STEM FORWARD:

BUILDING WEST VIRGINIA'S CAPACITY THROUGH COMPUTER SCIENCE

2018

STEMx™

EducationAlliance.org

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THE EDUCATION ALLIANCE

The Education Alliance is a nonprofit organization that advocates for a quality public education for all West Virginia children. It was established in July 1983 by business executives who saw the importance of supporting public schools and giving the business community a voice in education. Through statewide advocacy efforts and student-centered programs, The Education Alliance:

- Serves more than 40,000 students annually
- Utilizes more than 2,400 volunteers to provide more than 46,000 hours of service
- Matches more than 850 students with a caring adult role model to provide more than 23,000 mentoring session
- Pairs 96 percent of West Virginia schools with at least one business partner
- Provides more than $1.5 million in resources leveraged directly to West Virginia schools
- Provides sound research and data in public dialogues about education

From the Partnerships in Education program in the 1980s to our current programs, The Education Alliance has continually placed students first and supported higher levels of excellence from our public education system. From the very beginning, business and community partners have been the key to the organization. Without these dedicated men and women, The Education Alliance would not be where it is today. Together with our partners, we look forward to a strong collaboration to improve public education in West Virginia.

The Education alliance
Business and Community for Public Schools

STEM Forward in Computer Science

In his inaugural State of the State address, Governor Jim Justice spoke clearly about the need to “create an education mecca in West Virginia.” He identified cultivating a qualified workforce that is prepared for current and future jobs as a key part of his vision for the state.

With growing opportunities in technology fields, West Virginia leaders understand the evolving link between STEM (science, technology, engineering and math) and excellent jobs in the mountain state. Recent reports, including the 2014 Governor's STEM Council report and the 2017 West Virginia Forward report, identified an increased STEM focus as a key strategy for growth and development.

Major occupational groups with West Virginia STEM-related jobs are also heavily impacted by technology and computer science. They include: manufacturing; natural resource development; healthcare practitioners and technical occupations; computer science occupations; agriculture and environmental science; and aerospace and engineering.

Computer science jobs are considered high wage and high skill. Workers in these occupations will use computer science skills to drive our state’s innovation and competitiveness by generating new ideas, new companies and new industries.

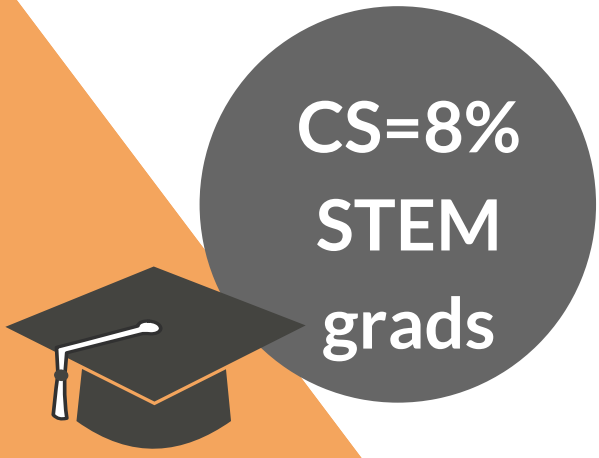
2018

WHY COMPUTER SCIENCE (CS)?

According to Code.org the "STEM" problem is in computer science. Fifty-eight percent of all new STEM jobs are in computing while only 8% of STEM college graduates are in Computer Science.

This presents an additional challenge for West Virginia schools to educate PK-12 students with the computer science/coding skills that will enable them to be ready for success in a 21st century economy.

Expanding statewide access to computer science education programs is a key strategy in addressing this challenge and is the focus of this report.



BACKGROUND

The STEMx™ network is a multi-state STEM network which provides an accessible platform to share, analyze and disseminate quality STEM education tools to transform education, expand the number of STEM teachers, increase student achievement in STEM and grow tomorrow's innovators. West Virginia University Center for Excellence in STEM Education (WVUCE-STEM) is the STEMx lead in West Virginia, partnering with The Education Alliance, the Governor's STEM Initiative, and the West Virginia Department of Education (WVDE). In fall 2017, West Virginia submitted a STEMx Challenge Grant proposal to convene stakeholders and make recommendations to expand statewide access to Computer Science (CS) education in West Virginia. The Planning Committee included members from the STEMx team (WVUCE-STEM, The Education Alliance, the WVDE, and the Governor's STEM Initiative) along with the Appalachian Regional Comprehensive Center (ARCC). The convening occurred on February 2, 2018 and included approximately 100 participants from diverse perspectives such as STEM educators, business and industry leaders, state policy makers, school district leadership, higher education institutions, and not-for-profit partners.

