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## *House Policy Committees*

*Rep. Kerry Benninghoff, Majority Chairman*

*Rep. Mike Sturla, Minority Chairman*



### JOINT POLICY HEARING AGENDA

#### Pennsylvania's STEM Learning Ecosystem: Building Pennsylvania's Workforce Through Informal STEM Partnerships

November 20, 2017 – Harrisburg, PA

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| <b>10:00 a.m.</b> | <b>Welcome by Chairman Kerry Benninghoff and<br/>Chairman Mike Sturla</b>  |
| <b>10:10 a.m.</b> | <b>Panel on National and State Level Perspective:</b> <ul style="list-style-type: none"><li>• <b><u>Julie Stolzer</u>, Director of STEM Learning Ecosystems/Community of Practice; and Senior STEM Consultant at the Teaching Institute for Excellence in STEM (TIES)</b></li><li>• <b><u>Matthew Stem</u>, Deputy Secretary for Office of Elementary and Secondary Education, Pennsylvania Department of Education</b></li><li>• <b><u>Laura Saccente</u>, Director, Pennsylvania Statewide Afterschool/Youth Development Network (PSAYDN)</b></li></ul>  |
| <b>11:00 a.m.</b> | <b>Panel from STEM Learning Ecosystems:</b> <ul style="list-style-type: none"><li>• <b><u>Rachel Miller Strucko</u>, Director of the Schools and Homes in Education (SHINE) Afterschool Program (Carbon, Schuylkill &amp; Luzerne STEM Ecosystem)</b></li><li>• <b><u>Todd Pride</u>, Co-Managing Director of LifeBuild Partners; and Managing Partner for Mid-Atlantic Youth Anglers &amp; Outdoors Program (Philadelphia STEM Ecosystem)</b></li><li>• <b><u>Robert Krasne</u>, Chief Executive Officer, Steinman Communications (Lancaster County STEM Ecosystem)</b></li><li>• <b><u>LaTredna Leonard Sherrill</u>, Director, Pittsburgh Regional STEM Ecosystem</b></li><li>• <b><u>Jesse Maine</u>, Director of Curriculum, Instruction, and Assessment, Southern Tioga School District (Pennsylvania Rural Ecosystem)</b></li></ul> |
| <b>Noon</b>       | <b>Adjournment</b>   |

### MORE INFORMATION

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**Joint Public Hearing with House Democratic Policy Committee on Pennsylvania's STEM  
Learning Ecosystem: Building Pennsylvania's Workforce  
Informal STEM Partnerships  
November 20, 2018 10:00 am–12:00 pm**

Julie Stolzer, Director of the National STEM Learning Ecosystem Initiative and Senior STEM  
Consultant with TIES (Teaching Institute for Excellence in STEM)

Good morning. I am delighted to be speaking to you today about the National STEM Learning Ecosystem Initiative and to let you know that five dynamic teams from the Commonwealth of Pennsylvania are setting a high standard of STEM innovation and leadership for other communities across North America to learn from and emulate.

The national STEM Learning Ecosystems Initiative (SLE) was officially launched with 27 Cohort 1 communities in 2015—including both Pittsburgh and Philadelphia—as an incubator and catalyst to establish a robust Community of Practice around STEM teaching and learning across the United States. The initiative is supported nationally with funding from members of the [STEM Funders Network](#) and regionally with locally cultivated public private partnerships, private and corporate philanthropic funding, as well as significant volunteer commitments of time, energy, leadership and in-kind support.

The inspiration for this initiative came from over 25 years of education and workforce research from leading institutions such as the National Institutes of Science and Engineering; Achieve, Inc. and their Next Generation Science Standards (NGSS) Framework; and The National Science Foundation, to name just a few. The founding funders of the SLE initiative were alarmed by the dire statistics on the anticipated lack of appropriately trained students able to fill the ever-expanding demand for a STEM-fluent workforce and the persistent gap in underrepresented students advancing in STEM fields. This extensive body of work inspired the Noyce Foundation to fund the 2014 research “[How Cross Sector Collaborations are Advancing STEM Learning](#)”. In this report, the authors examined 15 leading efforts to create STEM Learning Ecosystems that harnessed unique contributions of educators, business and industry employers, policymakers, out-of-school programs, science centers, libraries, families, and others in symbiosis toward a comprehensive vision of STEM learning for all children.

This seminal research, as well as an array of emerging work and research, continues to inform the SLE initiative as we iterate and respond to the rapidly changing economic, education and workforce conditions caused by a dynamic global information economy. (*A comprehensive and constantly updated list of additional resources is available at the [STEM Learning Ecosystems website](#).*)

To clarify: Science, Technology, Engineering and Mathematics, or STEM, are not 4 discreet subjects taught in silos to only those students who take AP classes. STEM is foundational and STEM is for all learners of all abilities and ages. STEM is actually an approach to teaching and learning that is transdisciplinary, hands-on, collaborative and works to better mimic real world conditions where working in groups across functional lines and using critical thinking and problem solving skills are required for all jobs in our increasingly complex world.

At its core, the STEM Learning Ecosystem model assumes that local communities of diverse and engaged collaborators from a rich array of sectors and points of view are best able to 1) determine what their community needs to thrive in the 21<sup>st</sup> century and to 2) access and leverage local assets to make that happen. The STEM Ecosystem model is simply a tool to support community-designed change.

This is what a STEM Learning Ecosystem may look like in practice:

- 1) A local employer engages with the community to share information about the unique workforce skills they need to thrive and grow now and in the future. They offer externships to educators to demonstrate how what is taught in the classroom translates to the workplace. They offer internships and apprenticeships to students to expose learners to real-world conditions and encourage cross-generational collaboration and learning that moves in both directions between educators and students.
- 2) Educators both in schools and in out-of-school settings, such as libraries or after school programs, use this information to inform their lessons and programming plans and create curricula to align with those mission-critical skills. They tangibly understand how what they are teaching is applied in the real world.
- 3) Institutions of higher education, including universities, community colleges, and career and technical schools, respond by co-creating with employers scalable, stackable credentialed programs aligned to the same workforce needs and skills.
- 4) Policy makers provide an easy path to implement innovative strategies for schools and businesses by removing barriers and providing incentives to encourage collaborative, grassroots, locally designed solutions to local problems.
- 5) Students are provided with real-world inspired lessons and experiences both in school and out of school that deepen their learning and understanding of an array of otherwise unknown career paths. They have access to new technology and mentoring in actual workplace settings where internships and apprenticeships are widely available.
- 6) Parents, families and caregivers actively promote STEM competency and fluency as an expectation for their children and know and value that a wide variety of post-secondary school options exist and can lead to successful careers and happy and secure futures.

- 7) Communities thrive with robust economic growth that benefits all and gainfully employed and citizens. Schools thrive while deeply engaging with stakeholders throughout the community and teachers feel valued, supported and proud of their important work in the STEM Learning Ecosystem.

This may seem implausibly naïve, but examples of each of these steps exist currently within the national STEM Learning Ecosystem Community of Practice. Many of these concepts are happening right here in Pennsylvania—today.

Some trends driving this approach are that we know:

- 1) We are educating our youth for jobs that do not yet exist and we do not yet know exactly what those jobs will be.
- 2) In many cases, we are using outmoded education models that have been largely unchanged in the last 100 years.
- 3) The lightning-fast pace of technological innovation means that some textbooks will contain outdated material before they are even delivered to the classroom. How can we expect classroom teachers to stay current on emerging technologies when even some of the creators of those technologies can't keep pace?

The answer, in short, is that we can't. We have to think differently to address these systemic challenges. We may not know exactly what job titles today's third graders will have in 15 years, but we have a good sense of the skills that will be required to succeed in the jobs of the future. These skills are embedded within the STEM Learning Ecosystem approach and philosophy.

At a national level, the STEM Learning Ecosystems Initiative is led by two funder co-chairs, Gerald Solomon of the Samueli Foundation and Ron Ottinger of the STEM Next Opportunity Fund. The program strategy, design, operations and management of the SLE, including technical assistance, is directed by TIES (The Teaching Institute for Excellence in STEM; [www.tiesteach.org](http://www.tiesteach.org)) led by TIES' CEO, Jan Morrison and me.

The program's design is based on extensive experience and lessons learned from our prior work on the Bill and Melinda Gates Foundation-funded investment in developing statewide STEM Networks. From that work came the understanding that sustainable communities supporting high quality STEM education for all learners require diverse cross-sector representation driven by the culture and workforce demands of the local community served. By coaching communities to help them design their own culturally relevant and responsive STEM Learning Ecosystems, we see much greater engagement and activation from the field of practitioners. The top-down or highly prescriptive models of the past tend to have less staying power than



those with deep local roots into the community they serve. In the STEM Learning Ecosystem model, stakeholders participate in local Design Teams facilitated by their technical assistance coaches and work collaboratively using the Engineering Design Process to create their own STEM Learning Ecosystems to suit their unique community needs.

Additionally, all 56 communities have access to:

- Approximately monthly STEM Learning Ecosystem webinars on a variety of topics of mutual interest.
- Bi-annual convenings to learn from thought leaders in education, workforce, policy, emerging STEM practices, philanthropic funders and work with colleagues from all over the country
- Curated Ecosystem-to-Ecosystem (E2E) presentations of exemplar models of programming to create conditions to prototype and scale promising practices.
- Online community to foster peer-to-peer learning, crowd-sourced problem solving and asset/idea sharing.

With this model in place, we are actively cultivating a Community of Practice that encourages peer-to-peer learning among and between all 56 SLE members. Our goal is to identify effective conditions and promising practices that give all learners the chance to become STEM literate and STEM competent citizens ready and able to pursue gainful, rewarding careers. Furthermore, the SLE initiative seeks to ensure that all employers of all types will have access to an abundant, appropriately trained and credentialed employee workforce to meet their business growth goals. In this way we believe that STEM Learning Ecosystems are much more than an “education initiative” but rather an essential element for creating thriving local economies to ensure a robust and healthy national economy.

Since the 2015 launch, hundreds of Ecosystem candidates have vied to become members of our growing Community of Practice, which currently includes 56 members across North America including British Columbia. Selected communities complete a rigorous and competitive application process to demonstrate their commitment to this approach. The Ecosystems vary widely in size, make-up and lead organization type, ranging from very large urban centers (New York City, Chicago and Los Angeles) to small rural communities (Downeast Maine, Cape Cod), singular statewide (Colorado, Indiana, Washington), and regional (Pittsburgh, Tulsa).

Pennsylvania has five officially designated SLE sites:

- PA SEED (the newest member added in July in Cohort 3)
- Pittsburgh Regional STEM Ecosystem
- Philadelphia STEM Ecosystem
- Carbon/Schuylkill/Luzerne STEM Ecosystem
- Lancaster County STEM Alliance

You will hear first-hand from these impressive communities today about the work they are doing. We view the Pennsylvania approach to SLE, which has been championed by your Secretary of Education with support from the Departments of Commerce and Agriculture, to be an innovative pilot we are eager to observe. Essentially, PA has leveraged the resources of this national initiative to catalyze innovation and growth throughout the Commonwealth, including launching an additional number of communities following the national model. This use of an existing platform to disrupt business as usual and explore novel opportunities for growth is exactly the sort of catalytic impact the founding funders imagined.

Within the PA Ecosystem communities, we believe we will find exemplar models and programs of promise that can be scaled throughout the country. We are already seeing evidence of the impressive work that addresses some of our greatest challenges including:

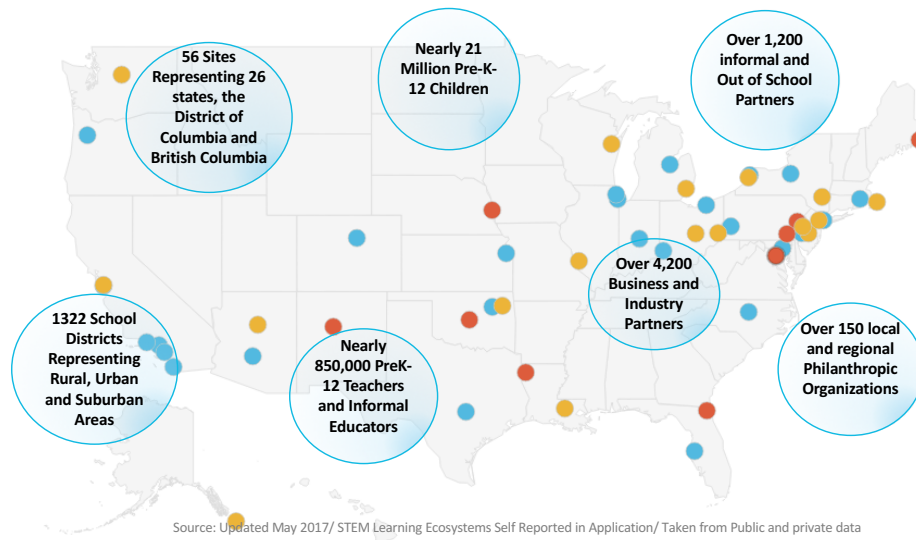
- How to have impact in rural under-resourced communities (The SHINE program in Carbon/Schuylkill/Luzerne STEM Ecosystem has already presented their work in our national convening)
- How to engage students and families in urban areas (Both Pittsburgh and Philadelphia have promising programs in this area)
- How to expose educators to the real world applications of their teaching in work settings to add context to their planning (Lancaster launched a very successful program this summer)
- How to engage school district leadership to advance the STEM Learning Ecosystem concept (PA SEED is designed with Intermediate Units in the lead role)

In addition to the tremendous work within Pennsylvania the potential impact numbers of this work are impressive. Based on data from the applications of our 56 member communities the STEM Learning Ecosystems Initiative:

- Is currently active in 56 sites representing 26 states plus the District of Columbia and British Columbia
- Has engaged over 1200 informal out of school partners, 4,200 business and industry partners, 150 local, regional and national philanthropic partners,
- Has the potential to reach 1,322 school districts, nearly 850,000 preK-12 teachers and informal out of school time educators and nearly 21 Million pre-k-12<sup>th</sup> grade children.

Thank you for this opportunity to discuss STEM Learning Ecosystems and thank you for supporting this vision for a robust and thriving STEM Future for the benefit of all.

## STEM Learning Ecosystems C1, 2 & 3



**We all live within ecosystems. Cultivating a STEM Learning Ecosystem to meet the needs of all young people requires intentional and strategic action toward shared goals.**

*Each STEM Learning Ecosystem is unique in design and practice, but we suggest the following design principles to help guide this work:*

1. There is no one right way, no 'correct model' for cultivating STEM Learning Ecosystems.
2. Ecosystems are complex and messy, and not necessarily linear. The goal of ecosystem cultivation is not to design the same STEM experience for all young people—but to maximize, grow and connect STEM learning opportunities so all young people have access to robust and connected learning experiences along pathways that are individualized according to their own interests.
3. Cultivating ecosystems requires a credible, highly engaged lead organization committed to collaborative practice.
4. Ecosystem cultivation features dynamic partnerships and diverse partners who share respect for each other's roles across sectors. The collaboration works by attending to the 'enlightened self-interest' of all partners.
5. Ecosystem cultivators embrace the values, beliefs, interests and strengths of diverse cultures that represent the communities they serve. Stakeholders welcome non-traditional partners and experiment with creative new ways to partner across sectors.

6. Identifying and eliminating barriers to equitable access to high-quality STEM learning for all young people is a key driver of ecosystem cultivation.
7. STEM learning ecosystems are grounded in the National Research Council's [Framework for K12 Science Education](#), [Surrounded by Science: Learning Science in Informal Environments](#) and [Community Programs to Promote Youth Development](#), as well as other research about how young people learn and develop.
8. Practices promote active, inquiry-based learning to 1) build students' competence and self-efficacy in STEM; 2) deepen their understanding of their current and future potential to solve complex problems; and 3) strengthen their social-emotional skills, including persistence, resiliency, creativity, problem-solving and collaboration.
9. Ecosystem cultivators value transparency and understand that data sharing and data-based decision-making are critical.
10. Collaborators prioritize time for reflection and peer exchange among and between practitioners engaged in implementing cross-sector strategies and organizational leaders focused on sustaining these efforts.

KEY STAKEHOLDERS IN A STEM LEARNING ECOSYSTEM INCLUDE:

- A credible, highly engaged lead organization committed to collaborative practice
- Schools and school districts
- Out-of-school time (OST) systems/programs
- STEM-expert museums and science centers
- Institutions of higher education
- STEM-related companies
- Businesses that recognize the need for STEM competencies
- Libraries
- Community-based organizations
- Philanthropies
- Families and parent organizations
- Youth organizations

**Joint Hearing of the House Republican and Democratic Policy Committees  
Matthew Stem, Deputy Secretary, Office of Elementary and Secondary Education  
November 20, 2017**

**Advancing Equity in STEM Education in Pennsylvania**

**What is STEM (Science, Technology, Engineering, Math) Education?<sup>1</sup>**

STEM education is an integrated, interdisciplinary, and student-centered approach to learning that encourages curiosity, creativity, artistic expression, collaboration, communication, problem solving, critical thinking, and design thinking.

**Why STEM Education?**

Pennsylvania's future rests on capacity of our young people to become the next "solutioneers" to society's greatest challenges. Building the capacity of every learner to be resilient problem solvers with the ability to communicate, collaborate with a diverse range of people and deploy a broad range of STEM skills from design thinking to computational thinking will ensure Pennsylvania is prepared for the needs of the STEM workforce.

National and regional data suggest that Pennsylvania needs to have a STEM-ready workforce to compete in the global economy.

- It is estimated that, by 2020, employers across the country will need an additional 1.6 million workers skilled in STEM.<sup>2</sup> In Pennsylvania, there will be approximately 300,000 jobs that require STEM skills or content knowledge by 2018;<sup>3</sup> and over the next decade, 71 percent of new jobs will require computer science skills.<sup>4</sup>
- Today, 60 percent of all occupations have up to 30 percent of job activities that could be automated with current and future technologies, making skills for working alongside or as collaborators with technology even more critical.<sup>5</sup>
- By 2025, more than 60 percent of jobs in Pennsylvania will require some form of postsecondary education or training, and an estimated nine in 10 STEM jobs will require continued education beyond high school.

These projected opportunities – coupled with an existing 21,000 unfilled computer science and software development jobs, as well as anticipated retirements in the engineering field – make the imperative for ensuring pathways for equitable access to STEM experiences for all students in Pennsylvania even more urgent.

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<sup>1</sup> Pennsylvania's definition of STEM education was developed by the PA STEM Coalition.

<sup>2</sup> U.S. Department of Education and American Institute for Research (AIR). STEM Leaders Workshop Report: "STEM 2026."

<sup>3</sup> The Alliance for Science & Technology Research in America: *Pennsylvania Federal R&D and STEM Jobs Report 2013*.

<sup>4</sup> *K-12 Computer Science Education in Pennsylvania*, Code.org, <https://code.org/advocacy/state-facts/PA.pdf>.

<sup>5</sup> McKinsey Global Institute | A Future that works: Automation, Employment and Productivity. January 2017

## Why Equity in STEM Education?

While opportunities in STEM abound, not all students have access to meaningful, high-quality STEM education or the prosperous long-term pathways they promise.

- According to a recent national report from Change the Equation, there are significant disparities in access to hands-on science activities between students in high-poverty elementary and middle schools compared with their peers in wealthier schools.<sup>6</sup>
- Students who take a computer science course in high school are six times more likely to pursue a computer science major, and women are 10 times more likely.<sup>7</sup>
- Only 1,559 high school students in Pennsylvania took the AP Computer Science exam in 2015; of those students, only 16 percent were female, only 36 students (2.3 percent) were Hispanic/Latino, and only 58 students (3.7 percent) were African American.<sup>8</sup>

## What is Pennsylvania Doing to Support Equity in STEM Education?

Over the past 18 months, the Pennsylvania Department of Education (PDE) has increased its focus on state-level support for STEM education, conducting more than 30 STEM stakeholder sessions across the commonwealth. As a result of these efforts, Pennsylvania now has a statewide STEM network, bringing together existing efforts in K-12 schools and communities across the commonwealth, in partnership with early learning, libraries, and higher education, as well as business and industry.

- **Pennsylvania STEM Coalition:** In November 2016, PDE launched a cross-sector PA STEM Coalition, which has grown to more than 150 members representing early childhood, K-12, and postsecondary education; public libraries; business, industry, and workforce development; and other national, state, and community partners. The group crafted a state definition for STEM education, and has identified strategies for improving equitable access to high-quality STEM education for all students in Pennsylvania.
- **STEM Ecosystems in Pennsylvania:** These state-led initiatives are aligned with existing and emerging locally-led, nationally-recognized STEM initiatives across the commonwealth, ranging from individual school and district level programs to more comprehensive regional “STEM Ecosystems.” Pennsylvania has five of the nation’s 54 STEM ecosystems formally recognized by the STEM Funders Network,<sup>9</sup> making the commonwealth second only to California as a national STEM Leader. STEM ecosystems are communities of practice that integrate resources from business, industry, philanthropic organizations, traditional education networks, afterschool providers, public libraries, museums, and others to provide high-quality STEM experiences for all students. Pennsylvania has been recognized as a national leader in STEM education for the collaboration between the state’s STEM ecosystems and larger educational systems.

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<sup>6</sup> *Ending the Double Disadvantage: Ensuring STEM Opportunities in Our Poorest Schools*, Change the Equation, July 2017, <http://changetheequation.org/ending-double-disadvantage>.

<sup>7</sup> Change the Equation analysis of Economic Modeling Specialist International, August 2015.

<sup>8</sup> *K-12 Computer Science Education in Pennsylvania*, Code.org, <https://code.org/advocacy/state-facts/PA.pdf>.

<sup>9</sup> [STEM Funders Network | STEM Ecosystems Interactive National Map](#). Pennsylvania’s five formally recognized STEM ecosystems include: Philadelphia STEM Ecosystem; Lancaster County STEM Alliance; Schuylkill/Carbon/Luzerne Region Ecosystem; Pittsburgh Area STEM Ecosystem; and PA SEED (Bucks, Chester, Delaware, and Montgomery Counties) STEM Ecosystem.

- **The Role of STEM Ecosystems:** At the center of STEM Ecosystems is the learner. The STEM Ecosystem then connects each learner with equitable in-school and out-of-school STEM opportunities to build their own STEM identity, literacy, skills, and knowledge.
  - **Engage every young person.** STEM identity is a key indicator of success in STEM-related opportunities in Pennsylvania. Since 2012, interest in STEM postsecondary opportunities (college or career) has increased by 5 percent. Despite these gains, significant equity gaps remain: only 13 percent of African American and 28 percent of Hispanic students display STEM interest and readiness, compared with 46 percent of their White peers.<sup>10</sup> Schools, libraries, nature centers, and YMCAs all provide opportunities to engage young people in STEM learning.
  - **Connect STEM learning opportunities across multiple settings.** Students want relevant, connected and real-world learning experiences. To meet that need, students should be provided with coherent learning opportunities through in- and out-of-school settings that challenge them to build complex skills to design, test, revise, collaborate, and communicate solutions to real world challenges bridge the gap between community and classroom. Coherent experiences build complex STEM skills like: computational thinking, design thinking, critical thinking, creative thinking, communication, collaboration, and resiliency.
  - **Match PreK-12 STEM learning pathways with opportunities in postsecondary and the workforce.** In Pennsylvania, STEM jobs are projected to grow by 8 percent between 2017-2027. Computer jobs are expected to grow by 10 percent, engineering by 4 percent and advanced manufacturing by 5 percent.<sup>11</sup> Between 2014-2015, only 31 percent of postsecondary certificates and degrees earned by Pennsylvania learners were in STEM-related fields.
  - **Equip educators with a STEM mindset and with STEM tools.** STEM education in Pennsylvania is an integrated, interdisciplinary, and student-centered approach to learning that connects the classroom with needs, opportunities, and challenges in the community. Only 1 percent of 4<sup>th</sup> grade students in majority-minority schools have a teacher that has an undergraduate degree in math; and that figure only increases to 8 percent of for 8<sup>th</sup> grade students.<sup>12</sup>
- **STEM Ecosystem Community of Practice Impact Goals:**
  - Identify and deploy metrics to determine impact of STEM Ecosystem from learner to community.
  - Cross-pollinate tools for ensuring equitable access to high-quality, rigorous STEM experiences for every learner.
  - Identify and design solutions to local, regional, and statewide workforce web gaps by generating connections between PreK-20 education and workforce.<sup>13</sup>
  - Design a playbook for communities across the commonwealth to establish a STEM learning ecosystem with the support of their local Intermediate Units, school districts, community organizations, workforce development boards,

<sup>10</sup> The Condition of STEM 2016 | Pennsylvania Report | [Prepared by ACT](#)

<sup>11</sup> Change the Equation | [Pennsylvania Vital Signs](#)

<sup>12</sup> U.S. Department of Education 2015 | Change the Equation | [Pennsylvania Vital Signs](#)

<sup>13</sup> Tools like the [Talent Pipeline Management](#)



economic development groups, chambers of commerce, postsecondary institutions, families, and businesses.

- **STEM Ecosystem Community of Practice Development Goals:**
  - By 2018, establish and sustain STEM Ecosystems in each of the five geographic regions Northwest, Southwest, Central, Northeast, and Southeast regions.<sup>14</sup>
  - By 2020, establish and sustain three rural<sup>15</sup> STEM Learning Ecosystems.
  - By 2024, establish a STEM Learning Ecosystem for each of the top 10 metropolitan areas<sup>16</sup> in Pennsylvania.
- **Cross-agency Support for STEM Ecosystems:** To strengthen the coherence of STEM Ecosystem networks a key component is intentional cross-sector collaboration. Strategies and policies that provide guidance for use of resources, incentives for collaboration, and pathways to intermittent or sustainable funding streams will help establish coherent and equitable STEM pathways for every learner in Pennsylvania.<sup>17</sup> STEM Ecosystems must leverage the diversity of STEM stakeholders to ensure entry points for every child along the STEM continuum PreK-20 and across STEM settings formal and informal. Cross agency collaboration should focus on five broad topics:
  - Braiding funding streams;
  - Promoting coherence from education to workforce;<sup>18</sup>
  - Establishing robust STEM experiences<sup>19</sup> for every learner;<sup>20</sup>
  - Establishing a coherent educator workforce partnership playbook; and
  - Ensuring consistent communication to STEM stakeholders connecting education, agency, and workforce.
- **Building Capacity and Technical Assistance:** As part of its statewide efforts to advance equity, PDE has established a statewide communication network and strategy for STEM education, as well as developing technical assistance and professional development resources.
  - The Department has established 28 Intermediate Unit (IU) STEM points of contact (POCs) across the commonwealth; all POCs have undergone training through the Carnegie STEM Excellence Pathway program, a recognized model.
  - PDE has partnered with the PA Training and Technical Assistance Network (PaTTAN) and others to support professional learning opportunities across the commonwealth:
    - Multi-tiered Systems of Support (MTSS) STEM Pilot (2017-2020) – Pennsylvania was one of 13 states to receive a National Science Foundation ACESSE Grant to support a comprehensive, 3-year professional learning experience for educators

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<sup>14</sup> Northwest and Northcentral regions are lacking formally recognized ecosystems. [ABC CREATE](#) is an informal serving Northwestern Pennsylvania rural counties of Butler and Armstrong.

