CTE Is Your STEM Strategy
December 17, 2013

The National Association of State Directors of Career Technical Education Consortium
Webinar Overview

- Overview of *CTE Is Your STEM Strategy* brief
- Speakers
  - Kate Blosveren, Associate Executive Director, NASDCTEc
  - Tina Marcus, Project Manager, STEM Education and Leadership, NC Department of Public Instruction
  - Dr. Tony Baldwin, Superintendent, Buncombe County Schools, NC
  - Dr. Linda Rosen, CEO, Change the Equation
- Q&A
Why CTE Is Your STEM Strategy?

• Significant interest/commitment to STEM education at all levels

• CTE programs can provide a strong foundation for and serve as a delivery system of STEM competencies and skills for a broader range of students.

• May not address everything within a STEM strategy, but policymakers, educators shouldn’t be reinventing the wheel

• Stakeholders need to understand inherent connection and overlap in goals and content of STEM and CTE
CTE Is Your STEM Strategy explores…

• The elements of a high-quality CTE program of study that makes it an effective tool for delivering or implementing STEM education;

• How STEM is naturally embedded across the 16 Career Clusters®;

• Examples of states embracing the link between CTE and STEM; and

• Areas where CTE and STEM programs can learn from and strengthen one another.
What is STEM?

✓ Getting more students interested in/prepared for the engineering fields.

✓ The Next Generation Science Standards “represent a commitment to integrate engineering design into the structure of science education by raising engineering design to the same level as scientific inquiry when teaching science disciplines…from [K-12].”

✓ “STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply [STEM] in contexts that make connections between school, community, work and the global enterprise...“

✓ STEM = STEAM
CTE Vision

1. CTE is critical to ensuring that the United States leads in global competitiveness.

2. CTE actively partners with employers to design and provide high-quality, dynamic programs.

3. CTE prepares students to succeed in further education and careers.

4. CTE is delivered through comprehensive programs of study aligned to The National Career Clusters Framework.

5. CTE is a results-driven system that demonstrates a positive return on investment.
What Do STEM & CTE Have in Common?

- Problem-based/Project-based learning
- Secondary-postsecondary alignment / college and career readiness
- Business-education partnerships
- Use of technology
- Integrated/Cross-Disciplinary
# STEM Across Career Clusters

<table>
<thead>
<tr>
<th>CAREER CLUSTER</th>
<th>SAMPLE STEM CAREERS</th>
<th>CAREER CLUSTER</th>
<th>SAMPLE STEM CAREERS</th>
</tr>
</thead>
</table>
| Agriculture, Food & Natural Resources | • Agriculture Technicians  
• Agriculture Engineers  
• Forest & Conservation Workers  
• Food Science Technicians  
• Veterinarians  
• Marine Biologists  
• Water Resource Specialists       | Architecture & Construction            | • Architects  
• Civil Engineers  
• Civil Engineering Technicians  
• Surveyors  
• Drafters  
• Cost Estimators                                                                 |
| Arts, A/V Technology & Communications | • Graphic Designers  
• Telecommunications  
• Multimedia Artists & Animators  
• Audio Technicians                 | Business Management & Administration | • Accountants  
• Auditors  
• Operations Research Analysts                                              |
| Finance                              | • Actuaries  
• Financial Analysts  
• Financial Planners  
• Loan Officers  
• Investment Bankers               | Government & Public Administration   | • Patent Officer  
• Cryptographers  
• Policy Analysts  
• Climate Change Analysts  
• Intelligence Analysts            |
## STEM Across Career Clusters

