state’s STEM Summit. In March 2017, Massachusetts Lt. Gov. Karyn Polito, a co-chair of the STEM Advisory Council, announced a \$1 million public-private grant to 45 schools to adopt Project Lead the Way curriculum. The STEM Advisory Council has also prioritized increasing the number of employers who offer STEM-focused internships to high school students and has leveraged its funding to support outreach to executives across the state.

Iowa Gov. Terry Branstad and Lt. Gov. Kim Reynolds have truly been a driving force in bringing coordination, consistent funding and quality assurance to their state’s STEM efforts. Just six months after his January 2011 return to Iowa’s executive office, Gov. Branstad issued an executive order creating the Iowa Governor’s STEM Advisory Council. The STEM Advisory Council, co-chaired by Lt. Gov. Reynolds and president and CEO of Kemin Industries Chris Nelson, and staffed by 4.5 FTEs housed in the University of Northern Iowa, coordinates a diverse array of STEM efforts, including STEM Scale-Up (expansion of preK–12 programs in computer science, engineering, physics, etc.), school-business partnerships called STEM BEST® (Businesses Engaging Students and Teachers), and STEM teacher externships in industry, to name just a few. To ensure regional voice in the council’s efforts and oversee local implementation, the council has split the state into six STEM regions, and cost-shared the staffing in each location with one regional STEM manager, in partnership with higher education institutional “hubs.”

Beyond funding for FTEs to support state and regional coordination, Iowa has brought significant resources to bear on developing and implementing high-quality STEM programs. For example, since 2012 the legislature has approved an appropriation (\$4.7 million in 2012, increased to \$5.2 million in 2014 and steady since) to support the STEM collaborative initiative, which supports preK–12 STEM programming, K–12 STEM teacher licensure and professional development, STEM college and career promotion, community engagement

and public awareness, and assessment and reporting. Iowa’s STEM efforts are also supported to some extent by state and federal grants, as well as private funds, but state funds remain at the core.

The state ensures, however, that programs funded through the Governor’s STEM Advisory Council are showing results. For example, the STEM Scale-Up Program establishes a menu of programs annually approved by the Governor’s STEM Advisory Council that applicant educators may offer. Annual STEM evaluation reports use teacher/leader surveys and student math and science assessment results to gauge the extent to which funded programs are enhancing interest, awareness and achievement in STEM.

Meanwhile, Utah launched its STEM efforts through the General Assembly, taking a slightly different approach to statewide coordination, funding and quality assurance. With strong backing from industry, 2013 legislation established the Utah STEM Action Center in the Governor’s Office of Economic Development. The STEM Action Center, governed by a board and under the leadership of an executive director, is charged with developing and implementing numerous STEM initiatives, including K–12 digital math programs, an Elementary STEM Endorsement and a recently funded kindergarten through post-secondary, K–16. Computing Partnership grant program, among others. The STEM Action Center is staffed by six FTEs, which includes a part-time foundation director, and three FTEs for the Utah STEM Bus funded by a grant. Statewide coordination is further supported by three liaisons who work part-time for the STEM Action Center and part-time for another state agency (Utah Department of Workforce Services, Governor’s Office of Economic Development and Utah State Board of Education). Liaison positions are jointly funded by the Utah STEM Action Center and the state agency they liaise with.

From 2013 to 2016, the Utah STEM Action Center has received a combination of one-time and on-going funding via three appropriations spanning four fiscal years, totaling \$23.5 million in one-time, and \$14.5 million in ongoing funding. The ongoing funding supports both operational functions and programs (\$1.5 million annually, and following the 2016 session, \$3 million to support a math program). A K–16 Computing Partnership grant program was recently funded in the 2017 legislative session for \$1.255 million annually. In addition, statute calls upon the STEM Action Center

board to strategically engage industry and business entities to cooperate with the board to provide private funding and support for the STEM Action Center. The law authorizes the board to establish a foundation with an endowment to assist in program development and implementation.