<sup>15</sup> A county is [defined as rural](#) when the population density is less than 284 persons per square mile. Currently there are [48](#) rural counties with 27% of Pennsylvania's total population.

<sup>16</sup> As defined by the U.S. Census, which include Philadelphia, Pittsburgh, Allentown-Bethlehem-Easton, Harrisburg-Carlisle, Scranton-Wilkes-Barre, Lancaster, York-Hanover, Reading, Erie, and State College.

<sup>17</sup> U.S. Department of Education and American Institute for Research. STEM Leaders Workshop Report: "STEM 2026"

<sup>18</sup> STEM skills identification for middle skill and high skill STEM learning pathways.

<sup>19</sup> Mentorships, apprenticeships, work-based learning, job-embedded, and providing students with the business / industry problems(challenges) to help bring relevancy to classroom learning experiences.

<sup>20</sup> <https://www.lancasterstem.org/page/people-in-stem>

in grades K-3, developed in collaboration with Penn State University, ACESSE, Southern Tioga School District, and Steelton-Highspire School District.

- K-5 Computer Science Fundamentals – 10 trainings reaching 350 educators, in partnership with IU3, DCIU, Code.org.
  - Virtual STEM Professional Learning Community, comprised of monthly one-hour sessions designed and led by PA STEM Coalition members.
- ***National Recognition for STEM Education Efforts:*** Pennsylvania has earned national recognition for its efforts to improve quality and access to STEM education across the commonwealth.
    - In fall 2016, Pennsylvania was recognized by the White House for its work to advance equitable access to computer science education through the Obama Administration’s CSforAll initiative.
    - During the Fall of 2016, at the STEM Funders Network national Community of Practice Convening, Pennsylvania was invited to share its efforts to build grassroots support for STEM through statewide stakeholders sessions and the formation of the Pennsylvania STEM Coalition.
    - In October 2017, Pennsylvania officially became a CSforAll state by outlining existing initiatives that demonstrate a commitment to promoting equitable access to computer science education for all students, especially historically underserved students.



**Testimony to the Joint House Republican and Democratic Policy Committee  
In Support of Informal STEM Learning Environments in Pennsylvania**

November 20, 2017

Submitted by Laura Saccente

Director, Pennsylvania Statewide Afterschool/Youth Development Network (PSAYDN)

Good morning, Chairman Benninghoff, Chairman Sturla, and members of the House Policy Committee. My name is Laura Saccente, and I serve as Director of the Pennsylvania Statewide Afterschool/Youth Development Network (PSAYDN), a statewide intermediary supporting thousands of children, families and staff who participate in out-of-school time (OST) programs, such as afterschool and/or summer learning, across the Commonwealth. I thank you for providing a forum today to discuss the importance of informal Science Technology Engineering and Math (STEM) learning environments, with a focus on STEM Learning Ecosystems.

Founded in 2004, PSAYDN is one of 50 Statewide Afterschool Networks housed at the Center for Schools and Communities (CSC) in Camp Hill, PA, a division of the Central Susquehanna Intermediate Unit (CSIU) in Northumberland County. Since 1988, the Center for Schools and Communities has been committed to improving outcomes for children and families through training, technical assistance, program evaluation, research and resource development. The Center's work focuses on prevention and intervention initiatives operated by schools, organizations and agencies serving children, youth and families.

PSAYDN continues to expand its members, partnerships and funding sources to strengthen the Network and its activities. Guided by its mission - *To promote sustainable, high-quality out-of-school time youth development programs through advocacy and capacity building to enhance the welfare of Pennsylvania's children, youth and families*, PSAYDN brings together key policymakers, state agency representatives, local leaders, advocates and service providers to promote sustainable, high quality OST youth development programs, such as before- and afterschool and summer programming. With over 2600 members, over 6,000 recognized OST providers, over one hundred partners, and serving in all 67 counties, PSAYDN has grown the network by providing services and supports that influence and impact afterschool on national, statewide and regional levels.

Today, the private sector spends more than \$164 billion every year on employee education and training to close workforce skill gaps.<sup>i</sup> Almost all 113 CEOs surveyed for a Business Roundtable and Change the Equation report said that skills shortages was a problem for their companies and close to 4 in 10 companies said that at least half of their entry-level applicants lacked basic STEM skills.<sup>ii</sup> In a recent 2017 National Association of Colleges and Employers Job Outlook survey, more than 7 in 10 employers report that they look for employees who demonstrate strong teamwork, problem solving, and communication skills.<sup>iii</sup> These are not new trends, as the 2016 Workforce Development survey commissioned by the PA Chamber of Business and Industry indicated that 72 percent of PA

companies had difficulty hiring employees with adequate skills, training and education. The Chamber found that successful companies supported partnerships, programs and workforce development such as internships, apprenticeships, mentorships and training programs. The Chamber's survey indicated a strong reliance on collaboration/teamwork, verbal/written skills and project management knowledge.<sup>iv</sup>

This morning, my testimony will focus on the research of how informal STEM environments within the Pennsylvania's STEM Learning Ecosystems are well positioned to be an effective partner in developing tomorrow's workforce by teaching skills and personal growth opportunities that are not typically part of the formal school day. You will hear today how informal STEM environments are helping to close the gaps that exist between the skills and competencies students possess and the needs of employers—which range from communication and problem-solving skills to proficient technical skills. OST programs are also connecting students to the workforce in other ways, such as helping them discover new interests and professions they may never have considered entering into and providing real-world work opportunities to help them to reach their career aspirations.<sup>v</sup>

In 2012, PSAYDN began implementation of Project Accelerate, a comprehensive STEM systems building project to successfully engage and excite Pennsylvania students (Grades K-12) in STEM subject areas, and build staff interest and capacity. Project Accelerate has been funded through STEM Next (formally The Noyce Foundation) and Heinz Endowments. This initiative has enabled PSAYDN to advance STEM efforts in three key areas: OST STEM Program Sustainability; Public Engagement and Outreach; and OST STEM Systemic change. Within the five-year investment, over 70 STEM-Rich partners and OST staff have utilized increased STEM programming and assessment tools and 90 percent of the participating staff provided an additional 50 percent in STEM instruction/activities to students they served.

PSAYDN has been a significant contributor to the work on informal STEM learning, in serving on the Pennsylvania Department of Education's STEM Advisory Committee, the Pennsylvania State Workforce Development Board Youth Council and as a partner with the Carbon-Schuylkill-Luzerne (CSL) Stem Learning Ecosystem. In 2017, PSAYDN's STEM Coordinator, Dr. Winnie Black, was selected as one of 22 national STEM LEADs. Sponsored by the STEM Ecosystem Program, LEAD STEM is a new leadership development experience empowers individuals with skills to shape the future of STEM education in measurable ways across the country. In 2016, PSAYDN partnered with Drexel University and the Philadelphia Education Fund with a three-year National Science Foundation (NSF) ITEST grant entitled *Kids as Urban Scientists*. The grant targets 400 inner city fourth, fifth and sixth grade students and 80 teachers/afterschool providers in West Philadelphia for the development of a career exploration component with the STEM curriculum for elementary students.

Today, you will hear more about Pennsylvania's rich STEM ecosystems and just a snapshot of the work being done in those informal STEM spaces that brings excitement to student learning while helping to improve essential 21<sup>st</sup> Century skills. Whether it is 1) a videography lesson that simultaneously engages children in math drills by requiring them to manage a video shoot budget to (EducationWorks) 2) transformed recreation centers into technology-enhanced learning centers to (REC2TECH) 3) urban community gardens embedding entrepreneurial skills (Steelton Highspire) to 4) hiring and training high school students to serve as "tech warriors" in the OST program to mentor elementary students in STEM (Neighborhood Learning Alliance )—there are thousands of programs and examples across Pennsylvania uniquely serving our students in informal STEM activities.

We know Pennsylvania is challenged to increase the skill levels of the existing workforce and to fill the pipeline with talented individuals who are prepared for the opportunities of the 21st-century economy. In particular, afterschool and summer learning programs around the state are playing a major role to prepare the young people of Pennsylvania for future workforce opportunities. They are partnering with formal educators, higher education, Career and Technical Education (CTE) and local businesses to help students, many from disadvantaged settings, broaden their understanding of the skills required to be successful in the Pennsylvania economy.

Among the business and educational communities involved in STEM, there is a growing recognition that focusing on K–12 education is not a complete solution and that other organizations must join the effort. As a result, OST has emerged as a key partner in informing young people about employment opportunities and supporting the development of the technical and workplace skills required to qualify for the skilled workforce. OST, historically perceived as serving the primary role of providing a safe place where kids can stay during those hours when school is not in session and parents are not home to provide care—can offer high-quality educational content that extends the learning day for students. Quality OST programs offer a space in which students can learn through hands-on activities that develop their self-learning responsibility and decision-making skills.

OST programs are increasingly viewed as an important arena for academic enrichment<sup>vi</sup>. Expanding the school day through afterschool programs offers the opportunity to increase a student's exposure to high-quality STEM education by providing three elements that lead to an individual's persistence into a STEM career: engagement, continuity, and capacity.<sup>vii</sup> While continuity and capacity are important factors, there is evidence that engagement is potentially more important than achievement or course enrollment.<sup>viii</sup> After a 15-month review, the National Research Council's (NRC) Board on Science Education concluded in a 2015 study that out-of-school programs have been shown to:

- Contribute to young people's interest in and understanding of STEM.
- Connect young people to caring adults who serve as role models.
- Reduce the achievement gap between young people from low-income and high-income families.<sup>ix</sup>

I now wish to share with you exciting research our organization was a part in demonstrating that quality afterschool STEM programs help Pennsylvania students gain interest in science and develop skills they need to succeed in school and their future careers, such as critical thinking and perseverance. The 2016 Afterschool & STEM System Building Evaluation, an eleven-state study, was conducted by The PEAR Institute: Partnerships in Education and Resilience at Harvard University and the Institute for Measurement, Methodology, Analysis & Policy at Texas Tech University. The research, available at [stemreadyamerica.org](http://stemreadyamerica.org), brought forth the following results:

- More than 78% of Pennsylvania students reported a positive change in their interest in science.
- Nearly 73% of Pennsylvania students reported their "science identity" increased—their own assessment of being a "science person."
- More than 78% of Pennsylvania students reported a positive gain in their science career knowledge.
- Nearly 78% of Pennsylvania students reported a positive gain in their interest in science careers.
- More than 75% of Pennsylvania students reported an increase in their perseverance and critical thinking skills following participation in an afterschool program.

This research confirms that high-quality afterschool programs are inspiring young people, building their confidence, and igniting a passion for learning that will help them achieve their full potential. It adds to the growing body of evidence showing that kids achieve more with afterschool. Furthermore, these programs are a good investment. Every \$1 invested in afterschool programs saves \$9 by reducing crime and public assistance costs, improving kids' performance at school and increasing kids' earning potential.<sup>x</sup> A full report of the study is available at <http://stemreadyamerica.org/>. The website also includes a research compendium of 40 authors, highlighting information from across the country of the latest in the growing body of research on the important role afterschool learning plays in providing the skills that are in high demand by employers in today's workforce.

At this time, the only dedicated funding stream for OST in Pennsylvania is provided through the federally funded 21<sup>st</sup> Century Community Learning Centers (CCLC) program. The programs offer academic and enrichment opportunities to children, particularly students who attend high-poverty and low-performing schools, to meet state and local standards in core academic subjects through a broad array of activities that can complement their regular academic programs. The 21<sup>st</sup> CCLC program is authorized under Title IV, Part B of the Elementary and Secondary Education Act (P.L. 107-110), as amended by the Every Student Succeeds Act (ESSA) of 2016. Nearly 40,000 students participate in 21st CCLC programs across Pennsylvania. In the 2016 program year, there were over 150 grantees operating 464 centers across Pennsylvania, benefiting over 650 communities.<sup>xi</sup> STEM programming is a priority focus for Pennsylvania 21<sup>st</sup> CCLC programs, understanding that the more students participate in STEM learning opportunities after school, the more interested they become in STEM subjects and majors.<sup>xii</sup> Under ESSA, updated language also allows funding from the 21st CCLC program to be used specifically for workforce development and CTE partnerships. While these programs provide STEM programming to underserved, underrepresented youth, demand is high. Out of the approximate 100 grant applications for PA's 21<sup>st</sup> CCLC program in 2015, federal funding was available for less than half of those that applied. Approximately 20 states provide dedicated state funding to OST and/or informal STEM programming. A strategic investment could provide access to the underrepresented student populations not currently being served.

OST programs and the STEM Learning Ecosystems they are a part of play an integral role preparing students for their career pathways. PSAYDN recommends elevating informal STEM environments to a greater scale in Pennsylvania and investment to provide opportunities for our young people, including the more than 811,000 kids who would access an OST program if one were available to them. Similar investment recommendations were made in 2016 "**Afterschool: Improving Lives in Pennsylvania**" report. The data report, supported by the Afterschool Alliance, National Conference of State Legislatures (NCSL), and Afterschool Caucus leadership (Senator Ryan Aument, Senator John Yudichak, Representative Jake Wheatley and Representative Bernie O'Neill), reviewed national and state research that identified key components of effective OST programs, highlighted specific state examples and made the following recommendations to benefit more of Pennsylvania's children:

- Make investments in OST programs a priority
- Adopt quality guidelines that help OST providers communicate their values and result in successful outcomes
- Align resources and build partnerships to support high quality OST programming that helps Pennsylvania families and the commonwealth's workforce needs

We ask the PA General Assembly to pursue collective impact strategies that leverage public and private investments in order to increase the availability of and resources for informal STEM environments and STEM Ecosystems. We also ask the legislature to consider avenues for innovative professional development and curriculum initiatives to support both teachers and OST educators to provide complementary STEM content delivery. Federal statutes such as ESSA and the Carl D. Perkins Career and Technical Education Act can also be utilized to support these partnerships.

We thank the House Policy Committee for allowing us to share this research, recognizing the unique role of informal STEM education programs to build interest, identity and skills in a way that is different from school-day learning. We also encourage the General Assembly to develop a comprehensive approach to STEM policy in Pennsylvania through the STEM Learning ecosystems and/or informal STEM Hubs. We look forward to these discussions and can share other successful state models and/or provide additional forums for these discussions to occur. Thank you for the opportunity to testify and I look forward to serving as a resource for you.

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<sup>iv</sup> <https://www.pawork.org/workforce-development-survey/>

<sup>v</sup> [http://afterschoolalliance.org/documents/issue\\_briefs/issue\\_workforce\\_readiness\\_70.pdf](http://afterschoolalliance.org/documents/issue_briefs/issue_workforce_readiness_70.pdf)

<sup>vi</sup> [www.afterschoolscience.org](http://www.afterschoolscience.org)

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<sup>xi</sup> Data provided by the PA Department of Education (2017)

<sup>xii</sup> Wai, J., Lubinski, D., Benbow, C. P., & Steiger, J. H. (2010). Accomplishment in science, technology, engineering, and mathematics (STEM) and its relation to STEM educational dose. *Journal of Educational Psychology*, 102(4), 860-871



# Building Workforce Skills in Afterschool

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Today, the private sector spends more than \$164 billion every year on employee education and training to close workforce skill gaps.<sup>1</sup> Currently, more than 1 in 3 workers agree that they do not have the education and training they need to get ahead.<sup>2</sup> These issues beg the question about one of the major challenges facing the country: how do we sufficiently prepare youth to enter the future labor market as adults? Afterschool and summer learning programs are helping to close the gaps that exist between the skills and competencies students possess and the needs of employers—which range from communication and problem-solving skills to proficient technical skills. Afterschool programs are also connecting students to the workforce in other ways, such as helping them discover new interests and professions they may never have considered entering into and providing real-world work opportunities to help them to reach their career aspirations.

## **The skills and experiences most expected to build a strong and vibrant workforce are largely missing**

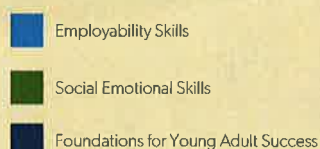
**Data spanning more than a decade indicate that there are sets of foundational skills and competencies that are strongly desired among employers, but challenging to find among potential employees.**

The ability to work in teams, solve problems, and communicate effectively are among the principal skills—included under various terminologies, such as “social and emotional learning,”<sup>3</sup> “employability skills,”<sup>4</sup> and “foundations for young adult success,”<sup>5</sup>—that employers consistently report desiring in their future hires. (See Figure 1.) In fact, in a 2017 National Association of Colleges and Employers *Job Outlook* survey, more than 7 in 10 employers report that they look for employees who demonstrate strong teamwork, problem solving, and communication skills.<sup>6</sup> This is not a new trend: a 2006 workforce readiness survey of more than 400 U.S. employers found that communication, teamwork and collaboration, and critical thinking and problem solving were among the most important skills reported.<sup>7</sup>

Figure 1:

## You say tomàto, I say tomāto.

When debating the skills and competencies students need to land their first job and do well in the workplace, one is likely to hear one or all of these terms: “social and emotional learning,” “employability skills,” and “foundations for young adult success.” While each framework has its own emphasis, a comparison of all three clearly illustrates their cohesive thread.



Yet, despite the high priority regularly placed on these skills, employers have long reported that these are skills difficult to find in potential and current employees. A 2017 Business Roundtable survey of its member companies found that although critical thinking, problem solving, and communication skills were highly relevant to positions within their company, these were also the skills that were challenging to find in qualified job candidates.<sup>8</sup> Similarly, employers in the 2006 workforce readiness survey largely did not rate new entrants’ communications, teamwork and collaboration, and critical thinking and problem solving skills as strong, reporting that, “many of the new entrants lack skills essential to job success.”<sup>9</sup>

### Hiring a workforce that possess the technical skills needed for open positions is another challenge for employers.

In addition to the foundational skills integral to success in the workplace, there are technical skills that are increasingly necessary in today’s rapidly evolving economy. For example, the U.S.’s STEM jobs will grow 13 percent between 2017 and 2027, compared to 9 percent of other jobs overall.<sup>10</sup> However, employers report difficulties recruiting qualified applicants. Almost all 113 CEOs surveyed for a Business Roundtable and Change the Equation report said that skills shortages was a problem for their companies and close to 4 in 10 companies said that at least half of their entry-level applicants lacked basic STEM skills.<sup>11</sup>

It is also important to note that the technical skills gap extends further than STEM-specific skills. Demand is high for middle-skill jobs,<sup>\*</sup> yet there is not an adequately trained workforce to fill job openings.<sup>12</sup> Although more than half of the current U.S. labor market is comprised of middle-skills jobs, only 43 percent of workers are trained for these jobs.<sup>13</sup>

### Job experience is another facet of the hiring challenge employers face when looking to fill open positions.

A third important category that factors into the hiring equation is one’s experience and familiarity with a position’s responsibilities. Despite the weight placed on job experience, a candidate’s lack of experience was one of the top reasons employers reported when asked why it was hard to fill positions, with approximately 1 in 5 employers reporting this to be the case.<sup>14</sup> Among unemployed adults looking for work, a lack of job experience was the number one obstacle to finding a job.<sup>15</sup>

<sup>\*</sup>Middle-skills jobs are those that require more than a high school degree, but not a four-year degree, such as health technicians, construction workers, and sales managers.

### Percent of Employers Who Look For the Following Attributes in a Candidate

Ability to work in a team	<b>78%</b>
Problem solving skills	<b>77%</b>
Written communication skills	<b>75%</b>
Verbal communication skills	<b>71%</b>

Source: National Association of Colleges and Employers, 2017

## Afterschool programs offer students a step up for future success

**Afterschool programs provide a ladder of supports that help students reach their career aspirations.**

Building students' workforce competencies is typically associated with programming for older youth, especially by connecting them to internships and apprenticeships, but preparing students for the workforce begins much earlier. While workforce experience is at the top of the ladder of supports afterschool and summer learning programs provide as students get older, there are intermediary rungs that students as early as elementary school can reach and programs without a workforce development focus can offer. For instance, afterschool programs serving younger students often work with students on their communication and teamwork skills, the foundational skills employers desire in their future hires. The flexible nature of afterschool programs also lend themselves to expose students to the wide spectrum of career fields, from introducing students to a potential new interest to taking students on field trips to local businesses to learn more about that field.

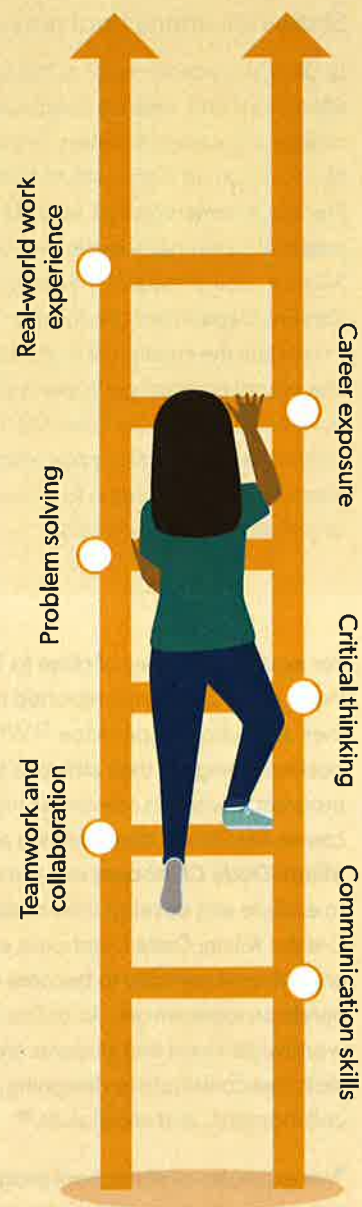
Research has found that younger students participating in quality afterschool and summer learning programs get along better with their peers and see gains in their pro-social behavior, as well as reductions in aggressive behaviors.<sup>16</sup> Among afterschool programs for older youth that focus on workforce readiness and building students' workforce skills, participation in programs has a positive impact on students' school day attendance and graduation rates.<sup>17</sup>

### **Building students' foundational skills and competencies that will help them in the workforce and in life.**

Close to 4,000 students in grades K-12 participate in *Minneapolis Beacons* (Beacons), which provides scaffolded leadership development opportunities to build students' foundational skills. Kindergarten through 5<sup>th</sup> grade Beacons students build teamwork and communication skills, work in groups, listen to and learn about different perspectives, and learn to reach consensus in a group setting. Middle schoolers work on goal-setting, explore their personal identities, and have the chance to become program assistants and youth advisory members, where they lead groups or clubs and weigh in on the activities offered at their center. In high school, Beacons students can also become program assistants and participate in the youth advisory council, continuing their foundational skills development as they plan, manage, and lead activities. In addition to the most recent Beacons Network Evaluation finding that the program spent more than 21,000 hours building students' communication, problem solving, and leadership skills, a 2016 longitudinal evaluation found that Beacons participants were 1.2 times more likely to attend school at least 95 percent of the time and 2.2 times more likely to graduate in four years relative to their peers.

### **Introducing students to new interests, opening their eyes to potential career pathways.**

A CareerBuilder survey found that approximately 1 in 4 high school students reported that career choice was based on something they saw on television or in a movie and 33 percent of full-time workers regretted their choice of college major.<sup>18</sup> Additionally, companies have reported their struggles finding qualified candidates with diverse backgrounds when looking at gender, race, and ethnicity.<sup>19</sup> Afterschool and summer learning programs—in which children from low-income households, African-American children, and Latino children are more likely to participate<sup>20</sup>—offer activities in various interest areas, introducing students to a diverse range of fields and occupations, including STEM fields.<sup>21</sup>



*Afterschool and summer learning programs provide scaled opportunities for students to gain foundational skills that employers desire in their future hires.*



## Statewide afterschool networks supporting workforce readiness

Large-scale systems—such as the 50 state afterschool networks—are also at work in the afterschool field, helping coordinate, grow, and strengthen afterschool programs' connections to college and career readiness. For instance, Kansas' afterschool network, the Kansas Enrichment Network, joined forces with the Salina Area Chamber of Commerce to develop the Education Practice & Immersion for Credit (EPIC) project, connecting afterschool youth in rural Salina to potential career pathways in the community. In South Carolina, the South Carolina Afterschool Alliance brought together a group of stakeholders, including a school district and the South Carolina Department of Education's Office of Career and Technology Education, and was able to facilitate the creation of digital badges that validated the skills and competencies high school afterschool program participants gained learning about careers in the health sciences. An upcoming white paper in late 2017 by the American Youth Policy Forum will further explore the systems-level work taking place across the country, including the ways in which state and local afterschool systems come together with workforce systems to prepare students for their futures, as well as their future careers.



For example, a survey of close to 1,600 students in 160 different afterschool programs found that 4 out of 5 students reported that their STEM career knowledge increased because of their afterschool experience.<sup>22</sup> What's more, 73 percent of students reported that they had a positive change in their attitudes toward STEM interest after participating in their afterschool program,<sup>23</sup> which is relevant as high STEM interest is positively associated with STEM course enrollment and selecting a STEM career pathway.<sup>24</sup> Students in the **YWCA Greater Miami-Dade Clubhouse** experiment with and build skills to use technology as an avenue to explore and develop their interests. As one of 100 Clubhouses across 19 countries, the Greater Miami-Dade Clubhouse empowers its student population (95 percent of whom are African-American) to become more capable, creative, and confident learners through hands-on experiences. An online survey of more than 1,300 youth involved in Clubhouses worldwide found that students are learning content in science and technology; building skills that contribute to designing, making, and problem-solving; and gaining professional, collaboration, and social skills.<sup>25</sup>



Two examples of afterschool programs connecting students to new career paths are **The City**, a program serving middle schoolers in Salina, Kan., and **MEDTwo**, a program that works with high schoolers in Columbia, S.C. The City students have the opportunity to take part in the EPIC (Education Practice & Immersion for Credit) project, headed by the Salina Area Chamber of Commerce. The project's goal is to create a "cradle-to-career continuum" in Salina. For instance, when learning about audiovisual jobs and digital production, students visited the local access television station where they were shown how to produce a show and put together their own video clips. MEDTwo's students gain a closer look at the health sciences field through a lecture series that brings in guest speakers representing an array of health science professions, including pathologists, pharmacists, and a trauma team from the local hospital. Speakers share with students what it takes to become a health science professional, discussing what a typical day looks like for them and the steps they took to get to where they are. There is also a lab component of the program, where students get hands-on experience in a health science profession. Students in both programs are able to earn digital badges to capture their new knowledge and skills.



