STEM READY AMERICA

Inspiring and Preparing Students for Success With Afterschool and Summer Learning

This collection of articles is excerpted from a new resource, *STEM Ready America: Inspiring and Preparing Students for Success with Afterschool and Summer Learning.* In this volume, Executive Editor Ron Ottinger and Contributing Editors Cary Sneider and Ian Hickox have collected expert perspectives on the state of the field of STEM learning—especially in afterschool and summer learning opportunities.

Collectively, these writings from more than 40 thought leaders highlight how young people are developing STEM knowledge and skills that will prepare them to be successful in school today and the workforce tomorrow.

The articles provide persuasive evidence and real-world examples to inform effective partnerships, policies, and actions to bring quality STEM learning to children and youth across the nation. This volume is focused in three key sections:

- The Evidence for STEM
- Partnerships for STEM Learning
- Ensuring Access to Quality STEM Learning



Developed by STEM Next with support from the Charles Stewart Mott Foundation, *STEM Ready America* builds on the award-winning 2013 publication *Expanding Minds and Opportunities: Leveraging the Power of Afterschool and Summer Learning for Student Success* edited by Terry K. Peterson, Ph.D., which made the definitive case for the power and effectiveness of afterschool programs and summer learning.

For more information about STEM Ready America and to download articles visit: www.stemreadyamerica.org.



Inspiring and Preparing Students for Success with Afterschool and Summer Learning Evidence and examples on how young people are developing STEM knowledge and skills that will prepare them to be successful in school today and the workforce tomorrow. www.STEMReadyAmerica.org

The Story Behind STEM Learning Ecosystems

Gerald Solomon

Ronald Ottinger, Executive Editor STEM Next | Charles Stewart Mott Foundation t begins with a curious 11-year-old boy living in southern California's San Fernando Valley who had a science project he needed to complete. He'd decided to build one of those manufactured electronic kits, known as a Heathkit. With the help of his elementary school teacher and an afterschool educator, the young boy began to make calculations, draw designs, wire and solder fuses, and install tubes. Once the kit was built, he plugged the radio kit into the wall and it produced sound. The young boy was enthralled. It was at that moment that he made the decision to find out everything he could about radio waves. That young boy's name was Henry Samueli. He later went on to earn his bachelor's, master's, and doctoral degrees at UCLA and subsequently founded Broadcom, one of the world's largest and most successful technology companies.

Years later when Dr. Samueli took his company public, his first thought was "how can I help create opportunities like the one I had as a young boy?," opportunities that leverage teaching and learning both in-school and out-of-school and which have the potential to spark a level of interest for young girls and boys to pursue a career based on innovation, entrepreneurship, and engineering.

In 2010, a number of years after the Samueli Foundation was formed and I was hired as executive director, the Samueli Foundation, in partnership with UC Irvine's Henry Samueli School of Engineering and the School of Education, the National Academy of Engineering, and the Children and Families Commission of Orange County hosted STEM Summit 2010, the first national gathering of over 200 STEM (science, technology, engineering and mathematics) leaders from around the country

One of the key principles in the design of the gathering was that it was not focused on any particular aspect of STEM education, rather on the entire learning continuum from birth to workforce



Figure 1

and all stakeholders that intersect within that continuum. The invitation list included thought leaders representing different facets of the learning community, including but not limited to: early childhood education, out-of-school-time (OST), informal STEM rich institutions, public education from PK-12, post-secondary, philanthropy and business. It was at this national gathering that the concept of a "STEM Learning Ecosystem" was born (see Figure 1).

As a result of the STEM Summit 2010, a group of dedicated leaders from Orange County, California representing each of these sectors gathered together to discuss lessons learned and the overall need for STEM education in Orange County. Central to the conversation was how Orange County could build a new system and architecture to support STEM teaching and learning based on the following set of core premises:

- Learning is 24/7;^{1,2}
- STEM learning begins early in life, well before kindergarten;²
- There is a continuum of learning from early childhood through higher education and workforce;³
- The learning experience has to be informed by employers who are the end users of the educational system;⁴
- Out-of-school learning offers unique opportunities to engage and interest youth in STEM learning that in-school does not, and that out-of-school learning platforms range from after-school and summer programs, to youth development programs, to STEM rich institutions; and⁵
- Literally every community stakeholder has a role to play in the STEM Learning process. It is all about an integrated approach.⁶

Thus, the Orange County STEM Initiative (OC STEM) was born.

Since its inception, OC STEM has served as a national model for both structure and operations of a STEM Learning Ecosystem. It is clearly not the only model and approach, but it has proven to be effective for Orange County and instructive for other communities. Figure 2 depicts OC STEM's operational and governance structure ,with the horizontal axis representing the learning continuum from PK through workforce.