The theme for the convening was "STEM Forward: Building West Virginia's Capacity through Computer Science." The morning sessions provided an overview from state and national leaders. State Superintendent Dr. Steve Paine shared his vision for expanding CS within the state's comprehensive approach to STEM education. Sean Roberts, Director of Government Affairs for Code.org, presented an overview of nine policies that will improve access to K-12 CS focused on clarity, capacity, leadership, sustainability, and equity/diversity. In the afternoon, participants divided into small groups for open-ended discussions around potential opportunities, partnerships, collaborations and next steps. Sarah Sayko, WV State Coordinator for ARCC, and Lori Whitt, Assistant Director in the WVDE Office of Technology Integration and Support, facilitated the small group discussions as part of the state's efforts to develop a logic model for STEM education.

Within the outcomes of the STEMx Challenge Grant, The Education Alliance was tasked with summarizing the convening recommendations in a formal report. This report organizes the resulting recommendations around the resources, activities and outputs that will strengthen Computer Science across West Virginia. It will be shared with the Governor, State Superintendent and other key state leaders and provides a framework for next steps and future action items.

RECOMMENDATIONS REGARDING RESOURCES, ACTIVITIES, AND OUTPUTS TO STRENGTHEN COMPUTER SCIENCE EDUCATION IN WEST VIRGINIA

1. HOW CAN WE LEVERAGE EXISTING RESOURCES FOR COMPUTER SCIENCE?

Participants at the STEM Forward convening recognized hardware/software infrastructure, state leadership, human capital and active partnerships as the key resources that will support expanded access to CS education. Specific aspects that were highlighted within these four resources include:

Hardware/Infrastructure/Funding

Participants acknowledged that West Virginia has a strong history of support for instructional technology. In general, students currently have appropriate access to technology devices, including computer labs and mobile labs in schools. Some districts have successfully spearheaded one-to-one initiatives. Access to broadband, although still problematic in some schools, is also readily available in most schools and is a clear resource for strengthening CS education.

State Leadership

Many participants reflected positively on policy-makers' efforts to strengthen CS education. In 2016, the West Virginia Legislature passed House Bill 4730 requiring the State Board of Education to submit a plan to the Legislative Oversight Commission on Education Accountability on the implementation of computer science instruction and learning standards in the public schools. Later that same year, the West Virginia Board of Education adopted a policy change that requires every high school in the state to offer computer science courses. In 2018, State Superintendent Dr. Steve Paine tasked the WVDE with convening stakeholders to develop a Comprehensive Approach to STEM Education that identifies Computer Science education as a priority. The WVDE Office of Technology Integration and Support also serves as a resource by providing leadership to school districts in planning, hardware, software, infrastructure, professional development, instructional utilization, evaluations and assessment.

EXISTING RESOURCES

Human Capitol

Participants also identified human capital, specifically classroom teachers, as one of the state's most important resources. Along with the technology infrastructure highlighted on the previous page, there has been a systemic and ongoing effort to provide professional development for educators to empower them with necessary skills to utilize technology. Administrative support (at the state, district, and school level) and teacher preparation programs also provide a foundation upon which the state can build a robust teacher workforce prepared to teach computer science.

Active Partners

West Virginia has an abundance of partners who are committed to strengthening CS opportunities. Forum participants specifically identified these entities as strong collaborators in efforts to improve access to CS education:

- 4-H Clubs
- Benedum Foundation
- Business/Industry
- Carter Family Foundation
- Clay Center
- Code.org
- Community Foundations
- Community Museums
- Federal programs
- Girl Scouts
- Governor's STEM Initiative
- Higher Education Institutions
- Marshall University's June Harless Center
- NASA IV&V Education
- Parents/Families
- Public Libraries
- Robotics Clubs
- STEMx
- TechConnectWV
- The Education Alliance
- Volunteers
- WV Statewide Afterschool Network
- WVU Center for Excellence in STEM Education
- WVU Extension Agencies

2. WHAT ARE SOME PROMISING ACTIVITIES FOR COMPUTER SCIENCE?

Participants in the convening identified a plethora of opportunities to strengthen CS education within three Promising Activities: engaging students, building educator capacity, and strengthening partner networks.

Engaging Students

Participants discussed a vision of CS education in West Virginia that engages students within two critical strategies. First, equity and increased access to CS must provide opportunities for ALL West Virginia students. Access to CS education cannot by limited by zip code and must specifically reach traditionally under-served groups such as females and racially/ethnically diverse students. Specific activities include:

- Involve individuals from diverse backgrounds in CS courses to interact with students
- Increase student interest and motivation in CS by helping them discover real career opportunities in CS fields
- Integrate CS education as part of "Freshman Academy" that would provide a basic introduction to all high school freshmen
- Provide support to female and underrepresented groups through mentors and outreach efforts
- Utilize high quality, engaging, online curricular resources such as Imagine Academy (Microsoft), CS First (Google), and Swift Playgrounds (Apple).
- Engage high school alumni from the same school/state come talk about their CS career