### Providing real-world work experiences that help build students' familiarity with and capabilities in the workforce.

Connecting students to work experiences through activities such as internships, and preparing students for the work through developing job-seeking skills, are valuable opportunities afterschool and summer learning programs can provide to help students succeed in the workforce. Research has found that the benefits associated with early work experience include less time unemployed and higher hourly wages and annual earnings.<sup>26</sup> *Sunrise of Philadelphia* in Pa., provides scaffolded workforce development programming to their K-12 grade students. While elementary and middle schoolers build their foundational skills and explore career options, the program's high school students participate in career-themed clubs and take part in paid internships, gaining hands-on work experience in fields from social media marketing to the restaurant industry. Sunrise also helps set students up to land their first job through mock interview practice, resume support, and tips on dressing professionally. A program alumnus and current Sunrise group leader shared, "[Sunrise is] a very welcoming and loving environment . . . I learned a lot of teamwork skills and different ways to handle situations depending on who I may come across. These skills helped me land a job with Sunrise as a Group Leader."

High school students enrolled in the *EVOLUTIONS After School Program (Evoking Learning and Understanding Through Investigations in the Natural Sciences)* in New Haven, Conn., a majority of whom are from low-income families and are first generation college aspirants, have the opportunity for paid museum and lab internships. After one year, high schoolers who participate in the program—which explores STEM careers—are eligible to work in the museum or intern in Yale science faculty's laboratories. The program also introduces students to a range of career fields available within the museum, from graphic designers to exhibit technicians. Through a collaboration with local schools, students earn school credits for successful participation in the program. A survey of EVOLUTIONS students found that more than 5 in 6 reported an increased understanding of the connection between high school academics, college academics, and careers; an increased ability to work in teams; and an increased knowledge of science related careers.

## Conclusion

A strong and vibrant economy is reliant on a strong and vibrant workforce equipped with the necessary skills, competencies, and knowledge. Afterschool and summer learning programs play an integral role readying students for their career pathways; not only helping them develop the foundational skills that are critical across the different contexts of their lives from an early age—including in school, in work, and in their everyday interactions—but providing them with opportunities that stretch their ideas of what is possible and of what they are capable. Programs introduce students to diverse career fields, teaching them about the array of jobs within each field and connecting them to internships and apprenticeships. Afterschool and summer learning programs are making sure that all students, regardless of their zip code, receive the supports that will follow them from school to the workforce, as they make the transition into successful adults.

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"[Sunrise is] a very welcoming and loving environment . . . I learned a lot of teamwork skills and different ways to handle situations depending on who I may come across. These skills helped me land a job with Sunrise as a Group Leader."

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— Sunrise of Philadelphia Alumnus





## Endnotes

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# Afterschool Learning is a Powerful STEM Solution

The number of science, technology, engineering and mathematics (STEM) related jobs is increasing much faster than overall employment. To fill these jobs, we need to engage youth early to get them excited about STEM and help build the skills they will need for the future.

## New research shows that STEM afterschool programs are an effective part of the solution.

With an innovative research design, a team from the PEAR Institute at Harvard University and McLean Hospital and IMMAP: Institute for Measurement, Methodology, Analysis & Policy at Texas Tech University surveyed nearly 1,600 youth and their program leaders in 160 programs across 11 states. They collected and analyzed data from observations of programs, student self assessment and teacher/facilitator questionnaires to create a fascinating new look into STEM in afterschool.

### STEM Learning in Afterschool Works



78% of students said they had a more positive attitude about STEM because of their afterschool experience.

INSPIRE



73% of students said they had a more positive STEM identity because of their afterschool experience.

EDUCATE



80% of students said their STEM career knowledge increased because of their afterschool experience.

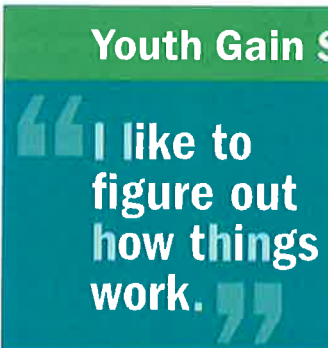
EXPLORE



72% of students said their perseverance and critical thinking skills increased because of their afterschool experience.

PREPARE

### Youth Gain STEM Skills



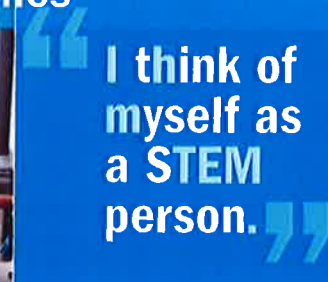
“I like to figure out how things work.”



More than 70% of students across all states reported positive gains in areas of STEM interest, STEM identity, STEM career interest and career knowledge, and 21st-century skills, including perseverance and critical thinking.

### Focus on Quality Yields Positive Youth Outcomes

STEM afterschool programs with the highest quality ratings demonstrated the most positive student outcomes. The gains in STEM interest and skills underscores the return on investment from building capacity in programs and focusing on quality.



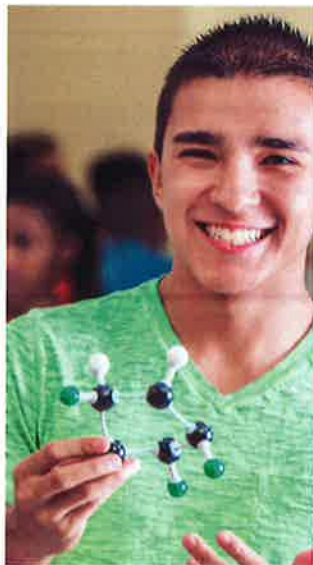
“I think of myself as a STEM person.”

Source: The PEAR Institute: Partnerships in Education and Resilience, Harvard University and IMMAP: Institute for Measurement, Methodology, Analysis & Policy, Texas Tech University, 2016

[www.STEMReadyAmerica.org](http://www.STEMReadyAmerica.org)



# More Details on What Youth Learn in Afterschool STEM



## Increasing Interest in STEM

**78% of students across all states experienced a positive change in their self-reported attitudes towards STEM interest following participation in their afterschool program.**

These youth are excited about STEM and innovation, they like to make things, they are curious about mathematics, engineering and related subjects, and they like to figure out how things in the world work, such as how rain forms or airplanes fly.

## Building a STEM Identity

**73% of all students reported their STEM identity positively increased following afterschool program participation.**

These youth find STEM easy to understand and that their friends and teachers believe they are a “STEM person” who does well at STEM.



## Sparking Interest in STEM Careers

**80% of the students across the 11 states reported a positive gain in their STEM career knowledge following program participation.**

Additionally, students reported significant gains in STEM career interest and STEM activity participation, with more than 75% of students reporting positive change in these areas.

These youth know where to find information about STEM jobs and the steps to take to get hired; they know that the connections that what they learn in STEM now is important and useful to them and will help them get a job later. They visit websites about STEM and frequently participate in STEM clubs outside of school.

## Building 21st-century Skills

**72% of students across all states reported their perseverance and critical thinking skills positively increased following afterschool program participation.**

64% of students across all states reported having higher quality relationships with adults and peers in their lives.

Results showed participation in a STEM-focused afterschool program made a positive impact across all 11 states on students' 21st-century skills, including perseverance, critical thinking and quality of relationships with adults and peers.

These youth like to think about different ways to solve problems, that they keep working to finish a task even if it takes longer than expected, that they discuss problems with adults they can trust, and that they get along well with peers.

Working across 11 states (FL, IA, IN, KS, MA, MD, MI, NE, OR, PA, and SC) the Afterschool & STEM System-Building Evaluation involved nearly 1,600 youth in 160 programs providing STEM learning opportunities.

[www.STEMReadyAmerica.org](http://www.STEMReadyAmerica.org)





# BACKGROUND ON STUDY

The Afterschool & STEM System Building Evaluation 2016 was funded by the C.S. Mott Foundation and STEM Next and examines the impact of afterschool programs on student attitudes.

Two-year study across 11 states, more than 160 programs and nearly 1,600 students.

Researchers analyzed retrospective self-reports completed by students and surveys completed by program instructors.

More than half of the programs (82) evaluated are funded by the federal 21st Century Community Learning Centers program.

It was conducted by The PEAR Institute: Partnerships in Education and Resilience at Harvard University and the Institute for Measurement, Methodology, Analysis & Policy at Texas Tech University.

## Overall Key Findings

- 1. STEM Learning in Afterschool Works:** Participation in STEM-focused afterschool programs led to major, positive changes in students' attitudes toward science and 21st century skills.
- 2. Good Programs = Better Results:** Students participating in high-quality STEM programs and students with facilitators who followed a formal plan for STEM activities reported more positive gains.
- 3. Dosage Matters:** Time spent in STEM afterschool had a significant impact on kids' interest in STEM and belief that they gained 21st century skills.

# Findings: Pennsylvania

## **More than 78% of Pennsylvania students reported a positive change in their interest in science.**

These students are excited about science and innovation, they like to make things, they are curious about mathematics, engineering and related subjects, and they like to figure out how things in the world work, such as how rain forms or airplanes fly.

## **Nearly 73% of Pennsylvania students reported their “science identity” increased—their own assessment of being a “science person.”**

These students find science easy to understand and that their friends and teachers believe they are a “science person” who does well at science.

## **More than 78% of Pennsylvania students reported a positive gain in their science career knowledge.**

These students know where to find information about science jobs and the steps to take to get hired.

## **Nearly 78% of Pennsylvania students reported a positive gain in their interest in science careers.**

These students know that the connections they learn in science now are important and useful to them and will help them get a job later. They visit websites about science and frequently participate in science clubs outside of school.

## **More than 75% of Pennsylvania students reported an increase in their perseverance and critical thinking skills following participation in an afterschool program.**

**OR**

## **Self-reported critical thinking (76.4%) and perseverance (75.8%) increased among the majority of Pennsylvania students following participation in an afterschool program.**

These students like to think about different ways to solve problems, that they keep working to finish a task even if it takes longer than expected.



I would like to thank Representative Kerry Benninghoff (R-171) and Representative Mike Sturla (D-96) for holding this hearing on the Pennsylvania's STEM Learning Ecosystems: Building Pennsylvania's Workforce Through Informal STEM Partnerships.

My name is Rachel Strucko and I am the Director of the Lehigh Carbon Community College SHINE Afterschool Program in Carbon and Schuylkill counties.

In 2016, the Carbon Schuylkill Luzerne (CSL) STEM Ecosystem was one of only 57 communities in the U.S. designated as an official STEM Ecosystem in the National Community of Practice. The CSL STEM Ecosystem is an initiative representing school districts, Intermediate Units, career and technical Schools, business/industry, community groups, higher education, and policy-makers from Carbon, Schuylkill and Luzerne Counties. The ecosystem members are committed to exposing students to the real life STEM experiences that will be necessary for the 21st Century Workforce.

Over the past year, Ecosystem members have created a comprehensive communication plan, developed a system to map STEM activities in the three counties, and designated representation on the PA STEM Leadership Board under the Secretary of Education. Through generous Educational Improvement Tax Credit donations from UGI, Lehigh Carbon Community College SHINE afterschool program was able to create four makerspaces with three partnering school districts. During the school day, the district utilizes the spaces for project based STEM activities and in the afternoon and evening the SHINE program uses them for afterschool program STEM activities.

Most recently Lehigh Carbon Community College, the lead agency for the Ecosystem, submitted a National Science Foundation Grant to implement a comprehensive K-3 teacher professional development plan in STEM learning for eight school districts (Jim Thorpe, Lehigh, Panther Valley, Tamaqua, Shenandoah, Mahanoy, Greater Nanticoke and Wilkes-Barre) in CSL counties. The project links informal and formal education through SHINE (Schools and Homes in Education). The Life Through SHINE project will integrate the promising practices of the successful SHINE afterschool professional development plan into the regular classroom. If funded, it would be the first comprehensive teacher professional development plan in STEM learning. **“I believe this comprehensive professional development framework is perhaps the first in the state and maybe the country. Through the mobilization of our ecosystem resources and providing our teachers the requisite opportunities to learn and grow our teachers we will be better equipped to engage students who are ready and eager to learn”.** Dr. Tony Grieco Executive Director Luzerne Intermediate Unit.

The Vision of the CSL Ecosystem is that all students will possess the needed STEM skills to be competitive for the 21st Century jobs in Northeastern PA. All educators are provided the training and tools to insure students are STEM competent and literate.

The **HEART** of the ecosystem is **SHINE (Schools and Homes in Education)**, a nationally recognized afterschool model that is a result of a grass root initiative that began in 2004 in Carbon County. SHINE is a 21st Century Community Learning Center program partially funded through the Department of Education in Pennsylvania.

The SHINE afterschool Program has been a prevention strategy for Carbon, Schuylkill, and Luzerne Counties. SHINE addresses several chronic, regional issues – poor school performance, lower higher education attainment, crime, higher poverty, and workforce development issues (reduced number of skilled, trained, and educated workers). The strong social/emotional components of SHINE help reduce risk factors that lead to negative behaviors such as issues in academics, familial problems and neglect, peer influences, and idle time. These same factors are also important for delinquency and gang

prevention. SHINE has been a catalyst for change by bridging the gap between formal and informal education. District Superintendents are actively working with the SHINE staff to equip formal educators with STEM learning principles by bridging OST STEM curriculum to the K-12 setting through joint professional development and training on emerging technology.

The SHINE afterschool model developed and administered by Lehigh Carbon Community College (LCCC), has provided academic support for over 4,500 students in eight school districts and one career and technical school spanning over 700 Square miles in Carbon and Schuylkill County. The SHINE program is a comprehensive 42 week after- school/ summer program including kindergarten home visits, 1st-4th grade STEM centers, 5th- 8th grade STEM Career Academy and high school mentoring program.

The SHINE program has created a unique academic support system that allows students to prepare for success at an early age. Each individual that participates in SHINE has an equal opportunity to excel, and is encouraged to do so. The characteristic that separates SHINE from other after-school programs is the unifying of schools and homes to achieve a holistic social and academic foundation.

**The success of the SHINE Afterschool Program lies in the “Whatever it takes,” philosophy adopted by SHINE instructors and administrators to help a student to achieve his/her potential.**

**Simultaneously SHINE in partnership with local schools has instituted early warning and prevention strategies that have increased educational attainment and decreased the likelihood of a student dropping out.**

The program prides itself on offering a network of academic and social services while contributing to the improvement of academic performance, student behavior and attendance and facilitating family involvement. The SHINE project’s mission is to link schools and homes in education to build a strong social and academic foundation.



The goals of the SHINE Program are:

1. To improve academic performance
2. To improve student behavior and school day attendance
3. To increase knowledge of STEM (Science, Technology, Engineering & Mathematics)
4. To facilitate family involvement in student learning and improve family literacy

The Demographics of the SHINE K-5<sup>th</sup> grade from 2008-2016 include: 100% referred for academic support, 89% low income, 21% minorities, and 33% have IEP's. **Despite those odds**, the effectiveness of the SHINE program has been documented in a longitudinal study with over 11 years of data.

	Homework Completion (HC)	School Attendance	Classroom Behavior (CB)	Academic Performance (AP)
2007-08	82%	31%	59%	74%
2008-09	82%	43%	69%	83%
2009-10	86%	40%	63%	83%
2010-11	84%	45%	64%	80%
2011-12	79%	37%	57%	73%
2012-13	76%	45%	56%	76%
2013-14	80%	48%	63%	82%
2014-15	81%	40%	62%	81%
2015-16	77%	39%	54%	77%
<b>2016-2017</b>	<b>80%</b>	<b>71%</b>	<b>67%</b>	<b>79%</b>

100% of administrators surveyed in all participating districts Strongly indicated SHINE is “having a significant positive impact on students”, and is having a positive impact on student achievement”.

100% of parents surveyed indicated they were pleased with the SHINE program (and that has been the case for more than 10 years on annual surveys). Ninety-eight percent of students were promoted to the next highest grade level for the 2017-18 school year.

WWW.AttendanceWork.org has highlighted the SHINE program for its exemplary attendance policy.

National consultant, Dr. Hedy Chang, published an article entitled, “Compendium of Success in After-



School Programs”, highlighting the SHINE after-school program and its successful strategies to improve school day attendance. SHINE feels that part of its success with good attendance is due to the highly motivating nature of the after-school program. The program design has become a motivational tool of its own.

Cross-sector partnerships have created a seamless pathway from pre-school to college promoting school readiness, STEM education, college ready students, - the foundation for a successful workforce. The Carbon/ Schuylkill SHINE program has been recognized for its work in STEM learning and the development of 21st Century work skills by numerous state and national publications. Most recently in STEM Ready America, a compendium of studies, reports and commentaries, SHINE was highlighted in “Career and College Exploration in STEM,” authored by Betsey Brand the Executive Director of the American Youth Policy Forum and Jessica Kannam, Policy Research Assistant. The article highlighted three exemplary high quality STEM afterschool programs in the country including the Lehigh Carbon Community College Carbon/Schuylkill SHINE program, Project Exploration in Chicago, Illinois and Evolutions a program at the Yale Peabody Museum in New Haven, Connecticut.

The work of the Ecosystem has resulted in the expansion of the SHINE Program into Luzerne County in the Fall of 2015. With the expansion into Luzerne County, there are 19 STEM centers in the Northeast serving 1,300 students and their families. **Congressman Lou Barletta on the replication of the Lehigh Carbon Community College Carbon/Schuylkill SHINE into Luzerne County said: “SHINE is a natural progression of what we have been doing through Operation Gang Up. The goals remain the same: to improve public safety in our region of Pennsylvania, healthy and educational alternatives to getting immersed in gangs.”**

The foundation of the SHINE program is based on research - based practices and a strong focus on STEM learning. An instructional plan is developed for reading/math readiness skills, which includes regular communication with the classroom teacher. The program utilizes innovative teaching strategies that focus on student strengths. SHINE has been featured in a national research paper as one of 15 programs in the

nation developing a STEAM Ecosystem, “HOW CROSS-SECTOR COLLABORATIONS ARE ADVANCING STEAM LEARNING”, February 2014. SHINE’s comprehensive 42-week after-school and summer program includes kindergarten home visits (The Little Scientist) which includes a mechanism for students in PreK Counts and Head Start to seamlessly enroll in SHINE Kdg. home visiting program. In the 2016-2017 school year SHINE Carbon/Schuylkill Home visitors made 1,814 visits.

Students seamlessly matriculate into the 1<sup>st</sup>-4<sup>th</sup> grade STEM centers, 5<sup>th</sup>- 8<sup>th</sup> grade STEM Career Academy and the high school mentoring tutoring program. The curriculum/instruction is inquiry based and has a real world connection. Students in elementary STEM centers take part in a 42- week STEM curriculum based on high-priority occupations. The curriculum places an emphasis on developing critical thinking and problem solving skills, global awareness, and effective communication. Utilizing physics, math, engineering skills, and art, students construct a bridge in small groups. Students become the banker, engineer, construction worker, and site manager and work cooperatively to build the bridge. Students build a solar house and wind turbines with the assistance from a representative from the Green Energy Partnership. Students experience project based activities through a new 3 D printing technology curriculum. The curriculum was developed by SHINE teachers and funded by Dept. of Community and Economic Development. Students worked with a local contractor/electrician to construct a dollhouse. Using Tinkercad, students designed and used a 3 D printer to print dollhouse furniture, attached solar panels, and electrified the dollhouse. The learning experience took student "through the process of designing, inventing and fabricating, as well as the skills used in industrial design, and engineering. Students experience how designers, architects and inventors find solutions. The results have included: 3rd-5th grade STEM Survey 2014-2016 92% strongly agree/agree that math/science will help them be more successful, 72% strongly agree that math is something they get excited about (Harvard Pear Math Survey), 67% said they had more friends now (Harvard Pear Science.) Middle School students: 95% strongly agree or agree that getting good grades is important to them (Harvard Pear Science), 100% strongly agree/agree that graduating from high school is important (Harvard Pear Science), 70% strongly agree/agree that science is an important subject because they will need it later for what they want to study.

90.77% STEM of the parents said their children improved in self-confidence. 100% of the OST teachers who were also classroom teachers said they had a better understanding of STEM and 100% said they would increase STEM activities in their classroom due to their experiences in SHINE. SHINE was one of eight programs in the country to be video-taped by Click2 Science for the Harvard University Dimensions of STEM training for administrators in the areas of Inquiry and Reflection.

**“I think the SHINE Program should always be there. I have five grandkids; all attended the program and continued through the school year with good academic grades, good behavior and they are very respectful. My oldest at this time is a senior and has been accepted into Penn State. The SHINE program also provided meals for my children”. Grandmother from the Shenandoah Elementary Program.**

**The middle school Career Academy program located at the career and technical schools builds on the STEM skills taught in the elementary program. The middle school curricula include five (6) week hands-on career projects. Academic teachers team with technical teachers, many from business and industry sectors, to work in technical/science labs. Teachers utilize an inquiry based learning approach. “When I was in fourth grade (at Penn-Kidder Elementary in Jim Thorpe), I was introduced to the wonders of the Schools in Home and Education program or SHINE,” he said Thursday at the annual Lights on Celebration at Jim Thorpe Area High School. “When I heard they were building hovercrafts at CCTI, my jaw dropped to the floor. I needed to be enrolled.” Trevor Keefer 12<sup>th</sup> grader at the Jim Thorpe High School, President of Senior Class 4.0 GPA. Trevor plans to attend the University of Pittsburgh and major in chemical engineering.**

The projects reinforce academic skills and demonstrate a real-world application to why reading, math, and science play a very important role in the student’s future. Teachers have observed the level of confidence increase as students work to complete projects. Through the engineering process students worked with engineers from Kovatch, a global leader in manufacturer of fire trucks to build two slingshot race cars. SHINE collaborated with UGI Gas Company to transform an engine to run on natural gas as well as

biodiesel. Young women in the program are a priority and most show a strong interest in the program projects. The long-term result has been that 40% of the 9th grade class in 2017 at the Carbon Career and Technical School were SHINE students. Students enrolled in the Career Academy improved in academics, attendance, behavior, and had a 98% promotion rate. The Career Academy has been a flagship program for SHINE. “Just as Career and Technical Education (CTE) can be an effective pathway for STEM education, efforts to bolster STEM education across the nation can advance certain CTE programs and goals. Efforts to support STEM and CTE are mutually reinforcing, and there are also advances driven by the STEM reform movement that can help advance CTE.” CTE Is Your STEM Strategy NASDCTEc [www.careertech.org](http://www.careertech.org) December 2013. With 50% of the future STEM careers, needing career and technical skills the SHINE Career Academy has effectively created a STEM career path through its partnership with the Carbon Career and Technical School.

**“Quality after-school programs make a difference not only in a child’s life in their academic excellence, but it also makes a difference in the private sector partners like Highwood USA and AT&T,” he said. “It (STEM) is really about pushing students to the full limit of their academic potential. We need to drive women, boys and girls into STEM programs.” Senator John Yudichak**

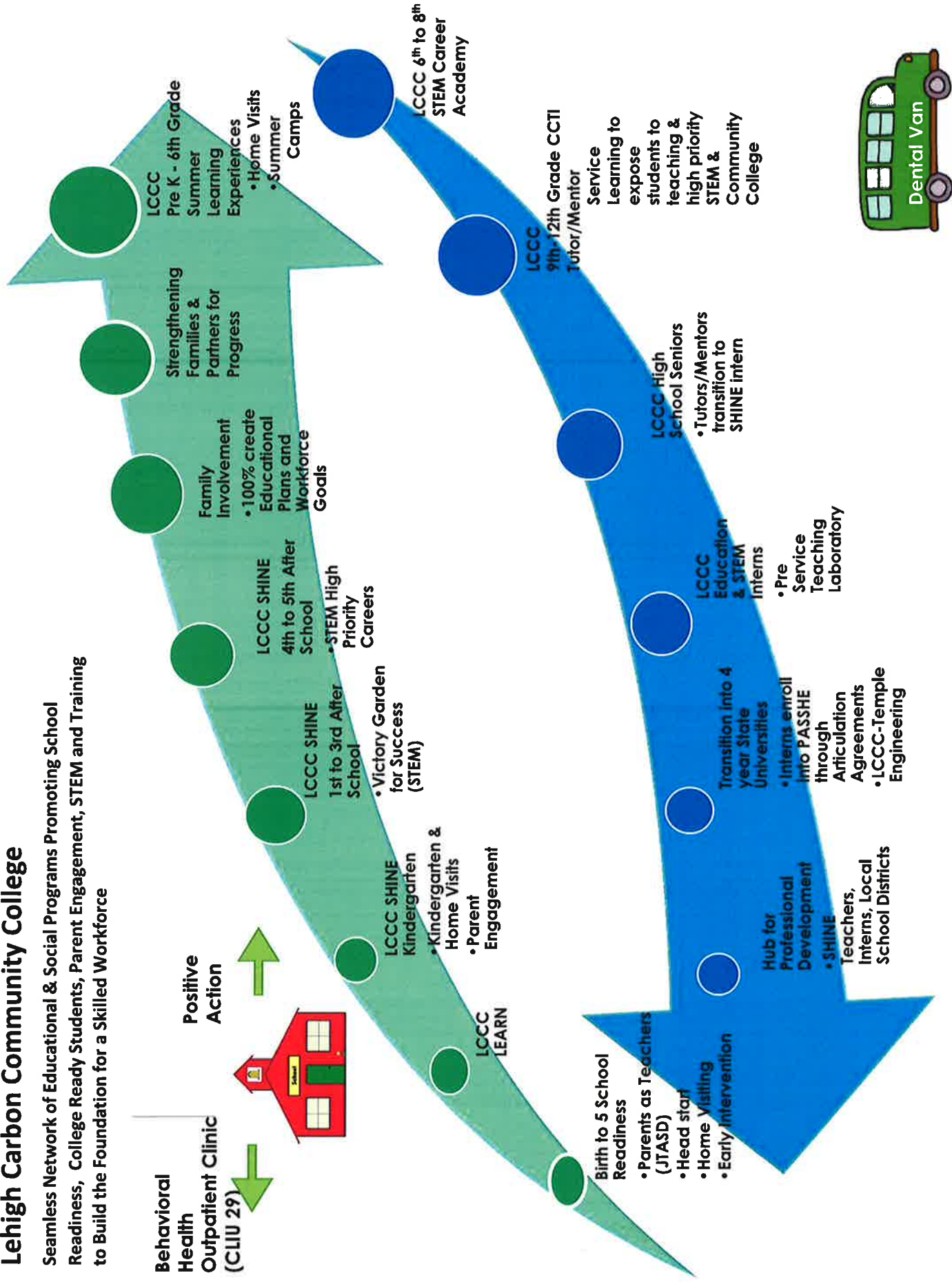
The CSL ecosystem is a true community success story. School administrators, guidance counselors, school day teachers and SHINE teachers have worked together to create a STEM-rich community driven by classroom innovation, forward thinking and future workforce opportunities. We have found that collaborating, sharing resources and shared professional development makes us stronger and better able to serve the students and families in our communities.

