STEM Learning Ecosystems Initiative Update

By
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Gerald Solomon, Samueli Foundation
STEM Funders Network Co-Chairs

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This initiative is supported by the STEM Funders Network.
Reminder...

WHY ARE WE HERE

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Questions at info@stemecosystems.org
Underlying Premise

When does learning occur?

Credit: Life Center, Univ. of Washington
Global Societal Challenge

- Level 1
  - Climate Change
  - Water Scarcity
  - Energy Security
  - Cyber Security
  - Global financial structure
  - Biodiversity and Ecosystem losses
  - Fisheries Depletion
  - Deforestation
  - Infectious Disease

- Level 2
  - Poverty
  - Education
  - The Digital Divide
  - Urbanization
  - Intellectual property
  - International labor and migration
  - E-Commerce rules
  - Biotechnology rules
  - Maritime Safety and Pollution

Unfortunately, little to no connection between education and real world

Eliminate our way of life

Disruptive to our way of life

Credit: Gregory Washington, PhD, Dean, Samueli School of Engineering, University of California, Irvine
Unprecedented Global Competitors

Singapore 1965

Shanghai - 1987

Are we educating students to truly compete globally?

Singapore 2015

Shanghai 2015

Credit: Gregory Washington, PhD, Dean, Samuei School of Engineering, University of California, Irvine
Equity Challenge...

Women have seen no improvement in STEM since 2001

Women remain as scarce as ever in engineering, computing, and advanced manufacturing.

<table>
<thead>
<tr>
<th>Women as a percentage of the:</th>
<th>2001</th>
<th>2014</th>
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<tbody>
<tr>
<td>Engineering Workforce</td>
<td>13%</td>
<td>12%</td>
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<tr>
<td>Computing Workforce</td>
<td>27%</td>
<td>26%</td>
</tr>
<tr>
<td>Advanced Manufacturing Workforce</td>
<td>10%</td>
<td>10%</td>
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</table>

African Americans and Latinos have lost ground in STEM

Whites and Asians still dominate the STEM workforce

Between 2001 and 2014, whites and Asians declined from 74 to 69 percent of the working-age population. Yet their dominance in critical STEM occupations continues unabated.

African American/Latino Percentage of:

- the U.S. working-age population
- the advanced manufacturing workforce
- the computing workforce
- the engineering workforce

Source: Change the Equation, “The Diversity Dilemma,” 2015
Employment Challenge...

**Figure 1: Sustained Growth is Projected for STEM Occupations**

Employment as a Percentage of 2006 Employment, by Occupation

- **Computer Occupations**
- **Life Sciences**
- **Mathematical Sciences**
- **Physical Sciences**
- **Engineering**
- **All Occupations (STEM and non-STEM)**

Source: Chairman's staff of the Joint Economic Committee based on data from the Bureau of Labor Statistics. The BLS does not project employment for individual years from 2010-20. For the purposes of this chart, Life Sciences excludes Medical Sciences.

Attribution: Ellen Lettvin, US Department of Education
Skills Gap Challenge…

Trends in Routine and Nonroutine Task Input in U.S. Occupations: 1960 to 2002


Credit: Ellen Lettvin, US Department of Education
<table>
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<th>Rank</th>
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Opportunity...

2.5 TIMES FASTER

Middle skill jobs that require technology grew 2.5 times faster between 2003 and 2013 than middle skills jobs that don't.

Almost all of the 30 FASTEST-GROWING occupations in the next decade will require at least some background in STEM.

The demand for STEM talent is growing

Between 2014 and 2024, growth in computing, advanced manufacturing, and engineering will meet or greatly exceed growth in non-STEM jobs.

Source: Change the Equation, "The Diversity Dilemma," 2015
Impact...

$2.5 \text{ TRILLION}

The U.S. would gain an extra $2.5 \text{ trillion} in Gross Domestic Product between now and 2050 if its students scored at the international average on math and science tests.
STEM Funders Network Membership History
The Research & Evidence for STEM Ecosystems
STEM Learning Ecosystems

STEM-Rich Institutions

Business Community

Institutes of Higher Education

Learner Centric

Out-of-School Programs

Formal PK-12 Education

Family

Source: Ellen Lettvin, US Department of Education
... Three Key Building Blocks

How We Cultivate the Ecosystem

1. Community of Practice
2. Technical Assistance/Community Coach
Ongoing Assessment

1. What factors influence the development of effective STEM Ecosystems?

2. What factors influence the sustainability of effective STEM Ecosystems?
Brief History of Initiative
Timeline and Activities

