Why is STEM education so important?
Global Societal Challenge

- Level 1
  - Climate Change
  - Water Scarcity
  - Energy Security
  - Cyber Security
  - Losses
  - Fisheries Depletion
  - Deforestation
  - Infectious Disease

- Level 2
  - Poverty
  - Education
  - The Digital Divide
  - Urbanization
  - 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, Samueli School of Engineering, University of California, Irvine
WHY Focus on STEM?
## STEM Occupations Gap

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Total Employment</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td><strong>STEM total</strong></td>
<td>327,100</td>
<td>74.9%</td>
<td>82,100</td>
</tr>
<tr>
<td>Computer Science &amp; Math</td>
<td>180,800</td>
<td>74.8%</td>
<td>45,500</td>
</tr>
<tr>
<td>Engineering &amp; Surveying</td>
<td>65,000</td>
<td>89.2%</td>
<td>7,000</td>
</tr>
<tr>
<td>Physical &amp; Life Science</td>
<td>42,700</td>
<td>51.3%</td>
<td>20,800</td>
</tr>
<tr>
<td>STEM Managers</td>
<td>38,600</td>
<td>77.2%</td>
<td>8,800</td>
</tr>
</tbody>
</table>

- The highest percentage of women is found in physical and life science occupations for NJ residents (48.7%).
- 77.2 percent of NJ residents that are managers for STEM occupations are male.

Source: New Jersey Department of Labor and Workforce Development
2016 American Community Survey public-use micro data: October, 2018
The STEM Workforce in New Jersey is Predominantly Male

The STEM workforce is predominantly male. Resident women hold slightly over twenty-five percent of science, technology, engineering & math jobs in New Jersey.

Source: New Jersey Department of Labor and Workforce Development
2016 American Community Survey public-use micro data: October, 2018
The STEM Workforce Continues to Expand
Projections from 2016 - 2026

<table>
<thead>
<tr>
<th>Occupational Title</th>
<th>Employment</th>
<th>Average Annual Job Openings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual 2016</td>
<td>Projected 2026</td>
</tr>
<tr>
<td>Total, All Occupations</td>
<td>4,318,450</td>
<td>4,671,200</td>
</tr>
<tr>
<td>Non-STEM Occupations</td>
<td>4,077,450</td>
<td>4,406,700</td>
</tr>
<tr>
<td>STEM Occupations</td>
<td>241,000</td>
<td>264,500</td>
</tr>
<tr>
<td>Computer and Mathematical Occupations</td>
<td>147,000</td>
<td>161,500</td>
</tr>
<tr>
<td>Architecture and Engineering Occupations</td>
<td>54,150</td>
<td>59,700</td>
</tr>
<tr>
<td>Life, Physical, and Social Science Occupations</td>
<td>39,850</td>
<td>43,300</td>
</tr>
</tbody>
</table>

- Nearly 20,000 average annual job openings are projected from 2016-2026.
- STEM occupations are projected to experience a 9.8 percent employment growth by 2026.

Source: New Jersey Department of Labor and Workforce Development
2016 American Community Survey public-use micro data: October, 2018
Equity Challenges…

African Americans and Latinos have lost ground in STEM

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>

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.

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

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
Opportunity...

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
$2.5 TRILLION

The U.S. would gain an extra $2.5 trillion in Gross Domestic Product between now and 2050 if its students scored at the international average on math and science tests.
Women
African Americans
Hispanics
Native Americans
Persons with Disabilities

The Missing 70%
71% of all new jobs in STEM are in computing

8% of STEM graduates are in computer science

Sources: Bureau of Labor Statistics, National Center for Education Statistics
Slide: Code.org
9 in 10 parents want their child to study computer science