Figure 3 illustrates OC STEM's programming with a focus on a county comprised of 27 school districts with approximately 445,000 K-12 students. OC STEM's success is directly attributable to the coordination of ALL learning platforms, from in-school to out-of-school to youth development and science rich organizations. Each contributes in a strategic fashion to the learning progression that meet the needs of our local economy (the business voice).

Concurrently with the launch of OC STEM, the first formal STEM Learning Ecosystem, a group of foundation executives happened to find themselves at a Grantmakers for Education (GFE) conference, where a conversation started on how STEM education could take on a more pronounced role. On the proverbial napkin, leaders from the Noyce Foundation, S.D. Bechtel, Jr. Foundation, and the Samueli Foundation began sketching out ideas for creating a collaboration of funders whose primary vision and purpose would be based on STEM teaching and learning. This group of leaders proceeded and met with GFE and asked if GFE would serve as a fiscal agent and sponsor the development of a STEM-based affinity group. GFE agreed, and the three funders contacted Jan Morrison, the executive director of the Teaching Institute for Excellence in STEM (TIES), to inquire if she were available as a consultant to help them design what a STEMfocused funding group might look like. Jan Morrison agreed, and the three funders contributed resources to begin the process.

The STEM Funders Network (SFN) was born.

Figure 2

www.ocstem.org | @steminitiative | #OCecosySTEM



Figure 3



Over the ensuing few months, the original funders reached out to their colleagues to share their concept. To no one's surprise, others recognized the potential value of such a gathering of STEMfocused funders and asked to join in. Within the year, an initial gathering of STEM funders met in Irvine, CA and then in Raleigh NC, to design the framework for what is today a group of more than 26 corporate and private funders dedicated to STEM learning, STEM literacy and the development of a STEM-skilled workforce. The principles behind this national STEM Funders Network were simple: 1) provide a space where funders can learn from one another and share their experiences and work, and 2) do something that none of them could accomplish alone, leveraging collective resources for systemic impact. To accomplish these priorities, SFN members agreed upon several guiding core values:

- The STEM disciplines should not be in separate silos; rather they must be integrated through a continuum of learning and a dynamic framework.
- STEM literacy emerges across learning settings and throughout one's lifetime. No one sector or setting can provide the comprehensive experiences and content needed to achieve STEM literacy.

- **3.** Advancements and innovations in STEM education should connect directly to the changing needs of the STEM workforce.
- **4.** The STEM Funders Network's activities and projects are informed by research and will be evaluated for their effectiveness and impact.

As their first collaborative project, the initial SFN members decided to support the development of and adoption of the Next Generation of Science Standards (NGSS). For two years, SFN members allocated resources to the State Science Officers and Achieve organizations to support this critically important effort. While NGSS was being designed, developed, and launched, OC STEM was demonstrating a new STEM learning model. Several SFN members decided to invest in similar STEM models, first in Tulsa, OK and then in Boston, MA, among others.

After watching these STEM Learning Ecosystems develop for a few years, the STEM Funders Network decided to take on a second national project, entitled the STEM Learning Ecosystem Initiative, a phrase coined by the National Research Council at the STEM Learning Is Everywhere national conference. In three short years, and with the support and leadership of many SFN members, the national STEM Learning Ecosystem effort is supporting the cultivation of nearly 40 STEM Ecosystems across the United States, with more expected to join in 2017, with the goal of cultivating more than 100 STEM Learning Ecosystems around the country.

From coast to coast, urban to rural, north to south, east to west, a set of core learnings and outcomes have evolved, affirming, in many ways, the hypotheses developed at the outset of OC STEM, which derived from the 2010 STEM Summit. The STEM Learning Ecosystem Initiative is transforming how students learn, how educators teach and how workforce pipelines are filled with workers who can think critically, collaborate, analyze, communicate and possess the core skills to adapt to and fit into an ever evolving workforce. The design features of a STEM Learning Ecosystem include:

Long Term Goals:

- Every learner (student and adult) needs to become STEM literate and acquire the 21st century STEM skills required to be gainfully employed and to be productive citizens of their community;
- 2. The education system, both in and outof-school, needs to be transformed and equipped to provide the training, expertise, and programming to achieve Goal #1; and
- By achieving Goals 1 & 2, people and communities will thrive in the new economy of tomorrow. We will build the most competent and skilled workforce in the world.

Inputs/Action Steps to Achieve These Goals:

- 1. Leadership is critical!
- 2. Resources are required for the long haul.
- 3. The group needs to wrestle with and manage the "WIFM" (what's in it for me) mentality that asks "why should I be part of this?" It is key to overcome that initial mentality to get beyond enlightened self-interest.
- **4.** As Jim Collins says, the right people need to be on the STEM redesign bus.⁷
- **5.** It's all about architecture and engineering design of cross-sector partners.