Second, CS opportunities must prepare and inspire students through active learning, collaboration, and creative problem-solving that extend beyond the four walls of the classroom. To truly engage our students, CS education must move beyond the "nuts and bolts" of learning how to code and extend to capture our students' imagination and passion. Participants cited specific activities (including resources and technology around which activities may be based) including:

- Code.org
- Crypto Club
- CS First- Free
- Cyber Patriot
- Hacker Con
- Lego robotics
- Makey-makey
- Piper computer
- Raspberry Pie
- Robotics
- Scratch
- Sphero Ball
- Tynker
- Unplugged activities

PROMISING ACTIVITIES

Building Educator Capacity

Through Professional Learning Communities teachers can strengthen their CS content knowledge, pedagogical strategies, and technological skills to design effective Computer Science instruction for use in the classroom. By creating partnerships between regions and schools, the number of school-based CS professional learning communities will increase. Participants cited very specific examples of activities that will assist in this process including:

- Utilizing effective, existing professional development providers including Code.org and other online or virtual resources with potentially free curriculum and training
- Providing funding to support teacher participation in CS trainings and conferences
- Organizing curriculum team meetings around CS
- Developing models of schools' Master Schedule that ensure time for school-based CS professional development
- Ensuring that academic coaches & TISs are proficient in CS
- Incentivizing teachers to develop CS skills proficiency through certification and "micro-credentialling"

Strengthening Partner Networks

By exploring current issues in CS initiatives collaboratively, the collective impact of individual partners will be enhanced. Utilization of these partner networks will increase emphasis on CS at all grade levels. By enhancing efforts to communicate, collaborate, and leverage change, the next phase of a CS network development has the potential to create a new and dynamic learning opportunities for West Virginia students. Specific partner network activities may include:

- Regularly coordinated CS partner networking opportunities
- Collaborative public engagement efforts such as student coding contests etc.
- Coordinated in school/out-of-school CS learning opportunities for students
- Coding "boot camps" for educators and students
- Districts participating in free professional development and teacher community-building activities through Code.org and others
- Joint efforts to showcase positive CS learning outcomes

3. WHAT ARE THE INTENDED OUTPUTS OF COMPUTER SCIENCE EDUCATION?

For each of the above categories of Promising Activities, participants also discussed the Intended Outputs (direct results) that they hoped would occur. Although the discussion connected the outcome to a specific activity, for the sake of this report they are organized around three broader outcomes: Career Ready Graduates, Highly Effective Educators, and Productive Partnerships.

Career-Ready Graduates

Perhaps the most critical subset of outputs were the positive student outcomes discussed by participants. Together, these outputs will ensure that students are both career ready and "life ready" for success in the 21st century. Specific student outputs of increased access to Computer Science Education include:

- Students will have more familiarity and interest in CS
- Students will be interested in CS at a younger age
- Students will have equitable access to high quality CS education offerings
- Students will increase their CS skills and demonstrate them in a continuum of proficiency from basic proficiency and advanced skills
- Students will learn CS based on their own intrinsic motivation and be self-learners
- Students will develop positive dispositions such as critical thinking, problem solving, computational skills, team work and collaboration
- Students will develop knowledge and skills to apply their CS knowledge in real-world environments
- Students will understand CS career opportunities
- Student CS successes will be widely celebrated
- Students/families will have more awareness and enthusiasm for learning

INTENDED OUTPUTS

Highly Effective Educators

Participants acknowledged that building educator capacity in Computer Science is foundational to expanding access for students. Some of the intended outputs of Promising Activities for Building Educator Capacity (see page 7) include:

- Teachers will participate in meaningful professional development
- Teachers will learn to use new and exciting curriculum and CS technology
- Teachers will receive new CS credentials that recognize their professional development
- Teachers will help expand CS offerings to all West Virginia students
- Teachers will have more cross-disciplinary engagement in CS
- Teachers will leverage new support from outside partners
- Teachers will be leaders in their professional learning communities

Productive Partnerships

A variety of partners who are actively working to increase access to Computer Science education across West Virginia also participated in the convening. By implementing some of the promising practices, these partners envision a greater collective impact that:

- Partners will help raise community awareness regarding the need for CS education across the state
- Partners will cultivates support from parents/families for expanding access to CS education for all children
- Partners will strengthen a technology-rich culture within West Virginia communities to increase CS education
- Partners will make contributions to economic development as West Virginia youth learn skills that enable them to develop Apps, invent new products and launch entrepreneurial efforts across the state.
- Partners will help attract more businesses to locate in West Virginia as the quality of CS-skilled workforce grows

Acknowlegements

The Planning Committee would like to express its sincere appreciation to all of the individuals that participated in the “STEM Forward: Building West Virginia’s Capacity through Computer Science” convening and to those who helped shape the report findings. We also acknowledge STEMx and the Challenge Grant funding that enabled both the state convening and the development of this report. The combined contribution of stakeholders, funders, and policy makers helped build consensus for some key recommendations that will be instrumental in moving this important work forward in West Virginia.

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