1 in 4 schools teach computer programming

Sources: Gallup
Slide: Code.org
% Women of Intended Majors

## Hunterdon County, NJ High School Testing Data in Mathematics

<table>
<thead>
<tr>
<th>Hunterdon County High Schools</th>
<th>Percentage of MALES scoring proficient or advanced proficient in Mathematics PARCC, 2017 (43.9% statewide)</th>
<th>Percentage of FEMALES scoring proficient or advanced proficient in Mathematics PARCC, 2017 (46% statewide)</th>
<th>Percentage of MALES scoring proficient or advanced proficient in Mathematics PARCC, 2016 (42.9% statewide)</th>
<th>Percentage of FEMALES scoring proficient or advanced proficient in Mathematics PARCC, 2016 (44.10% statewide)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunterdon Central Regional High School</td>
<td>55%</td>
<td>57.6%</td>
<td>56.7%</td>
<td>59%</td>
</tr>
<tr>
<td>South Hunterdon Regional High School</td>
<td>*no data to display</td>
<td>*no data to display</td>
<td>34.8%</td>
<td>*no data to display</td>
</tr>
<tr>
<td>Hunterdon County Vocational</td>
<td>85.4%</td>
<td>93.8%</td>
<td>*no data to display</td>
<td>*no data to display</td>
</tr>
<tr>
<td>North Hunterdon/Voorhees Regional High School</td>
<td>63%</td>
<td>63%</td>
<td>56.7%</td>
<td>57.9%</td>
</tr>
<tr>
<td>Delaware Valley Regional High School</td>
<td>46.6%</td>
<td>34.5%</td>
<td>30%</td>
<td>28.8%</td>
</tr>
<tr>
<td>North Hunterdon/Voorhees Regional High School</td>
<td>54.5</td>
<td>61.7%</td>
<td>42.9%</td>
<td>44.10%</td>
</tr>
<tr>
<td>Hunterdon County K-8 School Districts</td>
<td>Percentage of MALES scoring proficient or advanced proficient in Mathematics PARCC, 2017 (43.9% statewide)</td>
<td>Percentage of FEMALES scoring proficient or advanced proficient in Mathematics PARCC, 2017 (46% statewide)</td>
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<tr>
<td>-----------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>East Amwell Township</td>
<td>72.5%</td>
<td>70.3%</td>
<td>73.8%</td>
<td>68.7%</td>
</tr>
<tr>
<td>Flemington-Raritan Regional School District</td>
<td>69.2%</td>
<td>67.7%</td>
<td>69.3%</td>
<td>67.6%</td>
</tr>
<tr>
<td>Franklin Township</td>
<td>54.7%</td>
<td>61.1%</td>
<td>55.9%</td>
<td>53.0%</td>
</tr>
<tr>
<td>Frenchtown Borough</td>
<td>44.4%</td>
<td>50%</td>
<td>66.6%</td>
<td>63.6%</td>
</tr>
<tr>
<td>Hampton Borough</td>
<td>51.6%</td>
<td>50%</td>
<td>25%</td>
<td>45.4%</td>
</tr>
<tr>
<td>High Bridge Borough</td>
<td>62.8%</td>
<td>60.4%</td>
<td>63.2%</td>
<td>55.5%</td>
</tr>
<tr>
<td>Holland Township</td>
<td>55.4%</td>
<td>62.8%</td>
<td>51.2%</td>
<td>60.8%</td>
</tr>
<tr>
<td>Kingwood Township</td>
<td>47.5%</td>
<td>67.6%</td>
<td>52.3%</td>
<td>62%</td>
</tr>
<tr>
<td>Lebanon Borough (pre-k to 6)</td>
<td>78.9%</td>
<td>53.3%</td>
<td>50%</td>
<td>54.6%</td>
</tr>
</tbody>
</table>
# Hunterdon County, NJ K-8 School Testing Data in Mathematics

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<tbody>
<tr>
<td>Lebanon Township</td>
<td>59.8%</td>
<td>59.3%</td>
<td>63.1%</td>
<td>62.8%</td>
</tr>
<tr>
<td>Milford Borough</td>
<td>50%</td>
<td>63.2%</td>
<td>63.2%</td>
<td>60.7%</td>
</tr>
<tr>
<td>Readington Township</td>
<td>62.8%</td>
<td>60.9%</td>
<td>64.2%</td>
<td>65%</td>
</tr>
<tr>
<td>Tewksbury Township</td>
<td>67.4%</td>
<td>69.6%</td>
<td>65%</td>
<td>62.4%</td>
</tr>
<tr>
<td>Union Township</td>
<td>64.4%</td>
<td>67.1%</td>
<td>67.8%</td>
<td>72.6%</td>
</tr>
</tbody>
</table>

In ten out of twenty-three 3 Hunterdon County School Districts, the males outperform the females in mathematics on the PARCC and New Jersey Student Learning Standards Assessment.
True or False?