# Lehigh Carbon Community College

Seamless Network of Educational & Social Programs Promoting School Readiness, College Ready Students, Parent Engagement, STEM and Training to Build the Foundation for a Skilled Workforce

Behavioral Health Outpatient Clinic (CLIU 29)

Positive Action





410 Center Avenue, Jim Thorpe, PA 18229  
570-325-2771 [www.shineafterschool.com](http://www.shineafterschool.com)

## **LCCC SHINE 21<sup>st</sup> Century After-School Program Early Warning System and Prevention Strategies**

The success of the SHINE Afterschool Program lies in the “Whatever it takes,” philosophy adopted by SHINE instructors and administrators to help a student to achieve his/her potential. Simultaneously SHINE has instituted early warning and prevention strategies that have increased educational attainment and decreased the likelihood of a student dropping out.

\* The following early warning strategies work because SHINE teachers and administrators emphasize the importance of developing a positive relationship with ALL families.

### **1. Monitoring Attendance *Data Collection on Attendance Triggers Call to Parents***

- Parents Sign a Contract – Parent Teacher Agreement & Handbook
- No School / No SHINE – If they are not in SHINE we know they are in school
- Center Teachers Fax weekly – Entered into Database for the Month – Teachers
- Receive Monthly Reports on Average Daily Attendance and the % Each Child Attends During the Month so are alerted on chronic absenteeism)
- Teachers Receive Attendance Every Nine Weeks From Schools
- Middle of the Year Letter – Importance of Attendance – Policy Reminder

### **2. Monitoring Academics**

- Parents sign a waiver to release all academic records, assessment and report cards to the SHINE after-school program
- 10 different data sources are used to assess student progress so after-school teachers know when a student is in academic distress
- Regular communication with classroom teachers and guidance counselors is established so after-school teachers can target academic weaknesses or if there are any behavior issues.

### **\* Prevention Strategies adopted by SHINE**

1. **Instructional Plans**- OST staff work with teachers/guidance in the development of student Instructional Plans to ensure we are targeting the necessary skills and that academic activities are aligned with school curricula. The Instructional Plan is a living document that is constantly refined to integrate best practices reassessing students periodically, identifying math, reading & science instructional goals. The Instructional Plan helps to insure teachers are providing activities that are assessment driven and focus on student strengths. SHINE Students who become more successful in the afterschool program become more confidence in the regular classroom.
2. **Teacher Professional Development** -One of the most important components in SHINE is having teachers who are armed with the tools to be effective educators in the 21st Century. The current SHINE program has received exemplary marks by PDE for its comprehensive 40 hours professional development plan. The plan is developed by the teachers. The first Friday of the month after-school teachers meet, have a meal together and receive 3 hour Act 48 training. Professional development is the key in providing the skills teachers need to incorporate after-school activities into aligned school district curricula and the ability to provide activities that are motivating as well as align to the students learning style. Teachers are trained to understand life ‘Beyond the Classroom Walls’ and the ability to create an environment that builds trust and open communication. Examples of Training include: the Culture of Poverty, Drugs/Alcohol and their Effect on Education and Developing a Resilient Classroom,
3. **Regular Communication with Parents**- Teachers are trained to regularly communicate with families before there are any issues with the goal of developing a positive relationship with parents before any problems occur. Students who transition into the Middle School program via the K-5<sup>th</sup> grade program have already developed a relationship with families through the summer home-visiting program.

**SHINE Engages At-Risk Students Through Hands-on Activities That are Relevant and Motivate** Research demonstrates that to keep an at-risk middle school student engaged in the educational process in regular or after school program you must provide leadership opportunities, mentoring relationships, hands on project based activities, experiences in the real world and high quality career programming. We have found the unique model of teaming technical and academic teachers, utilizing state of the art labs to be extremely effective and innovative. The product of this model is students who are highly motivated, happy and engaged in the learning process. We have also observed that it provides a sense of community and increases self-confidence and has been documented by parents and family members.





## About the SHINE Program

The SHINE program has created a unique academic support system that allows students to prepare for success at an early age. Each individual that participates in SHINE has an equal opportunity to excel, and is encouraged to do so. The characteristic that separates SHINE from other after-school programs is the unifying of schools and homes to achieve a holistic social and academic foundation. The program prides itself on offering a network of academic and social services while contributing to the improvement of academic performance, student behavior and attendance and facilitating family involvement. For each of the last several years, 100% of participating students are referred for academic reasons. The vast majority are from low income families, and nearly one third are minority students.

## Goals

- Improve academic performance
- Improve student behavior and classroom attendance
- Increase knowledge of STEAM ( Science, Technology, Engineering, Arts, Mathematics)
- Facilitate family involvement in students' learning and improve family literacy
- Serve as a deterrent for gang involvement and juvenile criminal activity

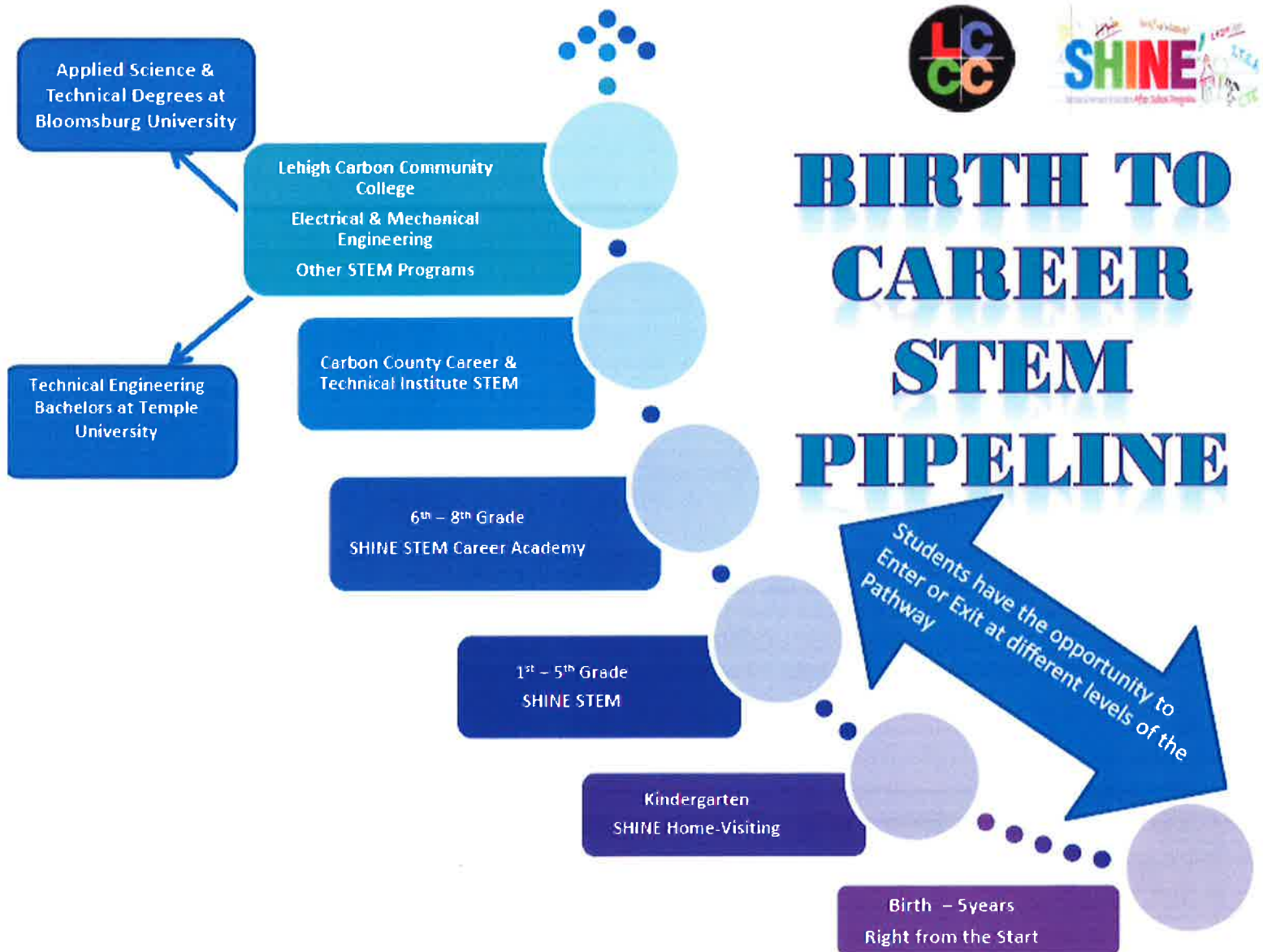


## Empowering Youth and Building Tomorrow's STEM Workforce

Since its inception in 2005, the SHINE Program has integrated STEM activities that motivate, promote the careers of the future and increase academic achievement.

Students are given instruction in areas such as Computer Aided Drafting, Heating Ventilation Air Conditioning (HVAC), Green Energy, and Transportation/Logistics.

The photo at right shows students and teachers working together to build a derby car. This project was the result of a collaboration between SHINE and Kovatch Enterprises.



## Success Stories

"Quality after-school programs make a difference not only in a child's life in their academic excellence, but it also makes a difference in the private sector partners like Highwood USA and AT&T," he said. "It (STEM) is really about pushing students to the full limit of their academic potential. We need to drive women, boys and girls into STEM programs."

-State Senator, John Yudichak



*"I think the shine program should always be there. I have five grand kids all attend program and continue throughout the schools year with good academic grades good behavior and are very respectful. My oldest at this time is a senior and excepted into Penn state also shine program provides a meals for my children that probably get meals until breakfast at school in the morning I think we should continue with any education, no matter what. This children are the children of the future and we need to help them no matter what they need to achieve in life."—SHINE Parent*

***"The SHINE program was originally championed by the late state Sen. James Rhoades. The program now serves as a lasting legacy to Rhoades"***

***-Times News 7/25/2013***

## Demonstrated Results

All children in the SHINE Program are referred for academic reasons. The vast majority are from low-income families and many are in special education programs or have remedial needs. Despite these challenges, the SHINE Program has a track record of successful outcomes for children in Carbon and Schuylkill Counties.

-98 Cohort 7 SHINE students (100%) were promoted to the next highest grade level for the 2017-18 school year

-100% of administrators surveyed in all participating districts Strongly indicated SHINE is "having a significant positive impact on students", is having a positive impact on student achievement", and "provides strong academic support in a safe environment"

-100% of Parents surveyed indicated they were pleased with the SHINE program (and that has been the case for more than 10 years on annual surveys

-98% of SHINE students demonstrated improvement on individualized Social Skill goals; 2% made no progress or declined

-85% of SHINE students did not have attendance problems and attended school on a regular basis.

-79% of Cohort 7 SHINE students Improved, Did Not Need to Improve, or Maintained Progress in improving Academic Performance



## Lehigh Carbon Community College



**LCCC Jim Thorpe**

1100 Center Street

Jim Thorpe, PA 18229

[www.lccc.edu](http://www.lccc.edu)

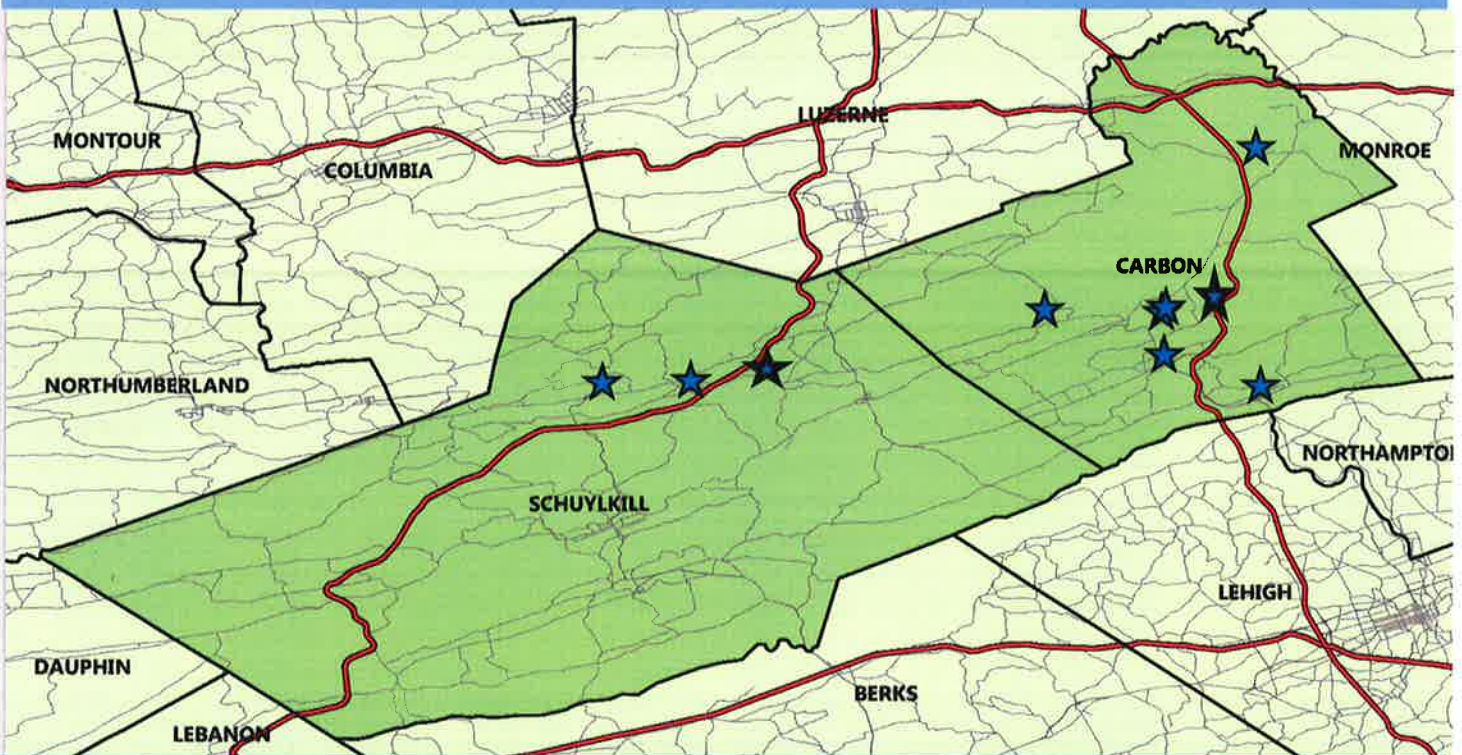
## Acknowledgements

The SHINE Afterschool Program is partially funded by the PA Department of Education 21st Century Learning Centers, Luzerne/Schuylkill Workforce Investment Board, and local businesses.

State Senators John Yudichak and David Argall and Congressman Lou Barletta have been strong bipartisan champions for the SHINE program. Through their hard work and support, the SHINE program has been able to thrive and grow!

Their support demonstrates the commitment to the children of Carbon and Schuylkill counties, our future workforce, and continues the legacy of the late Sen. James Rhoades, a champion of the SHINE Program.

## SHINE Centers



## Contact SHINE

**SHINEafterschool.com**

Jim Thorpe School District Building  
ATTN SHINE Program/Rachel Strucko  
410 Center Avenue, Jim Thorpe, PA 18229

**PHONE: 570-325-2771**

**FAX: 570-732-3916**



**PHILADELPHIA STEM ECOSYSTEM**  
[www.philastemeco.org](http://www.philastemeco.org)

Good morning.

My name is Todd Pride and I am the Managing Partner of the Mid-Atlantic Youth Anglers and Outdoors Program, which is headquartered in Southern Lancaster County and corporate offices in Philadelphia. More recently, I'm the Co-Founder and Co-Managing Partner of the LifeBuild Partners initiative.

I'm one of the lucky STEM educators because I get to teach STEM through fishing, archery, outdoors, wildlife, conservation, and agriculture education. I want to provide a context here of the seriousness and impact of our work with our partners and why the support of our state legislators is critical. With a little background; our Mid-Atlantic organization is completing our 9<sup>th</sup> year of operation this year and this summer we surpassed the 10,000# of students we've introduced and trained in fishing and related outdoors activities. We're one of the only organizations in the country that is full-time and year-round and with these activities that work with elementary, middle and high school students, parents, teachers, and community organizations leaders. We're the lead youth and adult fishing training partner of the largest outdoors retail store in the country, Cabela's located in Hamburg, PA which hosts over 6 million people a year and approximately \$100 million in annual revenue.

Our work in PA has also been recognized and modeled nationally given our success, as we were engaged by the fishing and boating industry in 2016 to help develop a national initiative to increase participation in these outdoors activities. We are also the only youth organization to have ever hosted and coordinated a major national T.V. fishing tournament, the 2014 Delaware River Bassmaster Elite Series event that broke the 40-year attendance records of these major season events, with over 37,000 people coming to Phila. to watch the 4-day tournament, and which has reached over 90 million people with the ongoing ESPN rebroadcasts of the event.

Through this past September, I committed 18 months of my work to assessing STEM and outdoors education in the Philadelphia afterschool and summer enrichment programs, that serve over 16,000 students per year at over 170 locations, and developed a strategy to simultaneously meet STEM educators', the outdoors industry, and national and state wildlife agencies and organizations' need to cultivate in youth a love of hands-on STEM education that translates to an ongoing engagement of nature, outdoors recreation, outdoors sporting, healthy activities and educational enhancement leading to greater employment opportunities.

The LifeBuild Partners initiative is the outgrowth of these assessment activities, and is a comprehensive initiative that is focused on engaging and educating students, families and community-based programs through hands-on building and craftwork-driven wildlife, conservation, agricultural, engineering, and land-preservation education projects. LifeBuild offers real world, problem-solving and solution-building STEM, workforce development, and life skills activities that teach and reinforce science, work ethic, and character development. Philadelphia after school urban agriculture programs, for example, are being coordinated by LifeBuild with PSAYDN and the PA Department of Agriculture's Workforce Development initiatives to introduce agricultural education, skills, and education to Philadelphia youth and families eager to take advantage of what will be 75,000 PA job openings in the agricultural industry by 2025.

The foundation and platform of this work is the Philadelphia STEM Ecosystem and the PA Statewide After-school Youth Development Network (PSAYDN), along with our statewide partners with the PA Fish and Boat Commission, the PA Game Commission and the Keystone Elk Country Alliance (KECA) among others such as the PA Dept. of Agriculture, community organizations, small and large companies. The Philadelphia STEM Ecosystem was one of the first STEM ecosystems established in the country by the STEM Funders Network. It now has over 80 member organizations encompassing the School District of Philadelphia, individual schools, intermediaries and community-based organizations, museums, environmental education centers, colleges and universities, government agencies, and businesses. In assessing the STEM market needs, demographics, challenges and opportunities, the Philadelphia Ecosystem partners developed five workgroups to carry out its activities, which are *Professional Development*, *Community Partnerships*, *Computer Science*, *Social Justice*, and *Education for Sustainability*.

The Philadelphia STEM Ecosystem that the Ed Fund runs continues to bolster and enhance the quality of organizations such as my own with its effective infrastructure and communication mechanisms that foster increased dialogue among different constituents (such as business and higher education), new connections with the Commerce Department and Chamber of Commerce, collaborative grant proposals such as to the National Science Foundation, and collective presentations to government officials such as the PA Secretary of Education.

Members of the Philadelphia STEM Ecosystem such as myself are convened by the Ed Fund, which sets the vision and mission; facilitates communication and connections among Ecosystem members; maintains a STEM Ecosystem Website; and communicates directly with Philadelphia Ecosystem Members. Through a Steering Committee, a small technical workgroup assures that Ecosystem goals, activities, and workgroups are aligned. Workgroups—Professional Development, Community Partnership, Computer Science, Social Justice, and Education for Sustainability—are a forum for members to synergize their work and leverage each other's experience and resources. Members such as my LifeBuild Partners expand our reach and impact through the STEM Ecosystem as the Ed Fund runs it.

While we all know the critical needs of STEM education throughout the state, a big question is "where can the impact happen at scale?" Our Mid-Atlantic organization has spent the past 10 years working at every

organizational contact point for students—before the school day, during the school day, at the elective end of the school day, and after-school and summer program environments. We determined that the most effective of these environments is the “after-school structure.” This environment is uniquely driven by having to attract, engage and keep students, because attendance is the students’ choice. It’s also an environment that is happening at scale throughout the Commonwealth. This is why the PA Statewide After-school Youth Development Network (PSAYDN) is so important to this work. It’s an organization that spans all the after-school organizations in the state and has the ability to identify and share their best practices across all after-school environments; whether taking place at a school or in a community organization. Further, the critical element of after-school structure, writ large, is that after school and enrichment capacity and offerings are what drive the success of the most successful educational institutions, everywhere—from college preparatory schools to our universities. Like highest quality prep schools and colleges, and what is important to acknowledge, is that after schools are “market driven.” Any parent anywhere will choose the best environments and offerings for their children, given the opportunity. College prep schools are not just private schools—they include our strong public and private schools that can provide the training, resources and mechanisms for students to get to college and vocational program opportunities.

You will and have heard all the data points on a state, local and national level about critical need of STEM education and career opportunities, but there are two simple factors that are about the success of students’ STEM and career needs— attracting students and hard work. Putting career opportunities and “STEM” in front of students has not worked at scale in the Commonwealth and in most communities. The biggest factor we hear from our partners— non-profit organizations, small businesses and major corporations—is the lack of work ethic and hard work. The LifeBuild Partners business model has been developed from over a decade of experiences to directly address this. Our Mid-Atlantic organization was one of the first in the country to demonstrate the academic connection between “STEM and fishing.” We’ve been doing this since our first year when we didn’t even know it. We’re not the “bobber and worm in the water” organization. Our training and activities focus on what we call the “path to college and careers,” which starts with how do you catch one fish and how do you catch more fish. Students learn about “meteorology”—barometric pressure, air and water temperatures, wind, sunlight, low light, cloud conditions, not just “weather.” They learn limnology and aquatic science, fish ecology—“what eats what,” water structures—ponds, lakes, streams, rivers and bays; tidal and non-tidal bodies of water and what’s the difference among these for successful fishing. They learn about rod and reel mechanical and materials engineering—graphite, fiberglass, composite—and what works best in various water conditions and using various lures and bait. Students learn about different types of fishing lines—monofilament, fluorocarbon and braid; what works best in various water conditions and using various lures and bait. Students learn types of live bait and artificial lures to use. For live bait, “what eats what” where you’re fishing, how do you find that out? For artificial lures, the same applies “what eats what” where you’re fishing, what is the material composition of the lures you’re considering, what are the sound attributes of the lures and what are the physics of the motion of the lure that will attract fish, etc.? What does all this mean? It means how to catch more fish and also a lot of STEM and without even using that word with

students, at the start. When our students-now-trainers are asked, what is the “blue and white” logo on your jersey, is that Penn State? “Yes, and I’m a PSU Bass Team alum and an environmental science major and I’m a petroleum engineering major.”

We focus on these activities with our partners the PA Fish and Boat Commission and the PA Game Commission as we help to expand them into urban markets like Philadelphia, stressing that at the core are these are very interesting, exciting and engaging STEM-driven activities in fishing, archery, wildlife education and conservation projects. One of the connected activities we’re focused on with these agencies and now the PA Dept. of Agriculture, is land and water conservation needs to keep our waterways cleaner from agriculture, commercial and residential stormwater run-off. It’s providing the opportunity with PSAYDN to get urban and rural students “hands on” with developing and implementing solutions such as riparian buffers, understanding and working with local farmers, developing these agriculture models at their after-school and school locations, and then helping to work on these models on Lancaster and Chester County farms, having fun and learning hard work through “showing up early and leaving late” —the characteristics of fishing, hunting, and agriculture, and the characteristics all employers want in an employee.

To end, I want to use a sports reference because ultimately, we’re all trying to “win” —the attention, engagement and commitment of students which are current and future employees. While I’m a Temple Owl, I respect and focus on success. Penn State football Coach James Franklin was recently asked about his preparation for each week. He said, “I’m not big on goal-setting, I want my players to focus on each day. I’m a big believer in you wake up every single morning, you maximize the day, you prepare the best you possibly can.”

Penn State is focused on success; many of you ultimately know this as PSU Alums. This is a model we all can use. Like PSU’s vast array of sports and clubs, after school programs have to be the best at what they do to attract students, get them engaged, keep them engaged, and get their commitment. We have some great models in this state to use to execute this mission of getting our youth STEM educated and working for our PA companies and organizations. With our work as part of the STEM Ecosystem and with PSAYDN, state outdoor agencies—and with your support— we can “win.”



## PHILADELPHIA STEM ECOSYSTEM

November 20, 2017

### National Context

- **Part of a National Movement.**
  - The Philadelphia STEM Ecosystem is one of fifty-six national STEM Ecosystems.
  - National STEM Ecosystems are supported by the STEM Funders Network and based on a collective impact model.
  - The purpose of the STEM Ecosystems is to facilitate coordination, communication, and collaboration around STEM education, to optimize student impact.
- **National Ecosystem Opportunities.**
  - STEM Ecosystem members participate in virtual and face-to-face communities of practice.
  - Members are also invited to special meetings and webinars.
  - Ecosystems can receive one or two AmeriCorps VISTAs each year.
  - Lastly, members receive training and customized technical assistance.