- 6/15/15: Launch at Clinton Global Initiative
- 7/15: Open Request for Qualifications
- 8/15: Selection of 27 STEM ecosystems
- 11/15: CoP Kick-off at the White House
- 3/16/16: 2nd CoP Chicago, IL
- 4/16: Solicitation for Year 2
- 5/19/16: Announce at U.S. News STEM Solutions
1st Cohort

United States

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Potential Impact for Year One

27 Communities Representing 18 States

576 School Districts

Over 15 Million PK-12 Students

Over 1,000 Out-of-School and Informal Partners

Over 3,600 Business and Industry Partners

600,000 Educators from In- and Out-of-School Time

350 Local/Regional Philanthropic Organizations

Over $20 Million in Investments
Year One
LESSONS LEARNED
## 1st: “THE SLOG”

The Evolution of a STEM Learning Ecosystem

<table>
<thead>
<tr>
<th>Networking</th>
<th>Cooperation</th>
<th>Coordination</th>
<th>Collaboration</th>
<th>Synergy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coalesce like-minded partners</td>
<td>Share vision and goals</td>
<td>Increase number of effective STEM programs</td>
<td>Develop network infrastructure</td>
<td>Agreed upon goals and objectives</td>
</tr>
<tr>
<td>Exchange funding information</td>
<td>Discuss common strategies and objectives</td>
<td>Provide more opportunities for program support and PD</td>
<td>Shared funding</td>
<td>Respect for all enlightened self-interests</td>
</tr>
<tr>
<td>Share grant-making information</td>
<td>Begin to build trust among partners</td>
<td>Provide opportunities for network infrastructure</td>
<td>Shared goals and objectives</td>
<td>Established and sustainable network infrastructure</td>
</tr>
<tr>
<td>Identifying resources</td>
<td>Program support and professional development</td>
<td>Commit to some common goals and objectives</td>
<td>Increase number of effective STEM programs</td>
<td>Funding done with conscious impact on others and the system itself</td>
</tr>
</tbody>
</table>

**Collaboration**

- Begin linkages between in & out of school learning platforms
- Agreed upon goals and objectives
- Respect for all enlightened self-interests
- Established and sustainable network infrastructure
- Funding done with conscious impact on others and the system itself

**Communities of Practice operate independently**

- Communities of Practice operate independently
- Established linkages between in & out of school

**Networking**

- Coalesce like-minded partners
- Exchange funding information
- Share grant-making information
- Identifying resources

**Cooperation**

- Share vision and goals
- Discuss common strategies and objectives
- Begin to build trust among partners
- Provide opportunities for program support and professional development

**Coordination**

- Increase number of effective STEM programs
- Provide more opportunities for program support and PD
- Begin to think about network infrastructure
- Commit to some common goals and objectives

**Synergy**

- Develop network infrastructure
- Shared funding
- Shared goals and objectives
- Increase number of effective STEM programs
- Provide more opportunities for program support and PD
- Begin linkages between in & out of school

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*1st: “THE SLOG”*
2nd: “The Focus”

STEM Ecosystem Elements

<table>
<thead>
<tr>
<th>Key Partners</th>
<th>Critical Attributes</th>
<th>Focus Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PreK-12 school system receptive to external partnerships</td>
<td>1. Anchored by a passionate leader(s) with a collaborative vision and practice</td>
<td>1. Building the capacity of educators in all sectors.</td>
</tr>
<tr>
<td>2. High-quality out-of-school time/youth development system and programs</td>
<td>2. Attentive to the enlightened self-interest of all partners</td>
<td>2. Equipping educators with tools and structures to enable sustained collaboration.</td>
</tr>
<tr>
<td>4. Institutions of higher education</td>
<td></td>
<td>4. Creating learning progressions that connect and deepen STEM experiences over time.</td>
</tr>
<tr>
<td>5. Private sector STEM-focused businesses</td>
<td></td>
<td>5. Focusing instruction on inquiry, project-based learning and real-world connections to increase relevance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Exposing young people to potential STEM careers.</td>
</tr>
</tbody>
</table>
3rd: The STEM Ecosystem Logic Model

**Resources**
- Local Initiative (Members, community partners, network connections and infrastructure)
- Implementation Partners
- Steering Committee (Members, network, expertise)
- Formal Ed
- Science Centers
- Youth Development Entities
- Afterschool and Summer STEM Programs
- Leveraging Existing networks
- State STEM Network
- State Afterschool Network
- Higher Ed
- Business
- Community