Utah statute requires the STEM Action Center director to conduct a variety of activities to identify best practices, and keep track of how best practices data are being used and who's using the data. By statute, the director must work with an independent evaluator to compare outcomes of STEM Action Center program participants to those of other students, on STEM and broader indicators.

Readers may be wondering how all this statewide coordination, funding, and quality assurance translates into increasing STEM interest and achievement for female and underrepresented minority students. Program outcomes data from all three states bear witness to positive impacts for these very students.

Iowa's extensive evaluation data indicate their investments are moving the needle for underrepresented students. For example, the 2015–16 evaluation report from the Governor's STEM Advisory Council notes that from 2011 to 2015, the largest proportional increase of high school students who aspired to a STEM bachelor's degree "was among students who were African American, with those aspiring to a bachelor's degree rising from 38 percent in 2011 to 47 percent in 2014. Among Hispanic students the proportion aspiring to a bachelor's degree increased from 46 percent in 2011 to 55 percent in 2015." Just from 2012–2013 to 2013–2014 alone, the number of females graduating with degrees in STEM fields at Iowa's four-year public universities increased 16 percent.<sup>1</sup>

Alternatively, one of Massachusetts' cornerstone STEM programs, the STEM Starter Academy, is targeted at increasing STEM success for more diverse students. Specifically, the goals of the STEM Starter Academy are to recruit more students, particularly diverse students, into STEM community college programs, and increase the number of STEM certificate and degree completers prepared to enter the workforce or transfer into a four-year STEM program. The latest program evaluation published in January 2016 shows encouraging results. STEM Starter Academy students reflect the racial and ethnic diversity of the overall community college population in the state. Seventy percent of STEM Starter Academy participants who have earned certificates and degrees

so far have done so in STEM fields, compared to 45 percent of the below-baccalaureate certificates and degrees earned statewide. And year one to year two retention rates for participants were slightly higher than for all full-time, first-time degree-seeking community college students.

Meanwhile, Utah has collaborated with the National Alliance for Partnerships in Equity in a federal STEM Equity Pipeline grant. A three-year pilot with one district resulted in dramatic increases in enrollments of girls in engineering and robotics classes. The STEM Action Center is scaling the root cause analysis work to two additional districts.

Beyond having appropriate structures in place to ensure program coordination, provide adequate and reliable funding and evaluate impact, states, regional employers and students also reap the benefits when programs are aligned with industry. States have taken various approaches to improving this alignment, including public-private partnerships, and structures to incent or require state or regional collaboration between K-12, higher education and business/industry partners.

Public-private partnerships take diverse forms across the states. The Massachusetts General Assembly, for example, appropriated \$1.7 million in both 2015 and 2016 for public-private dollar-for-dollar match of funds supporting computer science education in public schools. Florida House Bill 5001 passed in 2016 made a \$4.5 million appropriation to provide matching funds to school district education foundations for private funds received for various types of programs, including STEM initiatives.

And as some state STEM leaders are quick to point out, a valuable public-private partnership doesn't always mean someone needs to write a check. For example, Iowa's Governor's STEM Advisory Council website notes that businesses can support STEM through such programs as "Experienced STEM Professional" (lending STEM expertise through student internships, teacher externships, mentorships and other avenues), "STEM Resource" (including donations of materials, equipment and grant-writing support) and "STEM Supporter" (being a voice on behalf of STEM education, such as through commentaries in the press, testimonials and written support to local decision-makers and community organizations, presence in community events, etc.)

States have likewise adopted various programs to give industry a seat at the table in designing and implementing STEM programs. Most commonly,

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state approaches either support and incent localized programs via competitive grants to education and business partners, or establish a state-level structure for industry leaders to inform STEM program development and implementation.