### Philadelphia Overview

- **Philadelphia STEM Ecosystem**
  - Philadelphia was one of the first STEM Ecosystems established by the STEM Funders network.
  - Goals are to increase collaboration among members; decrease duplication of programs and services; identify gaps in resources and opportunities; and improve student, family, and community access to STEM education.
- **Backbone Organization.**
  - The Philadelphia Education Fund is the backbone organization of the Philadelphia STEM Ecosystem.
  - As the backbone organization, the Ed Fund sets the vision and mission and facilitates communication and connections among Ecosystem members.
  - The Ed Fund maintains a STEM Ecosystem Website and communicates directly with Philadelphia Ecosystem Members.
- **Steering Committee.**
  - The Steering Committee is a small group of Ecosystem members that cultivates synergy between the Ecosystem goals, activities, and Workgroups.
  - The Steering Committee is comprised of one Co-Chair from each Workgroup, plus additional Ecosystem members.
  - The Steering Committee may not exceed 8 members in total.
- **Workgroups.**
  - The Philadelphia STEM Ecosystem currently supports five Workgroups.
  - These Workgroups are *Professional Development*, *Community Partnerships*, *Computer Science*, *Social Justice*, and *Education for Sustainability*
  - Workgroups meet monthly and implement projects that are authentic and manageable.
- **Members.**
  - The Philadelphia STEM Ecosystem currently has over eighty individual Members.
  - Members are stakeholders actively engaged in local STEM education efforts.
  - Members' organizations include schools and school districts, intermediaries and community-based organizations, museums and environmental centers, colleges and universities, government agencies, and businesses and corporations.
  - Members are subscribed to the Ed Fund's monthly Got STEM? Newsletter, receive special STEM updates, are invited to quarterly Ecosystem meetings.

- **Additional Information.**

- For additional information, contact Nancy Peter, Director of the McKinney Center for STEM Education at the Philadelphia Education Fund: [npeter@philaedfund.org](mailto:npeter@philaedfund.org).
- Visit <https://www.philastemeco.org>

### Philadelphia Accomplishments

- **Ecosystem Overall.**

- Effective infrastructure and communication mechanisms.
- Increased dialogue among different constituents (such as business and higher education).
- New connections with Commerce Department and Chamber of Commerce.
- Collaborative grant proposals such as to the National Science Foundation.
- Collective presentations to government officials such as the PA Secretary of Education.

- **Individual Workgroups.**

- Professional Development:
  - Have been compiling a database of STEM teacher professional development in the Philadelphia region.
  - Currently, about 80 different professional development resources have been identified.
  - In December, will analyze all resources to then determine what gaps/areas of need can be redressed.
- Community Partnerships:
  - Identified and organized a team of individuals representing: SDP administration (including assistant superintendents and principals), teachers, research, academic and corporate partners.
  - Developed a working relationship with SDP Office of Strategic Partnerships and provided feedback on “on-boarding” guide given to potential SDP partners.
  - Began to evaluate the needs of the SDP and determine a list of goals, including: creating a STEM-specific list of providers, creating an addendum to the “on-boarding” guide for potential TEM partners and possibly scheduling a forum for partners to recruit teachers and schools
- Computer Science:
  - Established a network of CS education providers in Philadelphia, ranging from after-school programs, to school district initiatives, to higher education programs.
  - Is developing a city-wide CS4Philly Campaign to bring together stakeholders in Philadelphia's digital economy and develop new opportunities to expand CS education for all Philadelphia youth.
  - Created a concept model for a web platform that allows youth to share computer programming work, engage in competitions, and learn more about CS education opportunities across the city.
- Social Justice:
  - Is tackling the issue of equitable access to meaningful STEM learning opportunities across the city.
  - Is focused on increasing access for currently underrepresented student groups including girls, Black and Latino students, students in high-poverty neighborhoods, and students in special education settings.
- Education for Sustainability:
  - Have recruited 14 School District of Philadelphia teachers and 3 Community College of Philadelphia faculty to participate in a teacher leadership pilot program.
  - STEM and Non-STEM teachers are integrating subject areas to develop units of study that align with the SDP Scope and Sequence and environmental, social and economic sustainability .
  - The year-long program will end with an all day Conference in April or May in which participating teachers will present workshops.
  - A Sustainability Ecosystem will pull together specific Sustainability stakeholders from all sectors of the STEM Ecosystem, to provide resources and support to teachers and students.

# Mid-Atlantic Youth Anglers & Outdoors Program

NJ ~ DE ~ MD ~ Central & S.E. PA ~ Southern NY

**Host of the 2014 Delaware River Bassmaster Elite Series Tournament**



**TAKE ME FISHING™**  
takemefishing.org

***Our mission is to expose & train urban region youth and their supporting adults in the “path to college” through fishing, boating, wildlife education and conservation activities.***

## ***Our Services for Schools, Youth Organizations and Employee Groups***

### **1. Basic & Advanced Small Group Fishing & Boating Training for Youth and Adults**

(Youth: elementary, middle, high school & college) (*single & multiple indoor and outdoor sessions*)  
(*Outdoor sessions to take place at bodies of water close to your locations*)  
(**Training in:** rods & reels variations, artificial lure use and variations, fishing conditions & structures, fishing strategies, tournament techniques and \*boating safety certification)



### **2. Development of Fishing and Wildlife Clubs and Activities for schools, youth organizations, colleges, alumni associations, community organizations and employee groups**



### **3. Biking, Fishing & Fitness Initiative for Student and Adult Groups**

(facilitation of group riding sessions to access multiple locations on a body of water – creek, river, lake, large pond) (*includes fishing & equipment training*)  
(\*participants provide own bikes but we can help arrange for rentals)

### **4. Conservation Projects for Youth & Adult Groups**

(watershed, stormwater run-off and habitat improvement projects benefiting local bodies of water and land management activities)



### **5. Bass Fishing Guide Service (8-hour or 4-hour sessions)**

on the Delaware River (PA-DE), Upper Chesapeake Bay (MD), Potomac River (MD), Lake Champlain (NY) or Hudson River (NY)



## ***We are seeking urban region students for participation in the annual Student Angler Federation State Bass Fishing Championship***

(for PA, NJ, DE, MD students: **Sat., July 9<sup>th</sup>** - Upper Chesapeake Bay, MD / Launch – Elk Neck State Park)

(for NY students: **Sat., July 15<sup>th</sup>** - Mohawk River, NY / Launch - St. Johnsville Marina, NY – central NY area)

(*Eligible: high school students including seniors not yet college matriculated / 7<sup>th</sup> or 8<sup>th</sup> grader fishing with a high school student*)

For more information go to: [www.highschoolfishing.org](http://www.highschoolfishing.org) (drop-down “Tournaments”)

**For engagement of services or inquiries, contact:**

**Todd Pride, Lead Coach, Mid-Atlantic Youth Anglers at 267. 615. 3630 or [CoachToddF16@gmail.com](mailto:CoachToddF16@gmail.com)**

**[www.Facebook.com/MidAtlanticYouthAnglers](https://www.facebook.com/MidAtlanticYouthAnglers)**

Regional HQ: Camp Oak Hill Farms \* 53 Camp Road \* Nottingham, Lancaster County, Pennsylvania 19362

# Mid-Atlantic Youth Anglers & Outdoors Program

{NJ-DE-MD-Central & S.E. PA-Southern NY}

An Education-Plus Health operation

## History of Accomplishments

(2008 – 2017)

Our mission is introducing and training urban region youth and their supporting adults in the “STEM path to college” through fishing, boating, archery, hunting, agriculture, conservation, motorsports and outdoor activities. We train youth and their supporting adults in the fundamentals of fishing, boating, warm water aquatic ecosystems, archery, wildlife management, habitat improvements, watershed conservation, stormwater management, agriculture and hands-on engineering activities through instructional training and experiential activities.

- 1). Introduced over 10,000 youth to fishing and the outdoors over the past 9 years
- 2). Introduced fishing programs at every contact point with youth: before the school day, morning part of school day, during school day for class credit, after school at schools, after-school youth programs and summer camps
- 3). Certified by the National Recreation & Parks Assoc. and the national Recreational Boating & Fishing Foundation as the Phila. Region’s *Take Me Fishing* Program (4 years)
- 4). Brought the national Student Angler Federation’s annual High School Bass Fishing Championship Tournament to 4-state region (PA, NJ, DE, MD) in 2012 (Blue Marsh Lake – Berks County, PA)
- 5). Awarded and recognized three years in a row by the Phila. Police Athletic League (PAL) for introducing within the organization, the first ever youth fishing program and archery activities (led by U.S. Olympic Archery Coach). (Phila. PAL is the largest youth organization in the Phila. with over 26,000 youth)
- 6). Introduced the first youth and adult fishing training exhibit at Philadelphia’s National Marina Day (2013)
- 7). Recognized by the “Beyond Sport World” global sports organization for helping lead the effort to implement a successful youth program for challenged urban youth - an initiative started out of the White House and U.S. Attorney’s Office (Sports For Juvenile Justice Program). Phila. program is facilitated by the Phila. Youth Sports Collaborative (PYSC)
- 8). Introduced a campaign in 2012 and leading the effort nationally in highlighting the connection between “*Fishing, Boating and STEM education*” subjects (Science, Technology, Engineering and Math) for middle and high school students
- 9). Introduced and recognized for a TV video about “Fishing and STEM careers” being used by school teachers in Phila. and nationally (2014) (project funded by Glaxo SmithKline and Dow Chemical)
- 10). Awarded the “Youth Sports Organization” award by the City of Phila. and Governor of Pennsylvania at the inaugural Sports & Education Expo (May 2014)
- 11). First organization to adopt the only fishable lake in the City of Phila. (FDR Park) for youth and adult fishing training and outings
- 12). Launched first youth fishing program in Berks County (PA) in 2013, home to the largest outdoors retail store in the country, Cabela’s, Hamburg, PA (current partner of the Mid-Atlantic Youth Anglers organization)
- 13). Hosted and coordinated the first major TV pro bass fishing tournament in the Phila. region, which was the first series event to take place in a major media of this size; the Bassmaster Elite Series (Aug. 7-10, 2014) (Penn’s Landing, Phila). Tournament broke all national fishing tournament series attendance records. The Mid-Atlantic Youth Anglers operation was the first youth organization to ever host a major pro fishing tournament.
- 14). Presented a Resolution by Phila. City Council for attracting and hosting the Bassmaster Elite tournament
- 15). Helped to coordinate the first ever Bass Conservation School in Pennsylvania supported by the PA Fish and Boat Commission and managed by the Wildlife Leadership Academy (2016-17)

**Todd Pride**, Managing Partner & Lead Coach \* 484. 746. 9881 \* [CoachToddF16@gmail.com](mailto:CoachToddF16@gmail.com)

*Regional Headquarters: Camp Oak Hill Farms \* 53 Camp Road \* Nottingham, Lancaster County, Pennsylvania 19362*



# Mid-Atlantic Youth Anglers & Outdoors Program

{NJ-DE-MD-Central & S.E. PA-Southern NY}

An Education-Plus Health operation

## **Environmental Aspects of Fishing that pertain to STEM** (Science, Technology, Engineering & Math) (not including hydro, material and mechanical engineering equipment and boating segments)

- **Tidal systems**
  - Lunar phases
  - Salinity
- **Delaware and Chesapeake Bays**
  - Two of the largest estuaries in the U.S.
  - Vital fisheries that can become highly degraded, reducing catches
  - Effects of Eutrophication reduction of dissolved oxygen
  - Nutrient cycling and Biomass production
- **Ecology**
  - Biotic + abiotic elements that make up communities
  - Food webs
    - Predatory-prey relationships
  - Aquatic organisms
    - Threatened and endangered fishes
    - Wildlife protection
    - Spawning/reproduction life cycles
    - Structure and habitat
  - Adaptations
  - Niche creation
  - Environmental pressures
    - Limiting factors
  - Aquatic vegetation
- **Watersheds**
  - Connectivity of streams, rivers, bays, oceans and lake/pond effects
  - Water quality
  - Stream health
  - Drainage systems
  - Wetlands
  - Erosion control
  - Flood control
- **Limnology (freshwater science)**
  - Lentic/lotic systems
  - Water stratification / lake turnover
  - Biogeochemical cycling
  - Geology
    - Lake formation
- **Climate change – global warming**
  - Rising sea water
  - Water temperature increase
  - Seasons
- **Meteorology**
  - Weather patterns and forecasting (historical factors)
  - **Barometric pressure / weather fronts effect on catching fish**

**By Jessica Moldofsky, Former Penn State Bass Team Member / Environmental Science major / Fishing tournament competitor and Advisory Board Member of the Mid-Atlantic Youth Anglers & Outdoors Program**



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PA Joint Policy Committee Hearing  
Testimony Provided by Robert M. Krasne  
November 20, 2017

Good afternoon. My name is Robert M. Krasne and I am the Chief Executive Officer for Steinman Communications, a multi-channel communications company delivering high quality news, information, and entertainment to diverse audiences along the eastern seaboard. Today I am here as Chairman of the Lancaster County STEM Alliance, one of fifty-four STEM ecosystems located throughout the United States. I am also representing The Steinman Foundation, a proud member of the National STEM Funders Network.

Thank you for inviting me to offer testimony on the importance of science, technology, engineering and math to the economic health of Lancaster County, the future prosperity of the Commonwealth of Pennsylvania, and the ongoing global competitiveness of the United States of America. I believe STEM is a critical 21<sup>st</sup> century literacy that all adults need to be successful in their roles as workers, family members and citizens. Today I am pleased to share with you the work we are doing in Lancaster to make our county a hub for STEM literacy and experiential learning. I will also offer state and national data suggesting STEM fields stand at the forefront of innovation within the U.S. economy. As Pennsylvania's legislative leaders, you have a unique opportunity to safeguard the prosperity of our commonwealth by endorsing and promoting formal and informal STEM learning in multiple arenas. The actions you take today will help to determine the economic legacy we bequeath Pennsylvania's next generation. Indeed, it is a weighty responsibility.

In 2015, over the course of several months, a group of Lancaster County thought leaders convened several times to explore the mismatch between employer talent needs and the skills and abilities of individuals entering the workforce. These thought leaders included employers, educators, legislators, service providers, local government and philanthropists. Together, we explored the talent needs of Lancaster County employers, reviewed public school student performance data, analyzed county occupational trends, consulted with higher education providers, and mapped STEM assets across our county. We reached the conclusion that our county is facing a significant STEM literacy crisis, particularly with respect to middle-level STEM occupations in advanced manufacturing, agribusiness, information technology, live entertainment and health care. Particularly sobering, prominent Lancaster County employers that have flourished in our county for generations told us unless we can increase the number of highly skilled STEM workers locally, they may be forced to move their enterprise to another area. This would, of course, be devastating to the economy of Lancaster County and would also directly impact the overall economic health of our commonwealth.

Based on our work together, we formed the Lancaster County STEM Alliance and articulated the following shared vision for future economic prosperity:

*As a hub for STEM literacy and experiential learning, Lancaster County will recruit and retain visionary job creators, inspire learners of all ages to achieve academic excellence, and engage all its citizenry in building a prosperous future.<sup>1</sup>*

We went on to articulate five strategic priorities in support of our shared vision: 1) public awareness, 2) rational career exploration, 3) curriculum alignment, 4) informal and experiential learning, and 5) bringing business and education closer. For the past two years, we have structured our work around these priorities by creating cross-functional teams led by key members of our community such as the Lancaster Chamber, which chairs our Rational Career Exploration Team, The Economic Development Company which chairs our Resource Allocation Team and Lancaster-Lebanon Intermediate Unit 13 which chairs our Curriculum Alignment Team. Using a collective impact model, we are working hard to change the quality, complexion and focus of the work that is already occurring throughout the county rather than adding additional responsibilities to the plates of already busy community leaders. Workforce development through STEM excellence is the north star that helps us align our work in support of Lancaster County's future economy.

I want to take a moment to define the STEM occupations we're talking about in Lancaster County. All too often when we refer to STEM occupations, people think we're talking about only astrophysicists, computer programmers, and electrical engineers. While these certainly qualify as STEM occupations, and we would warmly encourage anyone with these qualifications to make their home in Lancaster County, our greatest need is for workers with post-secondary technical training who can work in a team environment to solve complex workplace problems. This might include occupations such as quality control technicians, biomedical technicians, laboratory assistants, welders, job estimators, logistics managers, data center technicians, and CAD programmers. Each of these family-sustaining occupations requires STEM literacy and some degree of post-secondary training, but none of them requires a 4-year degree.

My intent is not to disparage 4-year degrees; it is merely to underscore the importance of STEM literacy and challenge the college-for-all philosophy that leads approximately 66% of high school graduates to enroll in a 4-year degree program. The sad reality is that three out of four of these students leave college prior to graduation, lack the STEM skills needed to obtain family-sustaining employment, are saddled with thousands of dollars in college debt and have no realistic way to dig themselves out of the economic hole we have helped them to create.<sup>2</sup> National data also tell us that half of all college graduates are not prepared for the 21<sup>st</sup> century workplace. This leads to mal-employment, a specific type of underemployment that exists because college-educated workers are forced to accept jobs that do not use the skills and abilities they acquired in college.<sup>3</sup> What are we doing to our children and why are we crippling our communities?

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<sup>1</sup> Strunk, S. (2015). Lancaster County STEM Alliance Final Planning Report. Available at <https://www.lancasterstem.org/wp-content/uploads/2017/03/STEMFinalReport.pdf>

<sup>2</sup> Fleming, K. (2013). *Success in the New Economy*. Available at <https://www.youtube.com/watch?v=zs6nQpVI164>.

<sup>3</sup> Harrington and Fogg. (2011). "Rising Mal-Employment and the Disconnection between Recent College Graduates and the College Labor Market."



Sixteen to twenty-four year-olds in the United States ranked last in a test of numeracy skills given in twenty-three developed countries.<sup>4</sup> On the National Assessment of Educational Progress, less than one-third of U.S. eighth graders showed proficiency in mathematics and science.<sup>5</sup> The percentage of females and Native Americans who say they're interested in STEM fields is now slightly higher than it was in 2000; however, the percentage of African American and Latino students who say the same is down dramatically.<sup>6</sup> Statistics like these underscore how ill prepared our nation's youth are for 21<sup>st</sup> century workforce demands. Georgetown's Center on Education and the Workforce predicts that the total number of STEM jobs will grow by 26% between 2010 and 2020. The Georgetown Center also projects that professional and technical jobs in healthcare, which it doesn't include in its STEM numbers, will grow by 31%, far faster than the workforce as a whole.<sup>7</sup> In *The Hidden STEM Economy*, Jonathan Roswell of the Brookings Institution argues that most studies dramatically undercount middle-level STEM jobs that are available to workers without a 4-year college degree – jobs that pay 10% higher than jobs with the same educational requirements.<sup>8</sup> It is clear that in the future, STEM jobs will dominate the employment landscape. By preparing our students of today for these jobs of tomorrow, we ensure the prosperity of our next generation.

As a community, as a state, and as a nation, we stand at an economic crossroad. We can continue to do what we have always done in the naive hope that our future will magically resemble our past. Or, we can roll up our sleeves, tackle the complex workplace challenges of the 21<sup>st</sup> century, and embrace tomorrow as just another day in which to excel. STEM literacy and experiential learning are the tools our schools, our informal learning programs and our communities need in their pursuit of workplace excellence. As policy makers, you have the ability and the authority to transform Pennsylvania's future. Those of us at the local level stand ready to help in whatever way we can. Thank you for your time.

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<sup>4</sup> Change the Equation. (2015). STEMtistics. <http://changetheequation.org/stemtistics>

<sup>5</sup> President's Council of Advisors on Science and Technology. (2010). *Prepare and Inspire: K-12 Education in Science, Technology, Engineering and Math (STEM) For America's Future*.

<sup>6</sup> U.S. News and World Report. (2015). *STEM Workforce No More Diverse Than 14 Years Ago*. Retrieved from <http://www.usnews.com/news/stem-solutions/articles/2015/02/24/stem-workforce-no-more-diverse-than-14-years-ago>

<sup>7</sup> Rosen, Linda. (2013). *The Truth Hurts: The STEM Crisis is Not a Myth*. Huffington Post. Retrieved from [http://www.huffingtonpost.com/linda-rosen/the-truth-hurts-the-stem-\\_b\\_3900575.html](http://www.huffingtonpost.com/linda-rosen/the-truth-hurts-the-stem-_b_3900575.html)

<sup>8</sup> Rothwell, J. (2013). *The Hidden STEM Economy*. The Brookings Institution: Washington, D.C.



State Testimony  
Pittsburgh Regional Ecosystem  
11.20.2017

In Pittsburgh, we have been building a cross sector table where students, educators, higher education, policy makers and funders can convene and learn together. We have built a collaborative community—an ecosystem where educational innovation can thrive. From this table, that we have called Remake Learning, we have begun to convene specific and focused conversations around teachers and the interesting things that they are doing and how they can get more of their peers to do the innovative things; around entrepreneurship and making, and how we build a bridge to get more students to tinker and create themselves; and around STEM and computer science and how we can get every student in the Pittsburgh region to have the computational and critical thinking skills needed to participate in the economy of tomorrow, and even today.

Over the past decade, this networked approach has leveraged the following results:

- Worked with 130 School Systems; 27 Libraries, 18 Museums, 38 Community Centers; 24 Funders, 54 Corporate / Business partners; 30 Higher Education institutions.
- \$5 million delivered in STEAM grants that have helped transform over 250 learning spaces in the region; \$2M delivered to support innovative cross-sector learning partnerships.
- 170 educational makerspaces have been created since 2011 in schools, libraries, afterschool, and museum spaces.
- Seven mobile fabrication labs take innovation on the road to reach rural and under-resourced communities.
- 60 local professional development providers help educators develop modern STEM teaching skills, and
- Remake Learning days exposes families to STEAM programming in their communities. For the past two years, RLD has featured 602 free and public events that has attracted 53,000 youth and adults, and over 14 million social media impressions.

Our impact report, Learning Together, can serve as evidence for how an networked/ecosystem approach to address STEM learning can address scale of ideas and practices, reduce duplication, and organize a region with a vision and plan to advance high quality STEM learning that is open, accessible, and approaching equity.

Our work at Remake Learning has opened the door for our Pittsburgh STEM ecosystem which was formed in the Fall of 2015. It has allowed us to acknowledge and consider all of our local assets in this area in order to move forward, together, while addressing equitable, high quality STEM learning experiences for students not reflected in the region's STEM workforce.

According to "Inflection Point," a local report released by the Allegheny Conference, "Opportunity Occupations (those paying more than median wage, with fewer than 50% of postings requiring a bachelor's degree) represent 24% of the economy locally and 27% of projected growth." Most of those occupations are in STEM and advanced manufacturing. Focusing on STEM is an economic priority for the Pittsburgh region.

Additionally, Information Technology is also on the rise in Pittsburgh across industries. IT Jobs will grow extremely rapidly over the next decade (11%) – 2.6 times faster than the market overall and 89% of these jobs will require a bachelor's degree. But diversity is a large local challenge; only 1% of the local IT workforce is African American compared to 7% nationally. At the college level, African American students are 50% less likely to be enrolled in Computer Science and other STEM majors than all other students. At the high school level, only 37 African American students in the entire state took the AP Computer Science exam.

We have been able to take an entire view of our local context and determine what can we do to try to attack these challenges head on through the STEM Ecosystem. We are focusing on the quality of our ecosystem, how can we measure its success, and concurrently, understand that our success is tied to those that are not accessing these resources or acquiring these skills.

We are focusing on the following efforts for the Pittsburgh Regional STEM ecosystem:

- Pitt National Science Foundation award focused on alternative credentials in Admissions process at the University of Pittsburgh to increase in the number of students of color that matriculate in STEM majors.
- We served as thought partners in the talent development effort alongside regional leadership as they submitted the proposal to Amazon to locate its HQ2 to the Pittsburgh region.
- Computer Science 4 All (CS4all): We are organizing a collaborative regional effort to address Computer Science for all students through community and library based partnerships, teacher certification and training, curriculum, and business partners such as Google.

- We are developing a Maker to Manufacturing pathway to build common language around the competencies educational makerspaces focus on and how those can connect kids to the 30,000 projected manufacturing jobs our region will offer.

We are also beginning to measure our impact. The current vision of the Pittsburgh Regional STEM Ecosystem Action Plan highlights three measurable outcomes:

1. Diversity and equity of available opportunities
2. Quality of available opportunities
3. Long term impact on the broader citizenry

We have prioritized these three outcomes and have grounded our work in the belief that diversity, equity, and inclusion are prerequisites to quality. Therefore, the work that we do as an ecosystem must begin by identifying, connecting, and amplifying the work of STEM educators of color, with an emphasis on understanding the current landscape of STEM opportunities for black and brown students, conducting and publicizing a gap analysis that accurately portrays the STEM landscape for youth of color, and making recommendations to STEM funders and program directors to increase the number of black and brown students in STEM programs.

As you can see, our region is a STEM-rich region in learning experiences, professional development providers, business partners, higher education pathways, out of school time partners. In coming together we have learned that we don't need to create new programs and resources, but we must better connect these resources to address the diversity of our STEM workforce. This year we have expanded the diversity of STEM learning providers involved in the ecosystem and hope to continue to include more black and brown professionals, and culturally competent STEM providers to a very rich and full table.

Submitted by:

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## **Pennsylvania Rural Ecosystem**

Good morning, my name is Jesse Maine, I am the Director of Curriculum, Instruction, and Assessment at Southern Tioga School District located in Tioga County, Pennsylvania. I am here to provide our school district's perspective of the effect that even informal STEM ecosystems can have on our students. This testimony will unveil the impact of various local, county and regional STEM opportunities and how they are effecting our students and educational community.

Just to provide you with some context, our district serves a community experiencing the long term effects of generational poverty and the effects of fluctuating populations due to the boom and bust of the coal, oil and gas industries. The nation has persistent inequities in access, participation, and success in STEM subjects that exist along socioeconomic, gender, and geographic lines, as well as among students with disabilities. Southern Tioga School District is a geographically large (525 square miles) rural district serving a sparse population of 1,800 students of which 45% receives free or reduced meals. The average family income for our district is \$40,000. In recognition of the student population we serve, and the widening skills and opportunity gaps in STEM, our district is constantly seeking new partnerships in our region to increase our student's exposure to the career opportunities available locally and regionally. Southern Tioga School District has programs that incorporate; makerspaces, outdoor learning spaces, robotics, hydroponics, 3-D printing, and agricultural programming. Our students are digitally equipped with mobile devices in all grade levels, with a 1:1 mobile device program in grades 7-12. As a result of my involvement with Pennsylvania's STEM initiative, Southern Tioga has now partnered with Dr. Carla Zembal-Saul at Penn State's Science Education Department, Angela Kirby at PaTTAN and Judd Pittman at PDE to Pilot STEM as a Multi-Tiered Support System (MTSS) in our elementary schools.

In Tioga county, our teachers and students explore STEM careers at events like our annual health career day and STEM day thanks to organizations like the Tioga County Development Corporation and the Northern Tier Regional Planning and Development Commission. Thanks to a 2017 Career Readiness Mini-Grant, we are currently building partnerships throughout the region to develop career pathways for students that will embed job shadowing and apprenticeships in high needs occupational fields. Last year through our current partnerships within our school to work program, we had a student intern as a dental hygienist in a local dentistry, solidifying her passion to pursue a career in the field.