<table>
<thead>
<tr>
<th>CAREER CLUSTER</th>
<th>SAMPLE STEM CAREERS</th>
<th>CAREER CLUSTER</th>
<th>SAMPLE STEM CAREERS</th>
</tr>
</thead>
</table>
| **Information Technology** | • Programmers  
  • Hardware, Software Engineers  
  • Computer Support Specialists  
  • Information Security Analysts  
  • Database Administrators  
  • Webmasters  
  • Video Game Designers | **Law, Public Safety, Corrections & Security** | • EMTs  
  • Firefighter/Inspectors  
  • Fire-Prevention and Protection Engineers  
  • Brownfield Redevelopment Specialists and Site Managers |
| **Manufacturing** | • Aircraft Mechanics and Service/Avionics Technicians  
  • Automotive Mechanics  
  • Mechanical Engineers  
  • Electronics Engineering Technicians  
  • Wind Turbine Service Technicians  
  • Welders | **Marketing** | • Interactive Media Specialists  
  • Market Researchers  
  • Forecasting Managers  
  • Inventory Manager/Analysts |
| **STEM** | Any/all of careers listed | **Transportation, Distribution & Logistics** | • Transportation Planners  
  • Transportation Engineers  
  • Occupational Health and Safety Technicians |
Green & Sustainability Knowledge & Skills

- The result are four Green & Sustainability standards that apply across all 16 Career Clusters
- Career Cluster-specific standards in six areas identified as those being the most likely to experience the greatest need for green and sustainability workers
  - Agriculture, Food, & Natural Resources;
  - Architecture & Construction;
  - Information Technology;
  - Manufacturing;
  - Science, Technology, Engineering & Mathematics; and
  - Transportation, Distribution & Logistics
Areas of Improvement/ Leverage Points

- Career exposure
- Out-of-school partnerships
- Integrated teaching/integrated credits
Questions for Consideration

✓ In what industries are CTE programs of study well-aligned with your state’s or region’s labor market needs? Where are there gaps in your state’s CTE programs of study?

✓ How can the interdisciplinary STEM-focused PD be extended to more (or all) CTE and core academic educators?

✓ How can STEM-based career guidance be expanded into broader career guidance, which is otherwise under-provided, especially in the earlier grades?

✓ How can the instructional and/or programmatic tools and resources being created through your state’s STEM initiative be integrated or leveraged by CTE educators (and vice versa)?

✓ What strategies are in place to ensure no barrier is being set up – real or perceived – between “STEM” educators and “CTE” educators?
Stay Connected

Kate Blosveren:
kbloşveren@careertech.org

www.careertech.org

www.twitter.com/CTEWorks

www.facebook.com/NASDCTE
North Carolina
STEM Education

Tina Marcus

tina.marcus@dpi.nc.gov
CTE? STEM?

• …emphasize a need for business and educators to join efforts to ensure students are appropriately prepared for emerging workplaces in our communities

• …leaders agree support and goals are needed to ensure a workforce is prepared for the high-skill, high-wage, and high-demand jobs of a knowledge-based and innovative economy

• …prepare human resources to add the value that customers around the world desire

• …a vision that leverages public and private resources in the most effective manner possible, moving North Carolina further and faster toward a world-class workforce and sustained economic growth and development in a global market

same visions propelling similar goals and outcomes
NC STEM Education

Identified and Defined Three Principles

– Integrated STEM Curriculum aligned to Industry Standards

– On-going Community and Industry Engagement

– Connections with Postsecondary Education

preparing the next generation of innovators

www.ncpublicschools.org/stem
Quality STEM Education

21st Century Skills

- Responsibility
- Problem solving
- Adaptability
- Collaboration/teamwork
- Technology use
- Oral/written communications
- Creativity
- Critical thinking
- Professionalism
- Entrepreneurial spirit
- Healthful Living
- Ethics
- Language Arts
- Social Studies
- Music
- World Languages
- Art
- Science
- Engineering
- Technology
- CTE
- Math

Math
Science
Engineering
Technology

CTE: Career and Technical Education
What Do STEM & CTE Have in Common?