One example of a successful localized partnership approach is Iowa's Businesses Engaging Teachers and Students, or STEM BEST, launched in 2014. Under the model, the Iowa STEM Advisory Council applies a rigorous vetting process to award grants to applicant education/business partnerships to improve connections between STEM learning and in-demand STEM careers in the state. Grant funds underwrite curriculum development, teaching training and equipment purchases. Grant awards in 2016 impacted students across the state from the early grades through high school, and include virtual reality STEM career exploration, project-based learning, and potential work-based learning opportunities such as job shadows, internships and pre-apprenticeship programs.

Since 2009 the Utah Cluster Acceleration Partnership has provided grants to applicant education and business partnerships to develop new programs or increase the capacity of existing programs to address unmet workforce demand. Housed in the state Department of Workforce Services, the department partners with the Utah System of Higher Education and the Governor's Office of Economic Development to approve programs in growing Utah industries, including STEM fields such as computer science/IT and advanced manufacturing. Grants support individual schools or school districts in the development, implementation or redesign of career pathways linking students to higher education, as well as public postsecondary institutions designing, implementing or retooling programs to serve regional or state industry needs.

In March 2017, Utah Gov. Gary Herbert announced that the Utah Cluster Acceleration Partnership will become the Talent Ready Utah grant program with over \$2.1 million for education/business partnerships targeted at filling demand in high-growth industries and occupations. Fiscal Year 2018 grants are intended to increase attainment of industry-recognized credentials, design career pathways with multiple entrance and exit points, and "create systemic change that will last beyond the grant period by establishing partnerships, agreements, processes, and programs that better connect education, training, workforce, and employers to meet industry needs within the re-

gional economy."<sup>2</sup> Utah Senate Bill 190 passed in 2017 also incentivizes districts and public schools to collaborate with state level partners, Talent Ready Utah and the STEM Action Center among them, in developing and implementing comprehensive K-16 computing partnerships.

Turning from localized to state-level partnerships, it's worth noting that many state-level vehicles allowing industry leaders to inform STEM program development and implementation have been launched through legislation. In just one example, Colorado House Bill 1274 passed in 2015 tasked the Colorado Workforce Development Council to collaborate with specified partners to develop integrated career pathways in construction and related skilled trades, IT and health care. The measure directs the council and partners to apply the same template, and any improvements to the model based on implementation, that Colorado used in response to a 2013 legislative mandate to develop the manufacturing career pathway. House Bill 1274 passed in 2015 also directed industry, through regional sector partnerships, and state-wide trade associations to annually review each career pathway to ensure it maintains relevance, and provide input for changes to better align with workforce needs.

As computer science has picked up steam in statehouses across the country, legislators and other key decision-makers have seized upon task forces and similar entities as vehicles to ensure industry voice in the development of computer science standards (including in Arkansas, a national leader in the computer science education movement), as well as recommendations to address numerous other issues related to ensuring equitable access to high-quality computer science instruction, in California, Illinois and South Carolina, for example. Establishment of such state-level entities to guide policy development is a step in the right direction, as noted in the landmark 2017 State of the States Landscape Report on computer science. One of the report's three cross-cutting recommendations for action is for states to "Build a broad base of leadership and ownership among key stakeholders," including business and industry.

Lastly, state STEM advisory councils have historically included substantial business representation. While councils in many states have waxed and waned with turnover in the state leaders who have created them, they can play an important if underutilized role in ensuring the state return on investment in STEM education. One state that has

made promising strides in fulfilling the promise of industry involvement in its STEM advisory council is Michigan. Created by House Bill 4115 in 2015, the 11 gubernatorial appointees of the 15-member council must include representatives of business sectors that are important to Michigan's economy and rely on a STEM-educated workforce, among other stakeholders. Among the charges to the council is to provide quality assurance of state-funded programs, including by using Change the Equation's rating system program.

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### Notes

<sup>1</sup>Iowa Governor's STEM Advisory Council, 2015–2016 Iowa STEM Evaluation Report, August 2016.

<sup>2</sup>Utah Department of Workforce Services, "Talent Ready Utah Grant FY18," n.d.

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