STEM competitions in our region have become a favorite of our students over the last few years. Our BLaST IU 17 hosts regional STEM competitions like the Pennsylvania's governor's STEM competition, the K'Nex competition and the Pennsylvania Computer Fair. These opportunities challenge our students to apply classroom skills in a competitive and collaborative arena refining sought after soft skills that any employer would find favorable. I spoke with one of our teams after their presentation last year at the regional PA governor's STEM competition after the judges drilled them with questions regarding their project. Although they didn't perform as well as they wanted, they were already discussing how they could improve their presentation next year and how they would change their design given the judges feedback.



A community of practice can be defined as a group of people sharing a common passion for something, and learning how to improve their practice through regular interaction with one another. Three years ago, Dr. Christina Reed (IU 17), Penny Johnson (IU 17), Sam Rotella Jr. (Southern Tioga) and myself developed a plan for a community of practice focused on innovation, technology integration and STEM education in our region. What we now call the Innovation and Technology Collaborative or ITC is a network of educators and administrators interested in implementing twenty-first century approaches to transform teaching and learning. ITC convenes every other month to provide opportunities for professional networking, provide support for STEM programs, and support change leaders as they develop and implement innovative, creative and technologically rich curriculum and instructional practice. We make it a point to hold our day-long meetings in schools throughout the region to intentionally explore innovative programs and preserve our connection with the students. When attending, each district is encouraged to bring a team of four or more to promote capacity building within each of our organizations. Our district has seen such a return on investment within our organization, that this year we are sending ten teachers and two administrators to every ITC meeting. Each year we choose a topic to explore professionally as a group. As a leader within a remote school district, these opportunities to network with likeminded individuals and experts in the field are invaluable to our organization's growth and progress, even though many of the participating districts drive over 50 miles to connect. Through the collaborative, our BLaST IU has formed many partnerships that have benefited not only our ITC participants, but all of the 19 school districts within our BLaST IU region.

Being part of this community of practice is reinvigorating for me as a school leader, providing a safe place for me to explore ideas and implement new strategies. Last year the Innovation and Technology Collaborative explored design thinking, inviting Rose Cameron, a global thought leader in the field to guide our learning. As the year progressed, members of the group learned from each other as each district implemented various levels of design thinking within their own organizations. In some districts, teachers partnered with students to teach other teachers during in-service days, in others administrators shared workshops with their faculty. At Southern Tioga, we used the model with students and teachers to redesign how we approach learning and teaching in the high schools. In fact, next month we are redesigning and remodeling a few of our classroom environments with students providing insight throughout the redesign process.

This year we have nine districts that compose our ITC, those districts serve over 12,000 students in Bradford, Lycoming, Sullivan and Tioga counties. As a group we are exploring Computational Thinking. Our first session was informational and very engaging, connecting our participants with a Computer Science leader in our region, Lauren Poutasse from Delaware County Intermediate Unit. Throughout the day, we developed a common vocabulary and definition for computational thinking. Moving forward our team has already developed a district wide plan for our students to participate in Hour of Code, planned an after school program partnering with Girls Who Code, and exploring the addition of a new AP Computer Science Principles Course for the 2018-19 school year.

Because of the partnerships forged in our ITC and within the PA STEM coalition, our regional BLaST IU #17 has partnered with Amanda Smith from the Penn State Center for Science and the Schools (CSATS) and Kristen Baughman- Gray from Central IU #10 to create a STEM collaborative dedicated to building capacity and efficacy around STEM practice within our K-12 schools. As a member of the STEM collaborative last year, each district explored their organizations STEM efficacy and implementation level. This year, CSATS has developed workshops for teachers to explore transdisciplinary approaches to teaching science. The Intermediate Units are even providing instructional coaching support for districts; further strengthening the professional learning model applied. Last year 17 districts in seven counties, (Bradford, Centre, Clearfield, Clinton, Lycoming, Sullivan, and Tioga) participated in the STEM Collaborative. This year 7 districts, including Southern Tioga, have dedicated considerable funds and time to build STEM confidence and capacity with the guidance of CSATS consultants.

Over the last few years, our local higher education institutions have increased their outreach with local K-12 schools. Penn College of Technology offers a dual enrollment experience (Penn College NOW) that eliminates tuition cost for the student, trains our teachers as Penn College instructors and eliminates the need for students to leave our campus. These opportunities are providing exposure to high paying STEM career pathways that could change many of our students lives and providing the opportunity for students to achieve debt free college credit before graduation. Students in our district have the potential to earn up to 24 college credits (at no cost to the student, and extremely reduced cost to our district) before they receive a high school diploma. These experiences are positively changing the trajectory of our students lives each year.

Although our region does not have a formal STEM ecosystem designation, we have established and field tested our norms within our community of practice. Our next steps towards a more formal designation are to develop an understanding of STEM educational opportunities taking place throughout the region; develop common goals with regional stakeholders; and invite regional higher education and industry leaders into the community.

I want to thank the formal PA STEM ecosystems for being fantastic models for regions like ours; just getting started. I appreciate all that you have shared. Each time we meet, I leave with new and exciting ideas.

Finally, I would like to thank this committee for this opportunity to share a few things that are helping innovate educational practice in central Pennsylvania.

Jesse Maine  
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November 20, 2017

**JOINT POLICY HEARING**

Re: Rural PA STEM Collaborative

Dr. Kathleen Hill

Associate Director of Center for Science and the School and Assistant Professor of Science Education  
Pennsylvania State University ([kathyhill@psu.edu](mailto:kathyhill@psu.edu))

Distinguished committee members, I want to thank you for this opportunity to present the Rural PA STEM Collaborative from the perspective of the leadership team.

**Rural PA STEM Collaborative**

In the fall of 2016, Penn State Center for Science and the Schools (CSATS), CIU #10 and BLaST IU 17 formed a STEM Collaborative to build districts' capacity to integrate STEM into their classrooms. Through a three-year initiative, we plan to support districts in the region to develop transdisciplinary approaches for teaching science. The following are the goals of the Rural PA STEM Collaborative:

**Goals:**

- Teachers will be able to collaborate with other school districts, the IU representatives, and Penn State University professionals.
- Teachers will be able to implement transdisciplinary projects in their classrooms based on the Next Generation Science Standards.
- Teachers will be able to engage students in investigations that focus on phenomena and/or problems.
- Students will increase their awareness of the nature of science and NGSS science and engineering practices as they engage in a transdisciplinary project.

**Rural PA STEM Collaborative Leadership Team:**

- 1) Amanda Smith- Penn State CSATS, STEM Outreach and Engagement Liaison
- 2) Dr. Kathy Hill- Penn State CSATS, Associate Director and Assistant Professor of Science Education
- 3) Kristen Baughman-Gray-CIU #10, Educational Consultant
- 4) Penny Johnson-BLaST IU 17, Director of Professional Learning

Throughout the 2016-17 academic year, CSATS, IU-10 and IU-17 worked to build a network designed to support collaborations between school districts and Penn State University professionals, communicate current STEM opportunities for teachers and students, and provide informational sessions to improve districts' knowledge of innovative practices occurring throughout the Commonwealth of Pennsylvania. In addition, CSATS collected baseline data across 17 districts regarding teachers' self-efficacy for teaching science, conditions within the school contexts that are supportive of transdisciplinary approaches to teaching, and professional development (PD) needs in the area of STEM. Based upon the survey data, multiple districts reported the need to improve STEM teaching at the elementary level. Considering the reported needs, culture, and climate, the three organizations prepared to provide resources, opportunities, and PD to support student learning through transdisciplinary projects at the elementary level.

**Elementary Grades 3-6 Series -NGSS Integration Workshops:**

During the 2017-18 academic year, Penn State CSATS faculty and staff is providing 6 days of professional development to build teachers' capacity to integrate science and engineering practices to their curriculum, and create transdisciplinary approaches through phenomenon and/or problem-based themes. The workshop series will include instructional techniques, methods, approaches and strategies to

promote literacy learning within the content of science, technology, engineering, and mathematics. The professional development will target grades 3 through 6, culminating in an integrated STEM project at each grade level. With support from Penn State CSATS, the teacher participants will co-develop formative and summative assessments for the project.

In between the workshops, teachers will be encouraged to identify the science and engineering practices in their current science lessons as well as revise a lesson(s) to add one or more practices. To support continued collaborations, SLACK is an online tool that will be used to facilitate ongoing conversations and provide feedback. The IUs will be offering coaching services to provide planning support, conduct observations, and offer feedback regarding instruction using the practices.

#### Rural PA STEM Collaborative Professional Development Team:

- Ashley Rapsinski - Penn State CSATS, Research Assistant and lead developer for PD
- Taylor Wood- Penn State CSATS, Research Assistant and assistant developer for PD
- Dr. Kathy Hill- Penn State CSATS, Associate Director and presenter of science practices
- Dr. Matthew Johnson -Penn State CSATS, Research Associate and presenter of engineering practices
- Kristen Gray –IU 10, Educational Consultant, instructional coach to teachers between PD sessions
- Rob McKenzie- IU 17, Instructional Technology Specialist & STEM Consultant, instructional coach to teachers between PD sessions

#### Rural PA STEM Collaborative Funding and Sustainability:

For the 2017-18 academic year, seven rural school districts elected to dedicate funds for selected teachers to participate in the NGSS Integration Workshops for grades 3 through 6. These funds supported the development and implementation of the CSATS-led workshops, the IU instructional coaching, and substitute teacher costs.

#### School Districts participating in the Elementary Grades 3-6 Series -NGSS Integration Workshops:

- Bald Eagle Area School District - Tracy Boone, Director of Curriculum and Instruction
- Mifflin County School District - Jennifer Mitchell, Coordinator of School Wide Curriculum, Instruction, and Professional Development
- Montgomery Area School District- Daphne Bowers, Superintendent
- Northeast Bradford School District- William Clark, Superintendent
- Southern Tioga School District- Jesse Maine, Director of Curriculum, Instruction, and Assessment
- Towanda Area School District- Joel Spinney, Principle of Academic Affairs
- West Branch Area School District- Michelle Dutrow, Superintendent of Schools

We understand that school districts located in rural areas across the state experience somewhat different challenges than those in urban and suburban regions. First, due to their remote locations, they struggle to provide discipline-specific PD opportunities that enable teachers to better prepare students to be competitive in today's ever-changing world, particularly in STEM and STEM-related fields. Second, these rural districts also have significantly less access to adequate funding sources (e.g., corporations, foundations) needed to offset teacher PD costs and replace outdated or insufficient resources.

Funding the Rural PA STEM Collaborative will enable educators in these rural districts to build their capacity to incorporate science and engineering content and practices into their classroom, which will support their students to compete in the future STEM workforce.

For further information regarding the Rural PA STEM Collaborative, please contact Amanda Smith, [amandasmith@psu.edu](mailto:amandasmith@psu.edu). Thank you for your attention to this important issue and your commitment to STEM education across the Commonwealth.



## What is PA SEED?

Pennsylvania STEM Experiences for Equity and Diversity (PA SEED) Ecosystem is a collaboration between the PA Department of Education and the Bucks, Chester, Delaware, and Montgomery County Intermediate Units. PA SEED joins four previously recognized STEM Ecosystems in Pennsylvania.

STEM Learning Ecosystems provide the architecture for cross-sector learning, offering all young people access to rich learning environments in order to develop STEM skills and to engage in science, technology, engineering, and math from pre-school through university. Strong STEM Learning Ecosystems feature dynamic collaborations among schools, out-of-school time programs, STEM Expert Institutions (such as science centers and museums, institutions of higher education, and STEM professional organizations), the private sector, community-based organizations, youth, and families. A learning ecosystem harnesses the unique contributions of all of these different settings to deliver STEM learning for all children in symbiosis.

## What is the purpose of PA SEED?

PA SEED is committed to engaging, nurturing, and producing a STEM-fluent pipeline that is ready to contribute to the STEM workforce in the region. In order to accomplish this mission, the PA SEED Ecosystem will focus its actions on three Guiding Principles:

1. connecting all stakeholders to STEM educational experiences and opportunities,
2. generating coherent STEM experiences for ALL learners no matter their demographics, and
3. creating and implementing STEM professional learning for all educators and administrators in the region.

The opportunity in front of PA SEED is tremendous. The region is home to 2.5 million people, 100 colleges and universities, 200 private schools, 9 career and technical high schools, 62 school districts comprised of 485 schools and over 300,000 students.

## What is currently happening in the PA SEED region?

The PA SEED Ecosystem seeks to identify, illuminate, and amplify existing STEM experiences and instructional best practices. Professional learning for STEM teachers and leaders occurs regularly at the Intermediate Units on topics that include: makerspace development, coding and computer science, project-based learning, and STEM integration and best practices. Various opportunities for students to engage in STEM challenges, competitions, and out-of-school

### EXECUTIVE TEAM

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# PA SEED ECOSYSTEM

STEM EXPERIENCES FOR EQUITY AND DIVERSITY

activities also abound in the region: the Governor's STEM Competition, STEM Design Challenge, PA Computer Fair, and STEM Saturday programs are just a few examples.

PA SEED Days will take place May 16-26, 2018. The goal of PA SEED Days is to highlight and celebrate the STEM opportunities that are already happening and align with the guiding principles of the Ecosystem.

## How can STEM stakeholders get involved?

One of PA SEED's guiding principles is to connect cross-sector STEM stakeholders. The PA SEED Leadership Council is the mechanism to bring these stakeholders together to participate in the leadership of the Ecosystem. Current members of the Leadership Council include:

Boeing  
Chester County Economic Development  
Council  
Corbett, Inc.  
K-12 school districts  
K'Nex  
LaSalle University  
New Age Industries  
Quaker Chemical

Riverbend Environmental Education  
Center  
Temple University  
The Audubon Society  
The Bucks-Mont Manufacturing  
Alliance  
Workforce Development  
Boards

The Leadership Council will be meeting for the second time on December 11, 2017, and will begin the important work of drafting a shared mission and vision for their work.

To learn more about becoming engaged with the PA SEED Ecosystem, please reach out to [paseedecosystem@gmail.com](mailto:paseedecosystem@gmail.com).

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## TCHS Links STEM to the Workforce

### IMMEDIATE IMPACT

Leading STEM initiatives, projects and events for:

- Manufacturing Alliance of Chester and Delaware Counties
- Route 1 Economic Development Initiative
- Chester County Workforce Development Board
- PA CareerLink
- Industry associations and chambers of commerce throughout Chester County

### BEING AHEAD OF THE CURVE

STEM education must seek to be innovative and predictive in identifying the economic needs of tomorrow.

- Digital Media & Sound Communication program has quadrupled its enrollment since September by focusing on the skills necessary to be a successful entrepreneur.
- Expanded robotics program to include an avionics curriculum after consultation with Sikorsky Aircraft Corporation in Chester County. The aerospace industry is projected to grow by 3.0% in 2017.

### CULTIVATING TEACHERS

A pedagogical philosophy that seeks to take outstanding professionals and help them become excellent teachers.

Faculty members who have:

- Worked for the New York Times
- Produced albums for American Idol finalists
- Pursuing a PhD. at the University of Pennsylvania in Computer Science
- Patented a time tracking bib technology for runners

### LONG TERM INVESTMENT

A successful link between STEM and the workforce should also focus on long term investments in STEM career pathways.

- Three Allied Health alumni are now serving as a trauma surgeon, a neurosurgeon and a sexual assault nurse examiner.
- 1,200 students entering grades 6-9 come to TCHS each summer for Summer Career Academies to explore career pathways.





## TCHS Linking STEM to the Workforce

Chester County Technical College High School (TCHS) provides career & technical education to 2,226 students at three campuses located throughout Chester County. TCHS offers students the opportunity to explore careers in STEM, the Arts and Skill pathways. With 28 programs offered, TCHS believes in the importance of developing career & technical programs that will help prepare students for their future careers today.

TCHS has become a statewide leader in STEM career & technical programs by successfully creating a model for STEM education that focuses on the link between STEM and the workforce. The nature of STEM education is advantageous to meet the demands of the current and future economic climate of Pennsylvania. As a division of the Chester County Intermediate Unit (CCIU), TCHS has been able to build a strong foundation of STEM education through the use of shared resources throughout Chester County, which is so vital to the concept of a sustainable ecosystem.

TCHS has found that our success in linking STEM to the workforce can be summarized into four unique strategies that have been essential in creating a strong union between STEM education and the workplace in Chester County. These strategies, which can be utilized to improve the overall STEM ecosystem in Pennsylvania, include:

1). Immediately impacting the workforce:

- **Being a regional force for developing entire communities to participate in the STEM economy**

TCHS recognizes the importance of preparing students to make an immediate impact in the STEM economic sector. For example, TCHS is hosting an event to promote advanced manufacturing, which brings together students, parents, collegiate partners, displaced workers and industry professionals to help inform and encourage interest in advanced manufacturing career pathways. TCHS created the Advanced Manufacturing Premier (AMP) to serve as a conduit between the entire community we serve and to utilize resources throughout our larger STEM ecosystem to make an immediate impact in connecting STEM education to the workforce.

- **Partnering with economic development associations to promote regional development**

Not only does TCHS impact the workforce by preparing students to pursue career pathways that drive economic development, but TCHS also helps to shape regional economic initiatives through participation in industry development groups. Students in Computer Information Systems (CIS)- Programming from TCHS Pennock's Bridge used their coding skills to develop a website for the Route 1 Economic Development Initiative. The Route 1

Health program who are now leaders in their fields. A TCHS alumna, who graduated in 2003, is now a trauma surgeon; another TCHS alumnus, who graduated in 2004, is now a neurosurgeon; and a third TCHS alumna, who graduated in 2010, is now a sexual assault nurse examiner. The investment in the Allied Health program, which gives students hands-on, clinical experience in medical facilities, had a delayed impact on the workforce since these professions require extensive schooling. However, over a decade later, these students are now all leaders in their fields. Another example of this type of investment would be TCHS' Summer Career Academies. These summer academies introduce students entering grades six through nine the opportunity to explore career pathways in a structured, fun and age-appropriate manner. Each summer, 1,200 students from across Chester County register for these week-long academies, which always have significant interest in technically oriented programs. These long-term investments are critical to maintaining the long-term sustainability of STEM ecosystems at the local, regional, state and national levels.

4). Being ahead of the curve:

- **STEM education must seek to be innovative and predictive in identifying the economic needs of tomorrow**

With the rapid change of both technological and economic realities, it is more important than ever to seek to be ahead of the curve. TCHS, while offering students the opportunity to pursue career pathways currently in need of employees, is constantly seeking to identify the next industry or career pathway that will be in demand. For example, TCHS recently launched a Digital Media & Sound Communication program that has quadrupled in enrollment since September. This program taps into an entrepreneurial trend that is developing in Pennsylvania's economy and uses digital media, which many students are passionate about in their private life, and offers them a pathway to turn it into a business and career. TCHS Pickering has also expanded the robotics program to include an avionics curriculum. This expansion was done after consultation with Sikorsky Aircraft Corporation in Chester County and recognizing that the aerospace industry is projected to grow by 3.0 percent in 2017. TCHS believes that if we wait until there is consensus about an industry or area of STEM with an impending shortage, we will have missed the chance for innovation. We have to constantly seek to be ahead of the curve and not be afraid to explore opportunities in order to prepare our students for the economic realities of tomorrow.



November 16, 2017

Written testimony from the Afterschool Alliance and the STEM Education  
Coalition

# **BIPARTISAN POLICY COMMITTEE HEARING: PENNSYLVANIA'S STEM LEARNING ECOSYSTEM**



# About the Afterschool Alliance



- ✓ National non-profit based in DC
- ✓ Wide & deep reach at the grassroots & grassroots
  - ✓ Work with more than 25,000 program providers
  - ✓ 50 statewide afterschool networks
  - ✓ 100+ Afterschool Ambassadors at the city level
  - ✓ Bipartisan afterschool caucus in House & Senate
  - ✓ Publish the "America After 3PM" report, the only national survey of where kids are when not in school

## ✓ Systems-building approach:



# About the STEM Education Coalition



- ✓ Coalition of 750+ business, professional, and education organizations
- ✓ Aggressively working to raise awareness in all levels of government about the critical role STEM plays in the United States' economic and technological leadership

## Research and Monitor:

- ✓ K-12 Education
- ✓ Higher Education
- ✓ Veterans Transitions
- ✓ Informal Learning
- ✓ Career and Technical Education

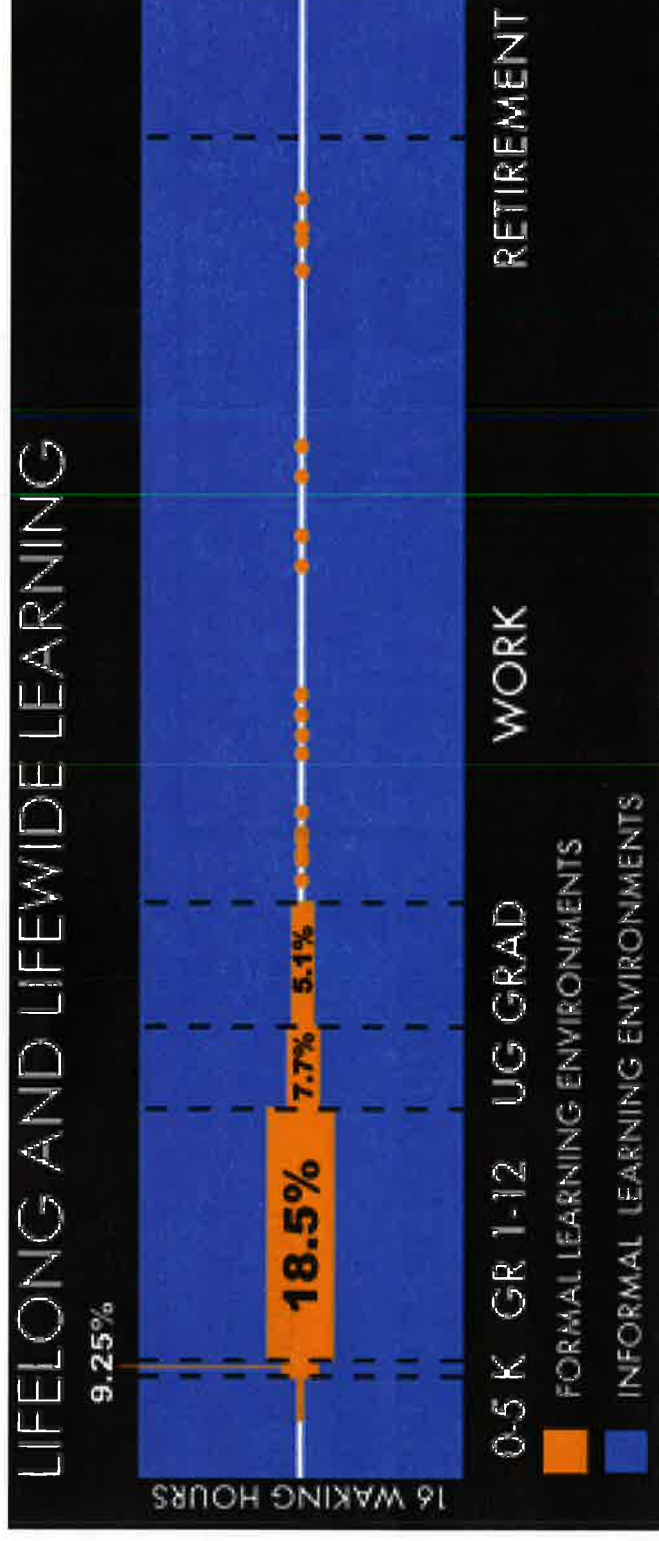
# 29

*Member organizations in Pennsylvania*





**School aged children spend the majority of their waking hours outside of the formal classroom setting.**



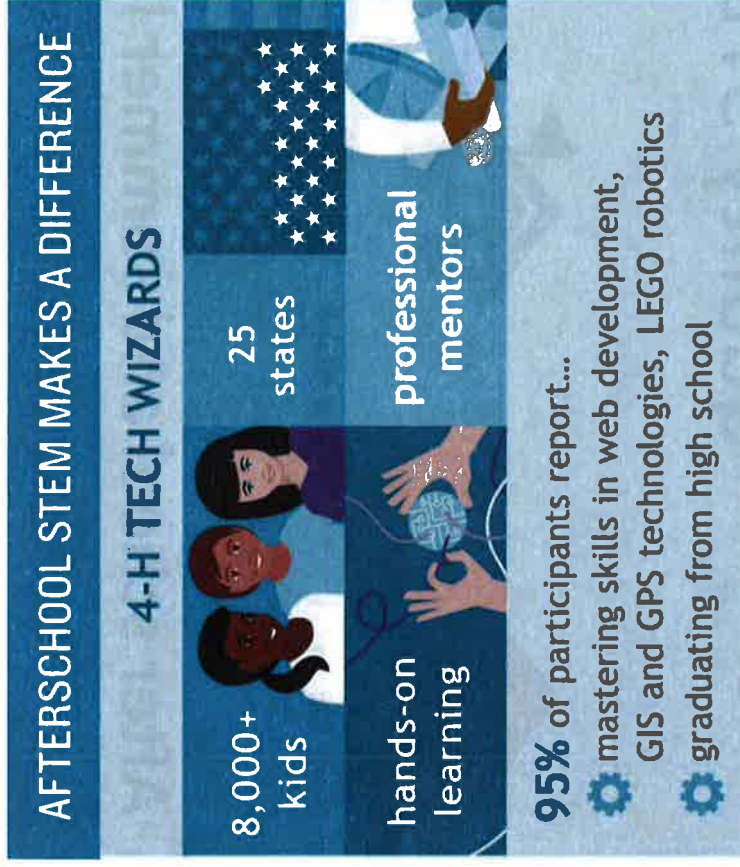
**To meet kids where they are, we must leverage the entire learning ecosystem to reach them in all the spaces they learn, including afterschool and summer learning programs.**

Across the nation, **STEM learning ecosystems** are leveraging cross-sector stakeholders to increase access to high-quality STEM learning.



After school and summer learning programs are critical components of a robust learning ecosystem.