There has not been any significant change in the performance between boys’ and girls’ mathematics achievements in recent years.

Credit: Thomaseia Lott Adams From Perceptions to Priorities: Empowering Girls in Mathematics
True or False?

If there is a gap in mathematics achievement differences between boys and girls, the achievement gender differences are often small and typically evident among higher-performing students.

Credit: Thomaseia Lott Adams From Perceptions to Priorities: Empowering Girls in Mathematics
True or False?

Girls are more inclined to use the specific procedures that are taught by the teacher.

Credit: Thomaseia Lott Adams From Perceptions to Priorities: Empowering Girls in Mathematics
True or False?

Teachers may impact girls’ perceptions of and achievements in mathematics beyond the mathematics lessons that are taught in the classroom through, especially if that teacher is female.

Credit: Thomaseia Lott Adams From Perceptions to Priorities: Empowering Girls in Mathematics
True or False?

Teachers may sometimes perceive boys’ mathematical performance to be higher than their girl counterparts, even when boys and girls are found to actually perform the same.

Credit: Thomaseia Lott Adams From Perceptions to Priorities: Empowering Girls in Mathematics
1. Social Encouragement:

Encouragement from family, friends and educators, regardless of their technical expertise, reinforces existing interest and can foster interest where none exists. Outreach programs should include a parent education component, so that parents learn how to actively encourage children to pursue STEM, especially their daughters.
Bottom Line: What Can We Do?

2. Self Perception:

Interest in puzzles, problem solving and tinkering can lead to a passion for, and personal confidence in, STEM abilities. Providing children, especially young women with the opportunity to practice these skills in a supportive environment in activities related to their passions can help build confidence and interest..
Bottom Line: What Can We Do?

3. Academic Exposure: experience with STEM in middle and high schools can motivate students, especially women, to pursue STEM. Support for organizations working to expand these opportunities to more schools can increase academic and informal access, provide a greater understanding of STEM and help young women make informed decisions about degree and career options.
Bottom Line: What Can We Do?

4. Career Perception: visibility of role models in STEM and telling stories about the positive social impact careers in STEM can have, can enable students, especially young women, to visualize themselves in the field.
A Call for STEM Partnerships...

❖ To prepare every child to thrive through high-quality science, technology, engineering and math (STEM) education.

❖ Designed to facilitate collaboration among community partners to improve access to high-quality STEM learning for all students, no matter their ZIP code.

❖ Partnerships with school districts, teachers, parents, higher education institutions and business institutions, through a STEM Ecosystem, will transform the local infrastructure for ensuring more students, particularly underserved and underrepresented students, develop the knowledge and skills they need to succeed and participate in STEM in and out of school activities.
What is the STEM Learning Ecosystems Initiative?

❖ To prepare every child to thrive through high-quality science, technology, engineering and math (STEM) education.

❖ Designed to facilitate collaboration among community partners to improve access to high-quality STEM learning for all students, no matter their ZIP code.

❖ Partnerships with school districts, teachers, parents, higher education institutions and business institutions a STEM Ecosystem can transform the local infrastructure for ensuring more students, particularly underserved and underrepresented students, develop the knowledge and skills they need to succeed.
After-School programs have a positive influence on STEM Skills (US News)

• A new study by the Charles Stewart Mott Foundation and STEM Next looked at the impact of after-school programs providing informal STEM education. According to the study, more than 70 percent of students in all participating states showed positive gains in STEM subjects, careers, knowledge and 21st-century skills by participating in STEM-focused programs after school.
The Evidence for STEM

The purpose of this set of articles is to establish the solid research base for documenting the accomplishments of STEM in afterschool and summer programs. Collectively they introduce the nature of the research, the kinds of outcomes that we have come to expect from afterschool and summer programs, and policy implications of the major findings. Read More
Kari McGann
Superintendent of Schools
Flemington Raritan Regional School District