- Problem-based/Project-based learning
- Secondary-postsecondary alignment / college and career readiness
- Business-education partnerships
- Use of technology
- Integrated/Cross-Disciplinary
# Attributes: Vision of STEM School

<table>
<thead>
<tr>
<th>Integrated Science, Technology, Engineering and Mathematics (STEM) curriculum, aligned with state, national, international and industry standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Project-based learning with integrated content across STEM subjects</td>
</tr>
<tr>
<td>2) Connections to effective in-and out-of-school STEM programs</td>
</tr>
<tr>
<td>3) Integration of technology and virtual learning</td>
</tr>
<tr>
<td>4) Authentic assessment and exhibition of STEM skills</td>
</tr>
<tr>
<td>5) Professional development on integrated STEM curriculum, community/industry partnerships and postsecondary education connections</td>
</tr>
<tr>
<td>6) Outreach, support and focus on underserved, especially females, minorities, and economically disadvantaged</td>
</tr>
</tbody>
</table>

## On-going community and industry engagement

| 7) A communicated STEM plan is adopted across education, communities and businesses |
| 8) STEM work-based learning experiences, to increase interest and abilities in fields requiring STEM skills, for each student and teacher |
| 9) Business and community partnerships for mentorship, internship and other STEM opportunities that extend the classroom walls |

## Connections with postsecondary education

| 10) Alignment of student’s career pathway with post-secondary STEM program(s) |
| 11) Credit completion at community colleges, colleges and/or universities * |

---

*Attributes define essential components central to 21st Century Skills

* Not required for Elementary or Middle Schools - For High Schools Only
### STEM Rubric Components
North Carolina Schools

#### Key Elements

1. **Early Development**
   - Program is seeking to establish partnerships with other schools, communities, postsecondary institutions, and businesses to identify solutions for building a quality STEM program.

2. **Developing**
   - Program engages with other schools, communities, postsecondary institutions, and businesses to identify solutions for executing a quality STEM program.

3. **Prepared**
   - Program has documented partnerships with other schools, communities, postsecondary institutions, and businesses to identify solutions for executing a quality STEM program.

4. **Model**
   - Program has multiple partnerships with other schools, communities, postsecondary institutions, and businesses to identify solutions for executing a quality STEM program; partnerships are purposeful, mutually beneficial, monitored, and evaluated.

#### Attribute Levels of Achievement

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Levels of Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>Indicators</td>
</tr>
</tbody>
</table>

#### Principle

- **Integrated STEM Curriculum, Aligned with State, National, and Industry Standards**

#### Rubric Components

**North Carolina Schools**

<table>
<thead>
<tr>
<th>Key Element</th>
<th>Attribute</th>
<th>Levels of Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.1 STEM Network</strong></td>
<td>Program is seeking to establish partnerships with other schools, communities, postsecondary institutions, and businesses to identify solutions for building a quality STEM program.</td>
<td>Program has multiple partnerships with other schools, communities, postsecondary institutions, and businesses to identify solutions for executing a quality STEM program; partnerships are purposeful, mutually beneficial, monitored, and evaluated.</td>
</tr>
<tr>
<td><strong>2.2 Students and STEM Professionals</strong></td>
<td>Leaders are creating plans to provide opportunities for students to meet STEM professionals and to participate in STEM learning environments outside school.</td>
<td>Direct experiences with STEM professionals and STEM learning environments during and/or outside school are available to students monthly, and are directly connected to in-class learning.</td>
</tr>
<tr>
<td><strong>2.3 Research &amp; Development</strong></td>
<td>On an annual basis, program leaders and participating STEM teachers share with each other research and information on best practices related to their STEM program goals.</td>
<td>On a quarterly basis, program leaders and participating STEM teachers frequently share with each other research and best practices related to their STEM program goals.</td>
</tr>
</tbody>
</table>
NC Anchor and Affinity Network Schools

**Themed Content**

- Aerospace, Security, Advanced Manufacturing
- Agri-science and Biotechnology
- Energy and Sustainability
- Health and Life Sciences

**Themed STEM Schools**

- Craven Early College High School
- Northeast Regional School of Biotechnology and Agri-science (NERSBA)
- Wake NCSU STEM Early College High School
- City of Medicine Academy
Globally Competitive Workforce
K-12 and Beyond

STEM and CTE strategies provide robust educational opportunities to prepare our future workforce, leaders, and next generation of innovators.