# Afterschool is great fit for STEM learning.



- Allows for youth-driven exploration in flexible, supportive environment
- Room for experimentation and failure and time to develop strong relationships with mentors
- Can support meaningful gains in STEM-related skills and attitudes

4H Tech Wizards: <https://4-h.org/parents/stem-agriculture/tech-wizards/>

Techbridge Girls: <https://www.techbridgegirls.org/index.php?id=23>

Afterschool Alliance. "Students Achieve More with Afterschool STEM". [http://afterschoolalliance.org/documents/StudentsAchieveMorewithAfterschoolSTEM\\_June2017\(2\).pdf](http://afterschoolalliance.org/documents/StudentsAchieveMorewithAfterschoolSTEM_June2017(2).pdf)



# Afterschool STEM programs engage students and fuel positive STEM identities.



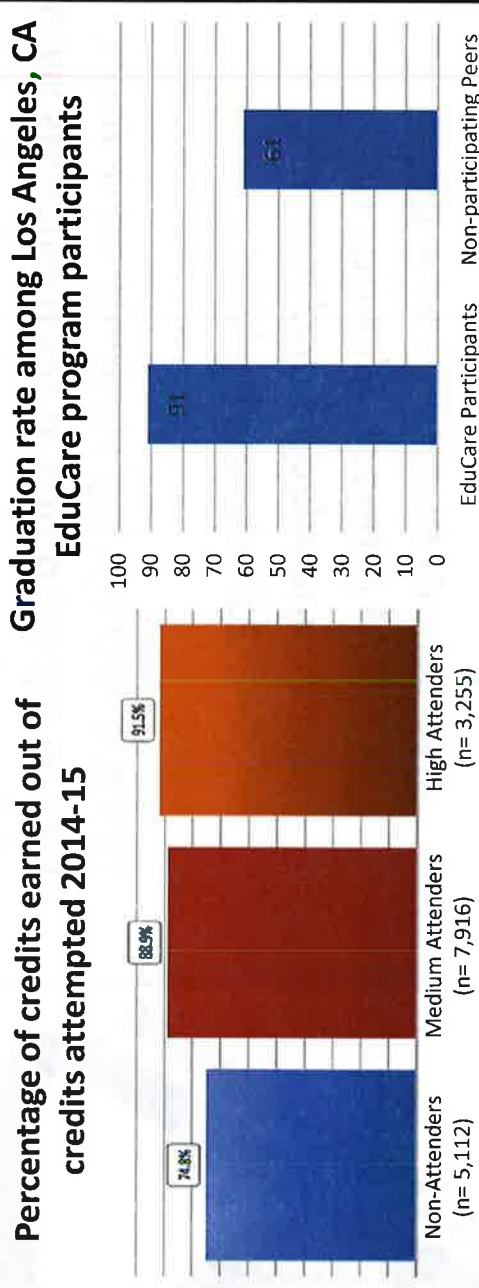
70%

of kids in STEM-focused  
afterschool programs saw gains  
in **STEM interest**, identity, and  
**career knowledge** and interest;  
**21<sup>st</sup> Century skills**

Female-identifying students were more  
likely to report gains in **relationships with**  
**adults** and **peers** in numbers significantly  
higher than their male counterparts.

# Regular participation in afterschool programs can lead to significant academic gains.

Participants in EduCare afterschool programs **completed more credits** and had **higher graduation rates** compared to their non-participant peers.



## In a study of over 200 programs across the nation

- Over a two year period, *elementary school students* who regularly attended the high-quality afterschool programs **saw gains of 20 percentiles in math achievement test scores**, compared to their routinely unsupervised peers.
- Regular participation by *middle school students* over a two year period was associated with **gains of 12 percentiles in math achievement test scores** over a two-year period, compared to their regularly unsupervised peers.

# Afterschool STEM programs inspire kids to keep learning.

PBS News Hour explains how afterschool supports STEM learning. Click [here](https://www.pbs.org/newshour/show/after-school-stem-programs-inspire-kids-to-keep-learning) to watch the full report

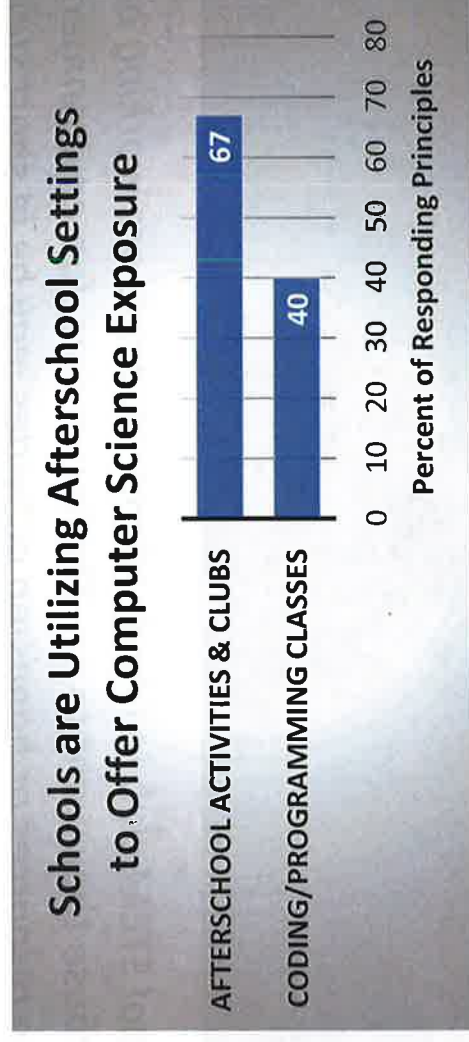


*“At an after-school STEM club in Rhode Island, students are working on an engineering challenge -- because they want to be. The low-stakes, fun environment offers time for exploration when resources or hands-on activities may be in short supply during school hours, and can help sustain interest as classes get harder. Special correspondent Lisa Stark of Education Week reports.”*

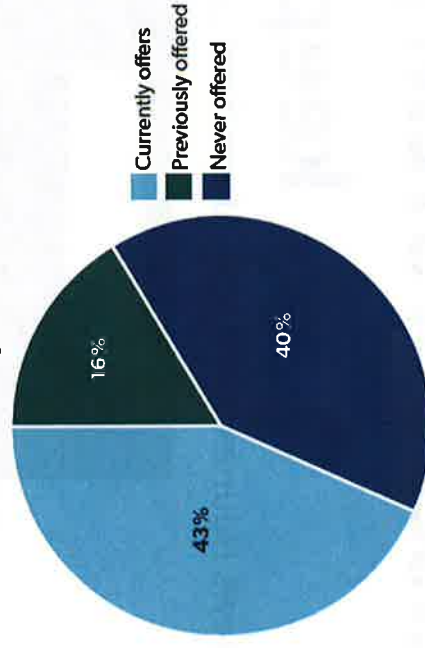
PBS News Hour: <https://www.pbs.org/newshour/show/after-school-stem-programs-inspire-kids-to-keep-learning>



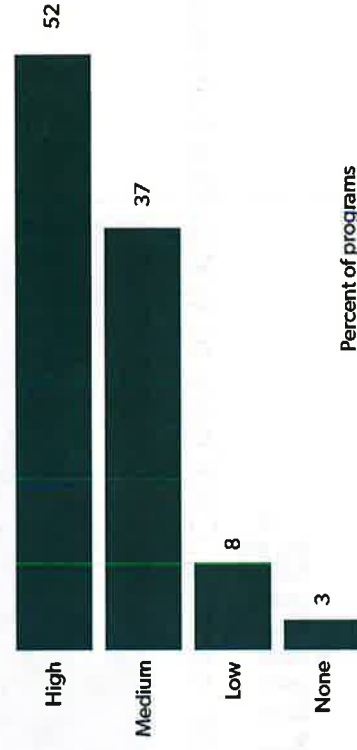
# Across the nation afterschool STEM programs can— and are—offering exposure to computer science.



Many afterschool programs are, or have, offered computer science experiences



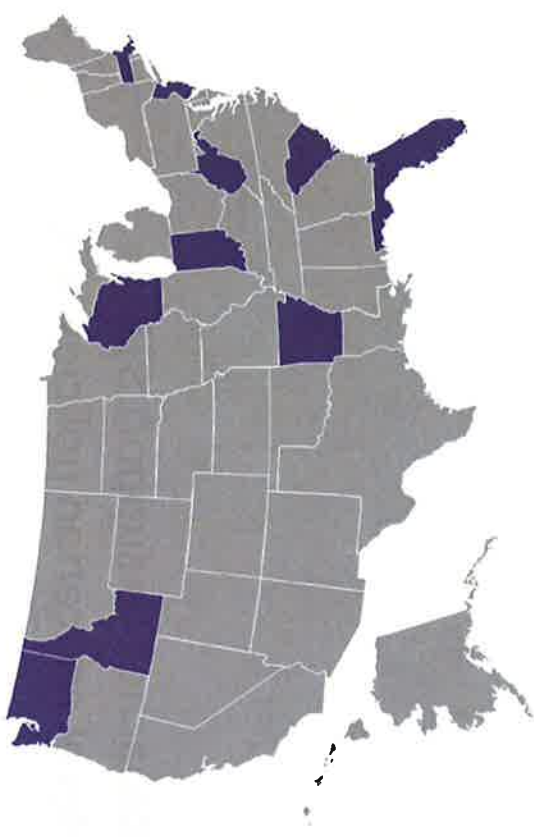
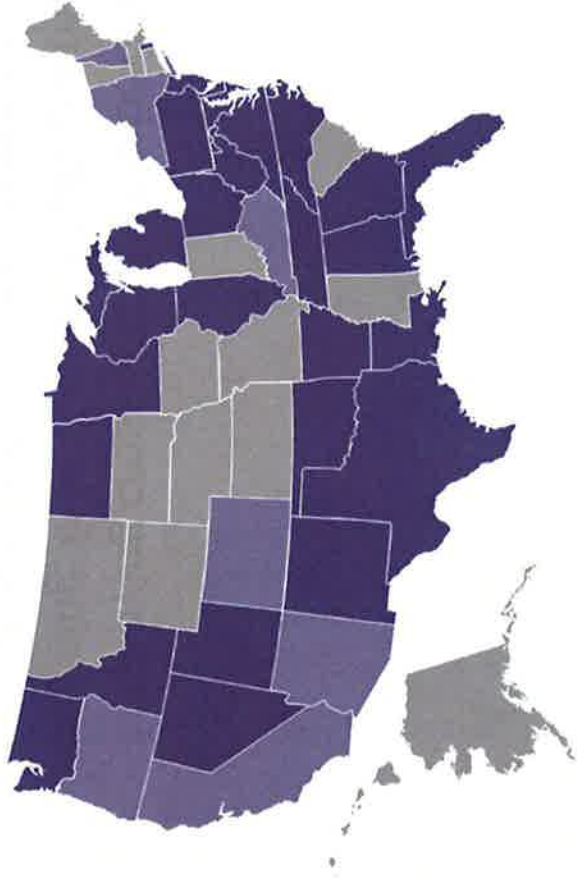
Most afterschool providers not currently offering computing have an interest in doing so.



# Pennsylvania has begun to make equitable and rigorous computer science available for all students

PA and 31 other states & DC allow computer science to count toward HS math or science requirements (**statewide** or **school dependent**).

Only **10 states** have created K-12 computer science standards.



There is more opportunity for PA to be among the leading states in bringing computer science education to all students by developing a state plan and rigorous CS standards that utilize the entire learning ecosystem.



Employing cross-sector, collaborative, approaches to support STEM learning, including grant programs, state-level education policies, and workforce and skills development.

## **EXAMPLES: USING ALL RESOURCES TO SUPPORT ROBUST STEM LEARNING & WORKFORCE SKILLS DEVELOPMENT**

# Pennsylvania: Supporting STEM career exposure through cross-sector partnerships

- **Opportunity:** Support the development of local STEM talent, and build the workforce needed by local industry.
- **Solution:** The SHINE (Schools & Homes in Education) program's STEM efforts evolved to promote the careers of the future through partnership with Carbon County Action Committee and the Lehigh Carbon Community College. The expanded Career Academy is a 36 week program composed of *6 week STEM Career Projects based on state/national standards, with students working in technical labs* with both technical experts and academic teachers.

# Maryland: Supporting robotics through competitive grants

- **Opportunity:** Utilize the excitement of robotics to develop in-demand skills like engineering, computer science, and mathematics in students. Build curiosity for STEM in underserved students by supporting programs in districts with financial hardship.
- **Solution:** H.B. 115 passed in 2016; provides \$250,000 in grants to *support robotics in public schools and non-profit robotics clubs*. This gives students an opportunity to participate both in and out of school time.

# Arkansas: Coding at every school through state-level policies

- **Opportunity:** Every state in the nation is facing a shortage of workers with the necessary computer science skills. Areas with a higher number of qualified computer science workers are experiencing a higher rate of economic growth.
- **Solution:** Arkansas *requires all public and charter high schools to offer computer science courses* and appropriated \$5 million to start this new program in 2015. The *courses must count towards students' math requirements*. Rural students can take the courses through Virtual Arkansas, a partnership between the AR Department of Education and AR Education Service Cooperatives.



# DC: Building solar job skills through multi-sector partnerships

- **Opportunity:** The number of jobs in the solar industry continues to grow and young D.C. residents need skills to join the workforce after graduation.
- **Solution:** GRID Alternatives, DC Dept. of Energy and Environment, and the Mayor Marion S. Barry Summer Youth Employment Program formed a public-private partnership which put more than 200 D.C. youth to work installing solar panels on the homes of low-income residents. *Students are prepared for entry-level jobs in growing green fields.* Students gained skills in engineering and finance in addition to soft skills like customer relations, all when they are out of school for the summer.



# Colorado: On the job STEM training through business partnerships

- **Opportunity:** Hands-on learning is proven to engage STEM students and can be the hook needed to pull in traditionally underrepresented populations.
- **Solution:** The St. Vrain Valley School District implemented the district's Innovation Center. This STEM-focused center *pays high school students to participate in project-based learning for local businesses*. Students get valuable work experience and low-income students, who need to earn a paycheck after school, can learn while earning \$10/hour.

Afterschool STEM  
programs support  
youth's **STEM identities**  
and **academic gains**.

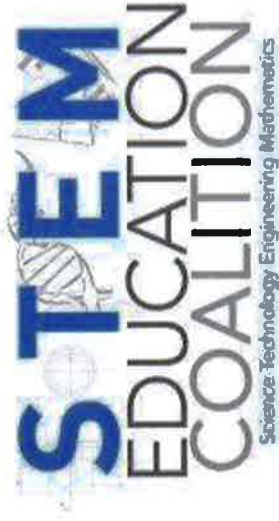


STEM learning ecosystems  
should **support and leverage**  
**afterschool and summer**  
**programs** to provide all students  
with sustained access to high-  
quality STEM learning.

# Further Questions? Contact us at:



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# Preparing all children to meet the challenges of tomorrow by expanding access to K-12 computer science education through out-of-school time programs

A statement from the Afterschool STEM Hub, a collaboration of national afterschool and summer learning leaders and stakeholders.

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Afterschool and summer learning programs are essential to states, districts, and communities seeking to support and expand K-12 computer science education. When used strategically, these programs provide a pathway of learning opportunities across the grade-span, spark interest and deepen engagement, and connect students what they learn during the school day. As computer science is, and will continue to be, a driver of innovation and economic growth,<sup>1</sup> it is essential that all students have access to an education in foundational computing skills. Afterschool programs serve 10.2 million kids across the U.S.,<sup>2</sup> and offer a tremendous opportunity to reach more kids with computer science.

## THE LEARNING ECOSYSTEM

In thinking about science, technology, engineering, and math (STEM) education, many educational institutions play a role in student engagement and learning, including schools, afterschool, and summer learning programs, museums and science centers, libraries, higher education institutions, and other community organizations. The same is true for computer science education—youth can gain exposure, knowledge, and skills at any or all of these institutions. Further, learning STEM is like becoming fluent in another language: all children need multiple, varied, and early learning opportunities to achieve mastery.<sup>3,4</sup> This is especially important when beginning computational thinking skills in the elementary grades and presenting youth with wide range of computer-related pursuits and application areas. Schools cannot and should not have to do it alone.

## WHAT AFTERSCHOOL PROVIDES

To spark engagement, youth must experience STEM content—including computer science content—as relevant, interesting, and enjoyable, while also seeing themselves and being seen by others as accomplished learners.<sup>5,6</sup> Interest, identity, and understanding are all fostered and reinforced in out-of-school time settings.<sup>7</sup> Interest breeds interest, and students who participate in afterschool and summer STEM programs seek more opportunities to engage, sparking life-long curiosity and persistence in the STEM fields.<sup>8,9</sup> Fueled by enthusiastic educators, and grounded in youth development principles such as student leadership, civic engagement, and positive adult relationships, out-of-school time programs are an essential component of strong K-12 computer science learning ecosystems.

## REACHING TARGETED POPULATIONS

Afterschool programs serve proportionally higher numbers of young people from low-income and racially marginalized communities,<sup>10</sup> and can therefore play a key role in reaching the demographics often targeted by efforts to broaden participation in computer science. Combined with approaches intended to be engaging and responsive to young people's needs and interests, afterschool and summer learning programs can be particularly powerful in ensuring that diverse groups of youth experience positive personal and educational outcomes.<sup>11</sup>

As stated in the 2016 K-12 Computer Science Framework, “informal education organizations are essential to the computer science education ecosystem and should be included as critical stakeholders in state and district implementation efforts.”<sup>12</sup> The specific policy and programmatic recommendations that follow will help reach more students with computer science education, while building bridges between schools and out-of-school time organizations.



## Recommendations

1

Include afterschool and summer learning as key components in state plans for K-12 computer science; and include experts in out-of-school time education in the planning, decision-making, and implementation of such efforts.

Formal state plans for K-12 computer science education bring coordination and coherence to the myriad stakeholders involved in supporting high quality, accessible computer science learning for all students. By making an inclusive and intentional plan for reinforcing policies, implementation strategies, resources, expectations, and the targeting of underrepresented and under resourced populations, states can garner the support, expertise, and participation of critical stakeholders, including out-of-school time providers.

- a. Partner on state standards:** State computer science education plans that identify rigorous standards and associated resources for K-12 computing should recognize informal learning providers as stakeholders and partners. While afterschool and summer learning programs would not directly implement standards, they can work closely with district and school partners to design programming that complements school day objectives and supports targeted student populations.
- b. Educate decision-making staff:** As state and local education associations prioritize STEM and computer science education with dedicated staff positions, those staff should be familiar with the value and structure of the afterschool and summer learning field. Furthermore, they should seek opportunities to work with informal learning stakeholders, such as the federally-funded 21<sup>st</sup> Century Community Learning Center offices and staff within the state's Department of Education; or museums and other STEM-rich institutions to ensure that high-quality computer science opportunities and resources are incorporated into the implementation of afterschool and summer learning programs.
- c. Include afterschool experts:** States and district leaders should appoint afterschool and informal STEM and computer science education experts to a wide range of government advisory bodies, including school district and governors' initiatives, to elevate the role of these learning spaces in the larger computer science and STEM learning ecosystem. Federal entities, such as the President's Council of Advisors on Science and Technology, the Committee on Science, Technology, Engineering, and Math Education (CoSTEM), the National Science Board, and other federal agency policymaking bodies should do the same. Any working groups should also include voices from the afterschool and summer learning field.

## Recommendations (continued)

2

**Leverage innovative professional development and curriculum initiatives to support afterschool computer science educators.**

Many afterschool programs are interested in offering computing experiences for their students, but need for professional development and curriculum tailored for out-of-school time environment to do so.<sup>13</sup> Computer science professional development opportunities should be open to educators working in afterschool or summer programs, and curriculum designs should accommodate implementation across all learning spaces, both in- and out-of-school. Professional development and curricula resources should incorporate culturally responsive approaches and address implicit biases.

- a. Leverage federal statutes:** For example, the Higher Education Act, the Carl D. Perkins Career and Technical Education Act, and the Every Student Succeeds Act can support computer science professional development opportunities and resource development for both formal and informal educators.
- b. Engage pre-service teachers:** As institutions of higher education develop their preservice computer science teacher preparation programs, they should allow for internship placements and practicum experience in afterschool and summer programs. Educator programs can make use of informal education spaces to serve as low-risk sites for teacher training, where prospective teachers can work with children in open-ended and nonjudgmental contexts.
- c. Computer science education experts** can design research-based professional development models, curricula, and evaluation tools designed for the afterschool environment.
- d. Researchers in computer science education** can engage afterschool and summer learning programs, staff, and / or volunteers as partners in their federally-funded research projects in support of broader impacts.
- e. Industry partners and grant makers** can support training for employee volunteers and fund partnerships between technology sector industries, informal STEM organizations (e.g., science museums), and afterschool programs to expand computer science expertise for the afterschool field.

## Recommendations (continued)

3

Pursue collective impact strategies that leverage public and private investments, in order to increase the availability of and resources for high-quality afterschool computer science.

Among parents and guardians, demand for afterschool programs outstrips availability by two to one—meaning that the parents of 20 million children would enroll their child in an afterschool program if one were available and affordable to them.<sup>14</sup> Expanding access to afterschool programs in general, is a crucial step that exists in parallel to growing supports for quality computer science education in out-of-school time. A cross-sector approach is required to provide all students with equitable access and build their interest in the computing fields. Public and private efforts can be coordinated to maximize investments and increase the level of funding for programs and for program supports such as professional development, curricula, and evaluation tools.

- a. **Make afterschool programs** eligible partners for federal and state grants that support STEM education goals, and ensure that STEM initiatives include computer science. Use public investments to set the stage for leveraging and growing private funds.
- b. **Fully fund federal programs** that support STEM and computer science learning and related resources, such as Title II, Part A, and Title IV, Parts A and B, of the Every Student Succeeds Act. These programs allow states and local districts to provide students the well-rounded education they need to be engaged and successful, and to prioritize STEM and computer science programs and teacher training. Increases in funding for both the 21<sup>st</sup> Century Community Learning Centers initiative (a dedicated funding stream for afterschool programs within the Every Student Succeeds Act) and the Child Care Development Block Grant will increase the number of low-income, school-age children regularly participating in federally-assisted afterschool and summer learning programs and begin to narrow the opportunity gap.
- c. **Design programs** and initiatives to link out-of-school and school day computer science learning. For example, Title IV, Part A of the Every Student Succeeds Act supports opportunities for hands-on STEM learning, increasing and improving computing instruction, integrating informal and formal STEM programs, and increasing the number of STEM specialty schools.
- d. **Solicit input** from afterschool and summer program experts and other informal STEM education stakeholders when establishing federal agency priorities in computer science education. Federal agencies should invest in an ambitious out-of-school time computer science research agenda that includes large-scale longitudinal studies that track children who have participated in out-of-school time computing programs and document if and how participation in informal computer science programs affects students' lifelong engagement with computer science and related academic and career pathways. Continuing to develop evaluation tools and understanding best methods for supporting the implementation of integrated evaluation practices in afterschool programs will lead to increased program performance and student learning outcomes.



## About the Afterschool STEM Hub

The Afterschool STEM Hub is a collaboration among a diverse set of national education leaders and stakeholders, working to ensure the important place of afterschool and summer learning programs in the STEM learning ecosystem. It includes representation from national afterschool providers, education researchers, informal science organizations, and STEM policy influencers. Further, the Afterschool STEM Hub, and its individual members, are experts in learning and engagement, and support cross-sector partnerships at the national, state, and local level. For questions, please contact [stemhub@afterschoolalliance.org](mailto:stemhub@afterschoolalliance.org).

### MEMBERS INCLUDE:

Afterschool Alliance  
 Association of Science-Technology Centers  
 Boys & Girls Clubs of America  
 Cornell Lab of Ornithology  
 Every Hour Counts  
 ExpandedED Schools  
 Girls Inc.  
 National 4-H Council  
 National AfterSchool Association  
 National Girls Collaborative  
 National Network of Statewide Afterschool Networks

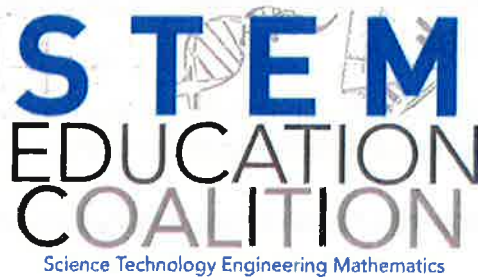
National Summer Learning Association  
 OregonASK  
 The PEAR Institute: Partnerships in Education and Resilience  
 Research + Practice Collaboratory  
 Robert Tai, University of Virginia  
 STEM Education Coalition  
 STEM Next  
 Techbridge Girls  
 Vermont Afterschool, Inc.  
 YMCA of the USA

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## **The Case for Investing in Out-of-School Learning as a Core Strategy in Improving Science, Technology, Engineering, and Mathematics (STEM) Education**

April 2016

### **Introduction**

Our complex and changing world demands an adaptable workforce that is prepared to collaboratively reason through tough problems and come up with creative solutions to the challenges of tomorrow. STEM (science, technology, engineering, and math) educational opportunities cultivate students' curiosity and creativity while teaching them to work as a team, base their reasoning on evidence, and solve problems through experimentation. Our students must gain the critical thinking abilities and other transferrable skills offered by STEM to be prepared for the unknown challenges and opportunities of our future. As such, education in STEM must be elevated as a national priority by enacting education reforms, crafting policies to drive innovation, and adapting federal and state spending priorities.

Imagine STEM learning opportunities as a network of charging stations across the country. Kids power up their STEM skills by plugging into immersive activities extending beyond the standard school day, including hobby clubs, afterschool and summer programs, museums, parks, and online activities. In communities without enough of these outlets, children miss the chance to charge their learning outside of school. That lack of extra STEM practice can have a draining effect on the knowledge and skills they accrue at school.

Exposure to formal and informal learning in STEM subjects, beginning at an early age and continuing through high school, prepares our nation's students for the future ahead. Supporting quality science, technology, engineering, and mathematics education for all children and youth is therefore vital to our country's social and economic prosperity.

The purpose of this brief is to summarize what we know, what we are still striving to learn, and what we must do through public policy to achieve this goal.

## **Part One: What We Know about Science, Technology, Engineering, and Mathematics (STEM) Education in the United States**

STEM education is closely linked with our nation's social and economic prosperity, and strong STEM skills are a central element of a well-rounded education. Why?

### **STEM Education Brings Prosperity, Preparedness and Opportunity**

- One job in the high-tech sector leads to 4.3 jobs in local goods and services industries – which results in positive ripple effects across the entire economy.<sup>1</sup> Between 2014 and 2024, the number of STEM jobs will grow 17 percent, as compared to 12 percent for non-STEM jobs.
- At all levels of educational attainment, STEM job holders earn 11 percent higher wages compared to their same-degree counterparts in other jobs.<sup>2</sup>
- Almost all of the 30 fastest-growing occupations in the next decade will require at least some background in STEM.<sup>3</sup>

### **The problem**

A survey of CEOs of major U.S. corporations in 2014 indicated that approximately 60 percent of job openings require basic STEM literacy, and 42 percent require advanced STEM skills; however, according to the Council on Foreign Relations, 60 percent of U.S. employers are having difficulties finding qualified workers to fill vacancies at their companies.<sup>4</sup> Furthermore:

- Twenty-eight percent say that at least half of their new entry-level hires lack basic STEM literacy;
- Sixty-two percent of CEOs report problems finding qualified applicants for jobs requiring advanced computer/IT knowledge;
- Forty-one percent report problems finding qualified applicants for jobs requiring advanced quantitative knowledge.

