STEM Learning Ecosystems Initiative
Cincinnati Design Studio: GCSC
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8AM - 1PM

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

WHY ARE WE HERE
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 and 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

Are we educating students to truly compete globally?

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>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Workforce</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td>Computing Workforce</td>
<td>27%</td>
<td>26%</td>
</tr>
<tr>
<td>Advanced Manufacturing Workforce</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>

African Americans and Latinos have lost ground in STEM

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

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

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STEM ecosystems Cultivate. Learn. Innovate.
Figure 1: Sustained Growth is Projected for STEM Occupations

Employment as a Percentage of 2006 Employment, by Occupation

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.
Skills Gap Challenge...

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

The Ohio Context
Ohio is Expected to See STEM Jobs Grow

Between 2014 and 2024 in Ohio

STEM jobs will grow  All other jobs will grow

15% 9%

▲ 17% Computing
▲ 6% Engineering
▲ 9% Advanced Manufacturing

Ohio Earnings in STEM Jobs are High

Median earnings in Ohio STEM jobs are:

$34.35_{\text{hour}}$

Median earnings in Ohio all other jobs are:

$17.52_{\text{hour}}$

Ohio has Made Progress in K-12 Math, But It Still Has Far to Go

Ohio trends in 4th grade math scores, 2003-2015

Proficient

Basic

2003 2005 2007 2009 2011 2013 2015

Ohio U.S.


Ohio trends in 8th grade math scores, 2003-2015

Proficient

Basic

2003 2005 2007 2009 2011 2013 2015

Ohio U.S.

Low-income and Minority Students Lag Behind in Ohio

Percentage of Ohio students at or above proficient, by race/ethnicity

- 4th Grade Math (2015): White 52%, Black 33%, Hispanic 12%
- 8th Grade Math (2015): White 40%, Black 24%, Hispanic 11%
- 4th Grade Science (2009): White 50%, Black 10%, Hispanic 8%
- 8th Grade Science (2011): White 45%, Black 31%, Hispanic 8%

Percentage of Ohio students at or above proficient, by income

- 4th Grade Math (2015): Not Eligible for Free/Reduced-Price Lunch 64%, Eligible for Free/Reduced-Price Lunch 24%
- 8th Grade Math (2015): Not Eligible for Free/Reduced-Price Lunch 64%, Eligible for Free/Reduced-Price Lunch 24%
- 4th Grade Science (2009): Not Eligible for Free/Reduced-Price Lunch 56%, Eligible for Free/Reduced-Price Lunch 20%
- 8th Grade Science (2011): Not Eligible for Free/Reduced-Price Lunch 56%, Eligible for Free/Reduced-Price Lunch 19%

Ohio’s Women Lag Behind in STEM Degrees

NUMBER OF COMPUTING DEGREES/CERTIFICATES IN OHIO

Number of engineering degrees/certificates in Ohio


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What are the Opportunities?
STEM Drives Community & Economic Development

“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

Fortune 100 Companies increasingly prefer proximity to higher ed than Wall Street.
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.

\text{STEMtistics}
Who Are We?
STEM Funders Network Membership History
Underlying Premise
When does learning occur?

LIFELONG AND LIFEWIDE LEARNING

16 WAKING HOURS

0-5 K | GR 1-12 | UG GRAD | WORK | RETIREMENT

- FORMAL LEARNING ENVIRONMENTS
- INFORMAL LEARNING ENVIRONMENTS

Credit: Life Center, Univ. of Washington
The Research & Evidence for STEM Ecosystems

1990s

1990s-2009

1/2010 - 7/2011

2011-13

2011 - 2013

STEM Ecosystem
STEM Learning Ecosystems

- STEM-Rich Institutions
- Business Community
- Institutes of Higher Education
- Formal PK-12 Education
- Learner Centric
- Family
- Out-of-School Programs

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
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
What It Takes- Checklist

1st Stage: (Threshold)
- Anchor/project leader
- Do they have capacity...Admin support/funding
- It’s all about the Architecture/System!!

2nd Stage: (Demonstrate Success)
- Start Small
- Identify defined area/region to start
- Enlist the right Key Partners onto the bus
- Engage in “community design”...build buy-in, consensus & commitment
- Create Logic Model/Implementation Plan

3rd Stage: (The Work)
- Launch the ecosystem work (demonstration)
- Have a SMART Focus
- Recognize it’s a “slog”
- Share successes and challenges, internally & externally

4th Stage: Replicate/Expand
1st: “THE SLOG”
The Evolution of a STEM Learning Ecosystem

**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

**Collaboration**
- 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 learning platforms

**Synergy**
- 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
- Established linkages between in & out of school

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Cultivate. Learn. Innovate.
## 2nd: “The Focus”

### STEM Ecosystem Elements

<table>
<thead>
<tr>
<th>Key Partners</th>
<th>Critical Attributes</th>
<th>Focus Areas</th>
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</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>
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<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/improvement 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
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...
Cohort 2: Invitation

ANNOUNCEMENT AT US NEWS
Announcing Newly Approved STEM Learning Ecosystems

- Bmore STEM (Baltimore, MD)
- Carbon/Schuylkill/Lucerne Counties Ecosystem (Schnecksville, PA)
- Central NM STEM-H Education Hub (Albuquerque, NM)
- Central Oklahoma Regional STEM Alliance (Oklahoma City, OK)
- DC STEM Network (Washington, DC)
- Lancaster County STEM Alliance (Lancaster, PA)
- North Louisiana STEM Alliance (Shreveport, LA)
- Northeast Florida STEM Hub (Jacksonville, FL)
- Omaha STEM Ecosystem (Omaha, NE)
- STEM Hub Downeast (Augusta, ME)
STEM Learning Ecosystems for 2016
37 Communities…and Counting

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The Why?

(IMPACT)
Opportunities for You…

• Engage your STEM ecosystem
• Thought leader
• Content Advisor
• Bridge between In and Out of School
• Encourage business involvement
• Build curriculum and career pathways
• Soooo…..
• **Improve Student STEM Learning**
  - More time for science in k12
  - Provide HS students access to advance STEM classes (AP)
  - More hands on STEM experiences (in & out of school)
  - Early exposure to engineering design thinking

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

• **Connect Education to Workforce (How to Thrive!)**

• **Design communities as STEM Learning Ecosystems**
Questions