**Activities**
- Develop Technical Support (PL/PD) (infrastructure, capacity, key partners, communication, project management)
- Develop and implement program support and professional development (program support and professional development delivery model based on three levels of technical assistance)
- Develop and implement Communities of Practice
- Develop STEM resource menu
- Assist in defining effective STEM programs for program implementation/implementation and evaluation purposes

**Outputs**
- Number of partners in network
- Number of STEM learning opportunities across counties
- Number of educators engaged in professional development
- Number of members in each Communities of Practice
- Types of STEM resources introduced to counties
- Number of effective STEM programs
- Evaluation findings

**Short-Term and Intermediate Outcomes**
- **Program outcomes**: An increase in the intensity, duration, and quality of STEM learning opportunities.
- **Staff outcomes**: An increase in the confidence, competence, and motivation in offering STEM learning opportunities.
- **Student outcomes**: An increase in engagement, interest, and applied knowledge of STEM content and processes.
- **Initiative outcomes**: The documentation of promising practices, linking of results to specific STEM in OST models, and the sharing of this information with the field in ways that can effectively guide program improvement and expansion efforts.

**Impact**
- All students possess the requisite STEM skills to be competitive for 21st century jobs
- All educators and teachers are provided the tools and support to ensure their students are STEM competent and STEM literate
- Community is a leader in STEM workforce competitiveness in State and the United States

Cultivate. Learn. Innovate.
4th: Strategies – Third Rail!

- EVERY Ecosystem wants to decide what IT wants and needs
- Bottom up...NOT prescriptive top-down

Curriculum Pathways, Career Pathways, Educator PL/PD, Workforce Development, Equity & Access, After School Programming, etc...
STEM Learning Ecosystem
Organizational and Governance Structures
• The KEY... match the structure with the *culture* of the community.

Drawings available under a [Creative Commons](https://creativecommons.org) license: Credit "Manu Cornet" [www.bonkersworld.net](http://www.bonkersworld.net).
**Gov’t Top-down**
- Stakeholders are "selected"
- Operational Funding dependent on legislative support.
- Programmatic funding may be mix of public and private.
- Prescriptive
- Political

Example: DE, OR, WA, CO

**Funder/Business**
- Stakeholders are invited
- Respects enlightened self-interest
- Broad focus, often with workforce outcome goals
- Partners with nonprofits to deliver programming

Example: OC, TRSA, SFN, Great Lakes, LA

**Higher Ed**
- Think Tank approach
- Career pathway & workforce focus
- Mix of public and private funding
- Narrower focus
- Challenge in bringing in OST, PK12

Example: OSLN, Empire STEM, STEM-X sites

**Intermediary**
- OST often leads
- Stakeholders are invited
- Group consensus
- Primarily grant funding
- Distributed leadership model often with hubs.
- Challenge bringing K12 & workforce

Example: NC, Indiana, PASA, NYC, BOS

**PK-12**
- Critical player, but most structurally challenged
- Strong parental engagement
- OST partnership
- Challenge in bringing in Biz, private funding

Example: Tampa, Empire STEM, Ventura, Evanston
Constellation Model
Cohort 2: Invitation

Announcement at US News
STEM Learning Ecosystems for 2016
37 Communities…and Counting

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The Why?

(IMPACT)
General Electric to Move Headquarters to Boston

GE set to get up to $145 million in incentives to leave Fairfield, Conn., its home since 1974

“The Boston region is an ecosystem that shares our aspirations.”

Mr. Jeffrey Immelt/ CEO of GE

“The area is crowded with 55 colleges and universities, including research centers like the Massachusetts Institute of Technology, Harvard and Northeastern University. G.E. said it was also attracted by the area’s thriving venture capital and start-up community... Only about 200 will be corporate staff, G.E. said, while the remaining 600 will be mainly “digital industrial product managers, designers and developers” in a variety of disciplines including data analysis, life sciences and robotics.”

From the NY Times 1/14/16
Opportunities for You…

• Engage your STEM ecosystem
• Thought leader
• Content Advisor
• Mentor & Coach K-12
• Bridge between education and business
• Build career pathways
• Soooo.....
• **Improve Student STEM Learning**
  • Ensure students college ready
  • Reduce remedial needs
  • More hands on STEM experiences
  • Early exposure to engineering design thinking

• **Develop & Retain Talented STEM Educators**
  • Boost educators’ knowledge of math & science
  • Retain & support excellent educators
  • Offer educators to STEM PL/PD

• **Connect Institution to Workforce (How to Thrive!)**
• **Design communities as STEM Learning Ecosystems**
Questions?