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<sup>1</sup> [Bay Area Council Economic Institute, December 2012.](#)

<sup>2</sup> Thomasian, John. (2011, December 1). Building a Science, Technology, Engineering, and Math Education Agenda: An Update of State Actions. *The National Governors Association Center for Best Practices*. Retrieved from <http://www.nga.org/cms/home/nga-center-for-best-practices/center-publications/page-edu-publications/col2-content/main-content-list/building-a-science-technology-en.html>

<sup>3</sup> [Business Center for a College- and Career-Ready America](#)

<sup>4</sup> Council on Foreign Relations Independent Task Force. (2012). U.S. Education Reform and National Security. *Council on Foreign Relations*. Retrieved from <http://www.cfr.org/united-states/us-education-reform-national-security/p27618>

Spotty access to resources like high-quality afterschool programs, science centers, libraries, and partners in STEM professions hinders the preparedness of our country's students to enter a world in need of STEM expertise. Equitable access to high-quality informal learning that engages young people in authentic STEM experiences is a critical piece of addressing these imbalances. Expanding the STEM learning ecosystem to include more learning environments for children will require crafting comprehensive public policies that recognize informal, afterschool and out-of-school programs in their roles as complements to formal education.

For example, African-American and Latino workers now represent 29 percent of the general workforce population (up from about 24 percent in 2001), but just 16 percent of the advanced manufacturing workforce, 15 percent of the computing workforce and 12 percent of the engineering workforce—all rates that have remained essentially flat for many years.<sup>5</sup> To fix this, we need to increase the number of strong STEM afterschool programs in communities that currently have too few, in order to ensure that all children, no matter where they live, have the opportunity to charge up their learning in STEM.

Minority students will be a growing part of the population—and of the potential talent pool. But too many of these minority students lack adequate preparation to major in and pursue careers in the STEM professions. African Americans, comprising just over 12 percent of the population, earn just 9 percent of all baccalaureate STEM degrees and make up only 3.9 percent of scientists and engineers in the workforce according to the National Science Foundation.

But, when we spark their interest early, students are more likely to continue on to study STEM subjects through high school, college and beyond. When we spark their interest early, we have the opportunity to reverse some of the problematic trends currently being seen, including that:

- In 2012, only 11 percent of African American and 14 percent of Latino fourth-graders reached proficiency in science. By the eighth grade, these numbers drop to eight percent for African Americans and 12 percent for Latinos. By the 12<sup>th</sup> grade, only four percent and eight percent, respectively, are proficient as measured by the National Assessment of Educational Progress.
- While progress has been made in some areas (such as biology and chemistry) toward equalizing the gender imbalance between men and women in STEM fields, women remain underrepresented in most STEM professions.<sup>1</sup> While women represent over 57 percent of college graduates, the number of women entering STEM fields is only 26 percent<sup>1</sup> and the number of women in fields such as engineering is even lower, at 22 percent (Hughes, 2013).

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<sup>5</sup> <http://www.usnews.com/news/stem-solutions/articles/2015/02/24/stem-workforce-no-more-diverse-than-14-years-ago>

### **It's never too early to get children involved in STEM-themed education!**

Girls must be involved in STEM subjects early in their K-12 education in order to increase the number of women in STEM fields.<sup>1</sup> Preparing women to pursue education in STEM fields will also increase the number of capable workers in STEM fields and positively contribute to the nation's economy. According to the National Center for Education Statistics, females account for the majority of college students, with 11.5 million females to only 8.7 males.<sup>1</sup> As the Pew Research Center demonstrates, there is a particular increase in college enrollment in the number of Hispanic and African American females when compared to their male counterparts.<sup>1</sup> Given all of these considerations about the importance of STEM education to our nation's economic future, one of the central goals of any national education policy must be to enable more of our students, especially those from underrepresented or disadvantaged groups populations, to plug in to opportunities to study and succeed in STEM fields as early in their studies as possible. Afterschool STEM programs are essential to this strategy, as they both expand and broaden the STEM ecosystem. The goal of STEM policy should be to create a country where access to STEM education does not depend on where a child lives, or on their background.

### **Out-of-School Learning must be a critical element in an overall strategy to improve STEM education.**

Over the past several years, the STEM education community has increasingly embraced informal education programs as a mechanism for strengthening STEM education. If we want to employ an "all hands on deck" approach to improve STEM, we must fully utilize the opportunities presented by out-of-school, informal, and afterschool learning environments.

Emerging research is demonstrating very clearly that out-of-school STEM programs contribute to both academic and social measures of student success.

A major study published in *Science* in 2006 found that "professed interest in STEM careers by eighth grade was a more accurate predictor of getting a science-related college degree than were the math or science test scores of those same eighth-grade students."<sup>6</sup> More than a decade of increasingly comprehensive studies have reinforced the notion that informal learning can make concrete, measurable contributions to student success, not only in the classroom environment, but in broader measures of youth development, maturity, and career success.

Two representative studies of specific out-of-school programs, 4-H and FIRST Robotics Competition, conducted by major non-profit organizations are representative of emerging data on the impact of in-depth educational STEM experiences on student success.

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<sup>6</sup> Tai, R.H., Liu, C. Q., Maltese, A.V., & Fan, X. (2006, May 26). Planning early for careers in science. *Science*, 312, 1143-1144.



In 2011-12, 4-H, which reaches more than 6 million students through its youth engagement efforts, performed an evaluation of its Science Initiative using information gathered from a Youth Engagement, Attitudes and Knowledge (YEAKE) survey.<sup>7</sup> Their findings indicated that:

- More than 80 percent of respondents intend to finish college or continue to pursue more education after college and fifty percent of respondents want to pursue a science career.
- Seventy-one percent of participants in the STEM group 4-H Science said science is one of their favorite subjects.
- Sixty-eight percent do science-related activities that are not for school work.
- Fifty-nine percent would like to have a job related to science when they graduate from school.

In a similar effort, Brandeis University's Center for Youth and Communities conducted an independent survey of FIRST Robotics Competition participants (ages 14-18), of which there are annually more than 70,000, and compared them to peers who did not have this opportunity.<sup>8</sup>

They found that FIRST students are:

- More than three times as likely to major in engineering when they go to college
- Roughly ten times as likely to have had an apprenticeship, internship, or co-op job in their first year of college.
- Significantly more likely to expect to achieve a postgraduate degree.
- More than twice as likely to expect to pursue a career in science and technology.
- Nearly four times as likely to expect to pursue a career in engineering.
- More than twice as likely to volunteer in their communities.

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<sup>7</sup> 4-H Council. (2010). Evaluating the 4-H Science Initiative: The 2010 Youth, Engagement, Attitudes and Knowledge Survey Results. Retrieved from [http://www.4-h.org/uploadedFiles/About\\_Folder/Research/Science/Final%20YEAKE%20Report.pdf](http://www.4-h.org/uploadedFiles/About_Folder/Research/Science/Final%20YEAKE%20Report.pdf)

<sup>8</sup> <http://cyc.brandeis.edu/partners/FIRST%20Robotics.html>

## Out of school opportunities can power up both parents and kids!

A study of the U.S. Department of Education's 21<sup>st</sup> Century Community Learning Centers (21<sup>st</sup> CCLC) program, the only federal funding source exclusively dedicated to afterschool programs, showed that participating students had fewer absences and less tardiness, higher grades, higher rates of homework completion, and increased rates of parental involvement in school.<sup>9</sup> STEM learning is now a priority for 21<sup>st</sup> CCLC nationally and 12 states now encourage afterschool programs to include STEM programming in their applications.

After a 15-month review of the current evidence base, the National Research Council's (NRC) Board on Science Education concluded in a recent 2015 study that out-of-school programs have been shown to:

- contribute to young people's interest in and understanding of STEM,
- connect young people to caring adults who serve as role models, and
- reduce the achievement gap between young people from low-income and high-income families."<sup>10</sup>

Further, the NRC found that:

**"Research and evaluation findings are not yet robust enough to determine which programs work best for whom and under what circumstances. The limitations of the existing research are due to the many types of out-of-school STEM programs, and the difficulties of measuring the outcomes of such programs. The findings are strong enough, however, to identify three criteria of programs that produce positive outcomes for learners: they are engaging, responsive, and make connections."**<sup>11</sup>  
*[Emphasis added]*

Afterschool and summer learning programs around the nation have enthusiastically embraced STEM programming and are engaging children and youth in STEM learning—including those who may not otherwise be selected to, or choose to, participate in STEM programs. A recent study showed that 7 million children are participating in afterschool STEM programs in the United States.<sup>12</sup>

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<sup>9</sup> Afterschool Alliance. (2011, May). Afterschool: A Vital Partner in STEM Education. *Afterschool Alliance*. Retrieved from [http://www.afterschoolalliance.org/Afterschool\\_as\\_STEMpartner.pdf](http://www.afterschoolalliance.org/Afterschool_as_STEMpartner.pdf)

<sup>10</sup> National Research Council. (2015). Identifying and Supporting Productive STEM Programs in Out-of-School Settings. Committee on Successful Out-of-School STEM Learning. Board on Science Education, Division of Behavioral and Social Sciences and Education. (Page 2)

<sup>11</sup> National Research Council. (2015). Identifying and Supporting Productive STEM Programs in Out-of-School Settings. Committee on Successful Out-of-School STEM Learning. Board on Science Education, Division of Behavioral and Social Sciences and Education. (Page 3)

<sup>12</sup> (Afterschool Alliance, 2015). *Full STEM Ahead: Afterschool Programs Step Up as Key Partners in STEM Education*. Retrieved from <http://www.afterschoolalliance.org/AA3PM/>

There has been a significant effort to define frameworks for youth outcomes<sup>13</sup> in afterschool STEM programs and to document evidence of impacts.<sup>14</sup> These programs host varied modes of intervention, allowing educators to match learning experiences to student interests and to use project-based learning that drives home the relevance and importance of STEM in daily life. The afterschool setting uniquely gives young people the opportunity to learn through solving problems and through failing—an experience crucial to research, experimentation and innovation and developing the persistence the fields require.

We know that high-quality out-of-school STEM learning programs are strong contributors to improving student learning in STEM fields. We also have a good idea of what we don't know, and that we must keep investing in research to help answer lingering questions about which forms of out-of-school learning work best in a diverse range of settings and communities.

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<sup>13</sup> *Defining youth outcomes for STEM learning in afterschool*. Retrieved from [http://afterschoolalliance.org/STEM\\_Outcomes\\_2013.pdf](http://afterschoolalliance.org/STEM_Outcomes_2013.pdf)

<sup>14</sup> *Examining the impact of afterschool STEM programs*. Retrieved from <http://afterschoolalliance.org/ExaminingtheImpactofAfterschoolSTEMPrograms.pdf>

## **Part Two: What We Must Do to Make Informal Education a Core Aspect of STEM Education Policies**

Students develop an understanding of STEM concepts and skills through immersion in a wide array of learning experiences that take place both in out-of-school programs and in school. Just as language immersion builds fluency in languages, STEM immersion will help to build literacy and fluency in STEM knowledge and skills. This immersive learning process demands that federal policies support programs that will deliver valuable out-of-school STEM and link them to learning in the classroom.

In developing criteria for successful informal STEM programs, the National Research Council concluded that there were three characteristics of successful informal STEM education programs:

**“Productive programs engage young people intellectually, socially, and emotionally.**

Productive out-of-school STEM programs provide young people with firsthand experiences with STEM phenomenon and materials, engage them in sustained STEM practices, and are aligned with participants’ cultural resources and practices. In such programs, young people are engaged in firsthand, materials-rich, and place-based learning experiences that involve processes of scientific or engineering investigation and practice. Thus, productive out-of-school STEM programs engage young people in the processes of doing STEM in ways they find compelling and challenging, and develop their interest, understanding, and commitment to continue engaging in STEM learning.

**Productive programs respond to young people’s interests, experiences, and cultural practices**

Productive out-of-school STEM programs make STEM relevant to the questions that interest young people, support collaboration and leadership by young people, and train staff to support and build young people’s STEM activities and interest. Productive out-of-school STEM programs are also responsive to young people’s prior interests and experiences so that they can see STEM as meaningful and relevant to their own experiences and aspirations.

**Productive programs connect STEM learning in out-of-school, school, home, and other settings**

Productive out-of-school STEM programs explicitly help young people make connections among STEM experiences in and across settings and programs, leveraging community resources and partnerships and brokering ongoing opportunities to engage in STEM learning activities. Productive out-of-school programs also help young people understand how what they experience and learn relates to learning in other settings, including school. Thus, productive out-of-school programs purposefully help young people, their parents, and others in the community capitalize on developing expertise and interests across time and setting.”



Student engagement in STEM activities in informal settings is too often considered an afterthought, but as we have seen, this view is not reflected in the rapidly expanding body of evidence about outcomes from informal learning.

Federal policies that seize on afterschool programs and their unique role in inspiring interest and success in STEM education will engage more young people in the STEM fields so important to the future of our country.

### **A Federal Informal STEM Education Policy Agenda**

As the number and diversity of out-of-school programs that support STEM learning supported by both private sector and government funding continue to grow, it is becoming increasingly important for policy makers to make informed decisions about which programs to support. Considering the enormous potential of informal learning opportunities to enhance the impact of efforts to improve STEM education, a broad-based federal public policy agenda must address the following needs:

- **Informal education as a core STEM strategy:** Informal education should be viewed by policymakers as a core strategy for enhancing and improving STEM education and informal educators and programs must be considered as valuable partners for STEM education improvement efforts. Out-of-school opportunities support STEM learning independently from classroom learning, much like the way multiple pollination points boost an ecosystem.
- **Integration of informal learning:** Broad-based STEM education reform efforts must integrate informal STEM education opportunities, immersing students in STEM much like they are immersed in a language. This includes stipulating informal programs as eligible partners for federal grant funds that support STEM education goals.

**To enable success, the following supports must be in place:**

- **Dedicated Funding:** Recognizing the unique role of informal STEM education programs to build interest, identity and skills in a way that is different from school-day learning, there must be dedicated funding streams available for such programs.
- **Professional development:** Afterschool learning practices must be integrated into federal professional development programs for STEM educators. Federal professional development programs must support professional development for both teachers and afterschool educators to ensure complementary STEM content delivery and effective implementation of high-quality K-12 math and science standards.
- **Federal coordination and management:** The executive branch must develop and implement a comprehensive federal strategy to coordinate and manage investments in

informal STEM education programs, resources and activities. Such a strategy must include a strong mechanism for including informal STEM education stakeholder inputs in the formulation of federal agency priorities, goals and policies.

### **How will we know that our efforts have been successful?**

- **Knowledge base:** Budgets must prioritize investments in educational research programs to build the knowledge base about what works in afterschool and other informal STEM education programs. To expand research-based knowledge about productive strategies to support STEM learning in out-of-school settings and programs, there is a need to invest in research that documents both the learning that occurs in individual programs and also how STEM learning develops across settings and over time through a wide variety of opportunities.

Spending time in programs outside of school that focus on STEM subjects gives all students the opportunity to experiment with STEM ideas in real-world situations. Such opportunities help spark curiosity, especially for those who might not think of themselves as "math and science kids." Additionally, out-of-school opportunities are particularly well suited to sparking interest in STEM and building identity as a STEM learner.<sup>15</sup> STEM education stands to be greatly improved by taking advantage of the complementary nature of formal and informal learning opportunities, which includes after-school programs. Settings like afterschool and summer learning programs can be thought of as pollination points in a wider STEM ecosystem, where having multiple locations to learn reinforces students' developing mastery of science, technology, engineering and mathematics skills. We all benefit when more of our children have a fair and equal chance to live up to their potential and contribute to our society.

### **Acknowledgements**

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<sup>15</sup> National Research Council. (2009). Learning Science in Informal Environments: People, Places, and Pursuits. Committee on Learning Science in Informal Environments.

# Da Vinci Science Center

## STEM Summer Learning Programs

### ***Innovative Programs***

Summer Learning programs exist to increase literacy skills that are so critical to a child's success in any career they choose in the future. These programs are especially designed for students with low income or with other barriers to success to address a phenomenon known as Summer Learning Loss. Integrating science, technology, engineering, and math (STEM) with literacy can engage and motivate students to improve their achievement in literacy and STEM. This early achievement is critical to creating a prepared workforce for the future. The Da Vinci Science Center, a hands-on Science Center in Allentown, PA, tackled the challenge of Summer Learning Loss by collaborating with 3 local school districts, Allentown, Bethlehem, and Easton, to host STEM Summer learning experiences with the following goals:

- Improve academic performance in literacy as measured by standardized test scores.
- Improve student attitudes about science, literacy, and STEM careers, measured by student surveys.
- Improve student performance of process skills and problem solving measured by student data.
- Increase classroom teacher interest in integrating STEM and literacy to improve student outcomes.

The programs integrate hands-on STEM investigations into existing literacy curriculum to make the reading and writing more purposeful. Popular topics included *Insect Investigations* and *Robot Explorations*.

### ***Demonstrated Results***

Last summer, 58 students between grades 3 and 5 participated between the 3 districts. The results have been tremendous.

- Every single student in the schools reporting data back (not all results are in) showed gains in standardized test scores for literacy. **Typically, these students lose 2-3 months of academic achievement during the summer.**
- Students made gains in scientific content knowledge, measured by tests of common misconceptions and students reporting that they thought they learned something. Students were able to articulate the new things they had learned in their own words.
- Students made gains in their interest in STEM Careers. Over 90% said their interest increased or that they were already interested.
- Over 60% of students said as a result of the program, they are more likely to do more STEM outside of school – after school, at home with family, or watching STEM related media.

The program employs classroom teachers and science educators working as a team to bring science and literacy to life. A quote from a classroom teacher:

***“One child stands out in my mind that brings faith back to how much effective teaching can reach a child. He was in the incoming 4<sup>th</sup> grade class and did not want to be part of a “boring summer school class”. He did all he could not to participate. He sulked. He slept. Teachers tried everything they could to engage him and still nothing.***

***Until the day we viewed a video on insects and their habitats. The reading and math were both correlated to our upcoming scientific study and field trip and then...bingo – we saw a spark of interest. He inched closer and closer to the groups and then picked one to be in. He even asked to be part of putting together an insect habitat. From then on, he became one of the biggest contributors to classroom projects and discussions. His reading and math inched up and showed improvement. As a teacher, I am definitely using this approach to reach students like him in my classroom.”***

## **YWCA STEM PROGRAMS: DESCRIPTION & OUTCOMES**

YWCA Greater Pittsburgh's out-of-school programs engage elementary and middle school girls with hands-on STEM projects; math and science enrichment; life skills; and college/career exploration activities – improving girls' interest, confidence, and aptitude in STEM. YWCA's programs are strengthened by partnerships with Carnegie Science Center and Allegheny Partners for Out of School Time (APOST).

During the academic year, girls participate in YWCA's STEM programs for two hours after school each week, working together to tackle project-based STEM challenges. Girls learn how to program robots, digitally edit videos, and conduct scientific experiments. They launch rockets, build rovers, and learn about NASA careers. They make lip gloss to practice measurement and fraction conversion, while learning about the jobs of cosmetic scientists. They learn about the body's anatomy and how STEM solutions are used to protect and promote their health.

Learning content is intentionally connected to Pennsylvania Academic Standards so that it reinforces curriculum taught in school, prepares girls to succeed academically, and bridges the gap between classroom instruction and real world application.

One Saturday each month, girls from our middle school sites gather at a local university to amplify their STEM experience and also focus on life skills, college awareness, and career exploration. Girls enjoy being on campus for these day-long sessions – an invaluable experience that helps girls envision themselves belonging at college. Girls speak with admissions officers about the college search process and learn how to choose a college based on their career goals. During Saturday Academy's "Career Café," girls interact with professionals in fields where women are typically underrepresented – meeting women who are doctors, chemists, and finance professionals, to name a few.

### **Attendance**



89% of girls achieved a 90% school attendance rate

### **Number of Students**



261 girls

### **Grades Improved**



70% of girls improved their math grades or maintained A's and B's



## STEM STARS STORIES



**Taylor Hill-Brown, a 7<sup>th</sup> grade Propel Homestead student, walks through the door of her STEM Stars after school program. She can't wait to get her hands dirty.** She dives in. Taylor builds a tower from index cards and tape, concocts slime from glue and borax, and designs a catapult from rubber bands and popsicle sticks.

**Taylor has learned about engineering at STEM Stars – and has dreams of going to a good college.** During her spare time, Taylor plugs away at her homework because she knows that getting good grades is important for doing well in life.

**Taylor and other STEM Stars participants spend one Saturday each month at Chatham University.** The girls explore campus, eat lunch in the cafeteria, and complete science experiments in college labs. Taylor and her friends begin to envision themselves belonging in the college world. She loves to scope out the best places on campus. **“My favorite part is taking pictures of the campus with my phone and sending them to my mom.”**

**“She is already planning for college because those doors have been opened for her. YWCA’s program has really boosted her self-esteem, showing her what girls can do.”**

**- Shayla’s mom**

Another STEM Star, **Shayla, is a budding archaeologist. She has fun doing “hands on things” like making catapults or slime.** Whether she is at STEM Stars after school or attending Saturday Academy at Chatham University, she says that **she likes STEM Stars because “it touches everything I love like Science, Technology, Engineering and Math.”**





## STUDENT TESTIMONY

### Jory Strothers

Neighborhood Learning Alliance

November 13, 2017

“Leadership is not about a title or a designation. It is about impact, influence and inspiration. Impact involves getting results, influence is about spreading the passion you have for your work, and you have to inspire teammates and others.” This quote by Robin S. Sharma shows what I stand for and without the Neighborhood Learning Alliance, I would not have been exposed to many of the opportunities

that have influenced my life. My job requires me to give 110% of my work ethic to the students that I work with. I provide many students with the support and confidence they need to believe in themselves. This program has given me the opportunity to demonstrate my public speaking skills and improve my teamwork skills when working with students, staff and other Warriors.

In this day and age, youth and STEM go hand-in-hand; STEM is becoming more popular, complex and interactive. Having hands-on experiences with STEM activities provides students with early exposure to the possibilities for after high school; this helps motivate them to dream big! I am glad to help shape the minds of our youth and provide them with the mentoring they need to become successful! Inspiration is key and I am proud of how I inspire these students every day.



# Mariah Greene

Neighborhood

Learning Alliance

November 13, 2017

The Neighborhood Learning Alliance has brought many life-changing experiences for me. I developed some very close relationships in my two years as a Reading and Tech Warrior. Our STEM and reading lessons have impacted our after school sites in terms of expanding

their way of thinking about these topics. I believe that our students are gaining interest in the sciences and are becoming more aware that STEM companies are growing rapidly each day. This gives them an opportunity to have a head start in the world to discover which STEM based occupation may best fit them. We teach our students to strive for the best and portray leadership wherever they are.

The program provides our kids with unique reading skills that not every child has the opportunity to grasp. Unfortunately, we cannot get a hold of every child in the world, but in aiding a large portion of youth in our communities with this education, we can help spread awareness to other children in need. This has a huge impact on our children as they grow to become our future teachers and supporters in the world!

Not only have I gained an interest in reading, but I have also gained enthusiasm and patience. The company has impacted me by improving my communication skills and my self-esteem. I think this is a bonus for me because it gives me another reason to wake up in the morning. Every day is a new chance for me to change the lives of several children. I have the ability to shift their perspective about STEM, and I am able to connect with them on a deeper level where I can provide them with the support they need. My literature skills are increasing as I become more interested in reading. It is a win-win situation for both the students and myself, as the program allows us to strengthen our passion for reading and STEM!

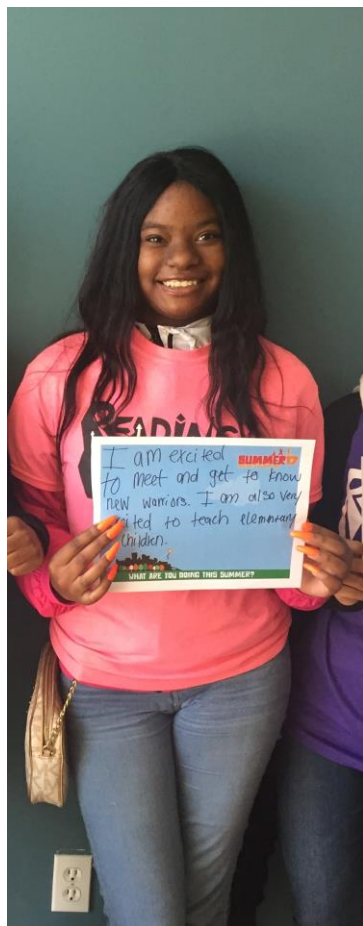




# Nakaiya James

Neighborhood Learning Alliance

November 13, 2017



At the Neighborhood Learning Alliance's after school programs, we have exposed our youth to a variety of STEM lessons and created an enthusiasm for reading! We provide support that shows kids how fun STEM can be; we lead activities that are fun, interacting, thought-provoking and engaging. Since the start of the program this school year, we have led activities dealing with chemistry, like slime and rockets, and tools for healthy living. At Lincoln Elementary School specifically, I was so happy to see how engaged the kids were and how much they enjoyed learning about concepts that interested them. Most of these students may not have access to the tools they need, and it is my pleasure to provide them with the tools for success. I want to show these kids that they can be anything that they want to be; reading comprehension and fluency skills are two main ingredients to all careers and two of our goals at the Neighborhood Learning Alliance! The Warriors' work teaching and exposing youth to STEM and reading techniques can influence their understanding of the world and how impactful they can both be.

Ever since I was in elementary school, I wanted to be a teacher; I even remember playing teacher and giving friends and family "homework". This job allowed me to experience being a teacher and I am so grateful I have had the opportunity to experience that at such a young age. Being a Tech Warrior has taught me to dream big and take advantage of every opportunity I am given! My dream is to own a business that designs and sells luxury cars. This entire experience as a Tech Warrior has made me better understand youth and just how much potential they have to be great; some of the students just need a mentor supporting them and telling them how great they can be! Within my 3 years of being a Warrior I was able to meet and network with wonderful people; I have developed really strong relationships with them and I am beyond grateful for all of their support. The constant support from my mentors, supervisors and peers is also extremely impactful.