...visions propelling similar goals and outcomes
Buncombe County Schools STEM-Themed Discovery Academy

Innovation and Design

Health Care | Science and Technology | Advanced Manufacturing/Applied Engineering | Knowledge-Based Entrepreneurship | Arts and Culture

Samples of possible courses available to students, based on the Asheville Chamber of Commerce 5x5 Industry Clusters

- PLTW Principles of Biomedical Science (H)
- Computer Science (AP)
- Computer Programming I/II (H)
- Intro to Engineering Design (AP-W)
- PLTW Computer Integrated Manufacturing (AP-W)
- Food Science Pro Start I and II Culinary (H)
- Game Art Design I/II (H)
- PLTW Human Body Systems (H)
- Foundations of Information Technology (H)
- Climatology
- Principles of Engineering (AP-W)
- PLTW Digital Electronics (AP-W)
- Entrepreneurship I and II (H)
- Scientific and Visualization I/II (H)
- PLTW Biomedical Innovation (H)
- PLTW Medical Interventions (H)
- Environmental Science (AP)

Courses listed will meet BCS and NCDPI graduation requirements. Options available based on interest and individual student plan.

H = Honors Level  AP = Advanced Placement  AP-W = Advanced Placement Weighted

Shadowing, Mentorship, Internship and Apprenticeships available. Aligned to post-secondary programs.
CTE is Your STEM Strategy

NASDCTEc Webinar

December 17, 2013
STEM Help Wanted

If you were unemployed

If you were unemployed with STEM skills
STEM Wage Premium

The median annual salary in non-STEM jobs is $41,000

The median annual salary in STEM jobs is $73,000

Source: Change the Equation analysis of 2011 BLS data, 2012
Why Corporations Join

• Concerns about the robustness of the near-term and future workforce
• Recognition that good schools draw good employees
• Genuine desire to be a good member of the community
• Concerns about economic development
Our Coalition

3M
Accenture*
The Aerospace Corporation
Agilent Technologies
Alcoa
Amgen
Amplify
Archer Daniels Midland
AT & T
BAE Systems
Bayer
Bechtel
Boeing
Booz Allen Hamilton
Boston Scientific
CA Technologies
Cardinal Health
Carolina Biological Supply
Causecast
Celgene
Chevron
Cisco
Cognizant
Dell
Deloitte
Direct TV
Discovery Communications
Dow Chemical
Dreamworks
DuPont*
Eaton
Eastman Kodak
Eli Lilly and Company
E-line Media
EMC2
Epic Games
ExxonMobil*
Facebook
Fluor
Freeport McMoran
GE
GlaxoSmithKline
Google
Hitachi, Ltd
HP
Honeywell
IBM
Intel*
LMI Aerospace
Lockheed Martin
McKinstry
Merck
Microsoft
MITRE
Motorola Solutions
Nature Publishing Group
The Nielsen Company
Oracle
PASCO Scientific
Procter & Gamble
Promethean
Qualcomm
RAND
Raytheon
Rockwell Collins
Rolls Royce
Sally Ride Science
Schlumberger Limited
Siemens
Sony Pictures
Space Systems / Loral
State Farm Insurance
Stellar Solutions
Symantec
Synopsys
Teradata
Texas Instruments
Thermo Fisher Scientific
Time Warner Cable *
United Launch Alliance
Valen Analytics
Verizon
Vernier Software & Technology
Viacom
Virgin Galactic
Xerox*

* Board Member
What We Do

A nonprofit, nonpartisan, CEO-led initiative that is mobilizing the business community since its launch in September 2010 to improve the quality of STEM learning in the United States.