Leadership:

This cannot be emphasized enough. It's all about selecting, and supporting the right "backbone" leader and organization who has the respect, credibility, and gravitas to drive the work. This is not a part time role. It requires significant dedication from launch to the long haul.

It does not matter where the leader comes from. It can be a foundation person, such as in OC STEM; a business leader, such as in the Great Lakes Bay Regional STEM Initiative serving the Great Lake Bay Region and Prosperity Region 5; an after-school leader, such as in the Providence After School Alliance STEM Ecosystem; a science center leader, such as in the Bay Area STEM Ecosystem in South San Francisco; or a public education leader, such as in the East Syracuse Minoa Central School District STEM Learning Ecosystem in New York. The critical factor is that they are LEADERS!

Resources:

The evidence is clear. Leading without the requisite backbone support is a formula for failure. Having the necessary infrastructure support, from the leader's own organization, or from a collaborative partner, allows the leader, and the cross-sector leadership team, to do "whatever it takes" to get the work done.

Enlightened Self-Interest:

It is human nature to want to get something out of one's effort. Everyone wants to feel valued, respected and feel a sense of self-worth. Recognize that principle, respect it, and have a conversation about how that fits into the paradigm of collective social impact. This is often a key stumbling block that sometimes requires intervention by an outside facilitator. If it is not managed, it will come back to haunt the effort.

The Right Team:

The STEM ecosystem is about "community," and entails a truly holistic collective engagement of all voices. To optimize opportunity and impact, all stakeholders need to be at the table: early learning, PK-12, post-secondary, workforce, after-school, youth development entities, STEM rich institutions and government. Not easy, but the greater the diversity, the greater the potential impact.

To make it even more challenging, the representatives from each needs to be a decisionmaker. Otherwise, the STEM ecosystem is hollow, lacks the nimbleness to make and implement decisions, and lacks the requisite credibility to have real voice.

It's All About the Architecture:

We say it over and over and over again, and cannot say it strongly enough: we are agnostic about the program work. It is ALL about the system and the architecture. There are a lot of good and promising programs, but without a cross-sector leadership and delivery system, they are simply one-off good programs. Conversely, systems without content are hollow. Combine the two and the ecosystem can scale, have impact, and be sustained.

Knowing what to do and who needs to be involved is two-thirds of the solution. To complete the work, it is vital to know how to do it? The answer is through engineering design thinking and principles.

When examining "process" we quickly recognized that everything—EVERYTHING—from the natural to the manmade world, has been engineering and designed. Why don't we teach that? Why don't we use that more than we do? So, we decided to take this design thinking and make it the fuel of the engine.

The STEM Learning Ecosystem Initiative deploys trained professionals to each ecosystem community and helps facilitate and guide the leaders and partners to design and create what works for them! It is not prescriptive. After all, who are we to tell someone local communities what they want or need to do. Engineering design is a process to help communities identify the roadmap themselves.

The leveraging value of philanthropy is its catalytic role. It seeds. In the past seven years, through the STEM Learning Ecosystem Initiative and the STEM Funders Network, philanthropy has done what it does best. The challenge now becomes how to sustain the growing number of ecosystems and the national initiative. We are cautiously optimistic that with government and business leaders engaged in STEM Ecosystem, the community (ecosystem) has created a cross-sector model, by its very nature, will provide the incentive and motivation for sustainability. Time will tell. Initial indications from thriving STEM Ecosystems are that the right formula has been developed.

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About the Author



Gerald R. Solomon has served as the Samueli Foundation's Executive Director since April, 2008. Prior to the Samueli Foundation, he served as CEO of Public Health Foundation Enterprises (PHFE) for seven years where he transformed the organization from an LA-centric provider of funding and services into national prominence. Mr. Solomon has served as the Executive Director of the Samueli Foundation since 2008, overseeing their philanthropic activities, focused on STEM Education, Youth, Integrative Health and Jewish Leadership. He led the design and development of the OC STEM Initiative, the nation's first STEM Ecosystem, which has served as the model for the development of STEM Ecosystems in nearly 40 cities around the country. Mr. Solomon, in addition to serving as the Chair of OC STEM, serves as co-chair of the STEM Funders Network, a collaboration of 20+ foundations focused on STEM education from PreK-20, encompassing formal and informal learning platforms. He also serves as co-chair of the STEM Learning Ecosystem Initiative whose goal is to cultivate the development of STEM Ecosystems in over 100 cities around the country by 2020. This initiative has received national attention and support from such organizations as OSTP in the White House, DOE, CNCS, CGI, NSTA and ASTC to name a few. Mr. Solomon also serves on the board of the CDE Foundation, the Southern California Grantmakers, and both the Dean's Advisory Councils for the UCLA Samueli School of Engineering and Applied Sciences, and the UCI Samueli School of Engineering, as well as the Dean's Advisory Council for the UCI School of Education.