• **Elevate universal STEM literacy**—Advance state and local policies and practices based on research to increase STEM literacy

• **Increase ROI**—Increase the impact of corporate philanthropy by emphasizing high quality, scalable programs

• **Ensure High Standards**—Provide the corporate perspective on high expectations and widespread STEM literacy
Levers for Improvement

• Steady stream of reliable information on how well we are preparing students for a global economy
• After-school programming is an unparalleled opportunity to spark students' interest in STEM
• Align high school graduation requirements with high expectations
• Focus on underrepresented groups in STEM literacy
All Over the Map 8th grade

Science 2009

Source: Change the Equation, 2012
Lost Opportunity

19% of households have children enrolled in out-of-school STEM programs.
Out of Sync

Source: Change the Equation, 2013
Half Empty

Computing degrees/certificates, 2001-2012

+38%

-29%

CHANGE THE EQUATION
Half Empty

Computing Associate’s degrees, 2001-2012

+88%

-28%

CHANGE THE EQUATION

Male
Female
Achievement Gaps

Trends in 8th grade math scores, by race/ethnicity, 2003-2013

Challenges

• Steady stream of reliable information on key indicators showing how well we are preparing students for a global economy

• High quality after-school programming is an unparalleled opportunity to spark students' interest in STEM

• Align high school graduation requirements with high expectations and sufficient resources

• Achieve widespread STEM literacy among those traditionally underrepresented in STEM
CTE and Business

• Youth CareerConnect grants
  ▪ Together with LEAs, discuss the practical applications of STEM skills to the workforce
  ▪ P-Tech in New York
  ▪ High School/College Hybrids in Chicago

• After school programs better aligned with workforce needs

• Involve potential business partners in early stages of development and ongoing.

• Ask for expertise, not merely funds.
CTEq and CTE

• Are College and Career Ready the Same Thing? STEM Salon
• Roundtable conversations about opportunities to modernize the Carl D. Perkins Career and Technical Education Act
• Half Empty brief and infographic
Contact Information

Linda Rosen
lrosen@changetheequation.org

www.changetheequation.org
Facebook.com/changetheequation
Twitter.com/changeequation
According to an analysis by the Georgetown Center on Education and the Workforce, however, the STEM skills gap is actually more about a gap in those STEM competencies among workers than about a gap in the number of STEM workers. The concern for STEM shortages tends to focus on the possibility of an insufficient supply of STEM workers, but the deeper problem is a broader scarcity of workers with basic STEM competencies across the entire economy. Demand for the core competencies is far greater than the five percent traditional STEM employment share suggests, and stretches across the entire U.S. job market, touching virtually every industry.

In addition, a recent report from the Brookings Institute estimates that as of 2011, 26 million U.S. jobs—20 percent of all jobs—require a high level of knowledge in any one STEM field, only half of which require a bachelor’s degree but nearly all of which pay well above the national median salary.

One benefit of viewing STEM through this CTE lens is that it allows for a broader understanding of STEM, an understanding that extends beyond just engineering or the traditional science disciplines, which is how STEM is all too often narrowly defined and implemented. It also allows states, districts and schools to build their STEM strategies based on existing efforts rather than adding another new initiative to the mix.

The policy brief will explore:
- The elements of a high-quality CTE program of study that makes it an effective tool for delivering or implementing STEM education;
- How STEM is naturally embedded across the 16 Career Clusters;
- Examples of states embracing the link between CTE and STEM, and;
- Areas where CTE and STEM programs can learn from and strengthen one another.

DEFINING STEM

There are many ways to define STEM education. For some, STEM is all about getting more students interested in and prepared for the engineering fields. Another common interpretation focuses on building applications within traditional science courses. The Next Generation Science Standards (NGSS), for example, offer this: “The NGSS represent a commitment to integrate engineering design into the structure of science education by raising engineering design to the same level as scientific inquiry when teaching science disciplines at all levels, from kindergarten to grade 12. There are both practical and inspirational reasons for including engineering design as an essential element of science education.”

NGSS’s approach to engineering design is largely drawn from the National Research Center’s K-12 Framework for Science Education, which includes the following statement: “We use the term ‘engineering’ in a very broad sense to mean any engagement in a systematic practice of design to achieve solutions to particular human problems. Likewise, we broadly use the term ‘technology’ to include all types of human-made systems and processes...Technologies result when engineers apply their understanding of the natural world and of human behavior to design ways to satisfy human needs and wants.”

www.careertech.org/legislation/briefs-papers.html