Tennessee’s Integrative Approach to STEM

A K-12 STEM Initiative for Tennessee

Deborah Knoll | February 2, 2017
Deborah Knoll
Division of College, Career & Technical Education
Career Cluster Consultant
Advanced Manufacturing, Information Technology, and STEM

Deborah.Knoll@tn.gov
(615) 532-2844

www.tn.gov/education/cte
CTE.Questions@tn.gov
Why is STEM Instruction Important?
Current STEM Initiatives

- STEM Academies
- General Education
- TSIN
- Industry
- STEM Hubs
- CTE
Ensuring a Future Ready Tennessee

• In 2012 there were 252,000 STEM employees in Tennessee.

• It is predicted that in 2022 the level will increase to 295,000 jobs.
  – Increase of 43,000 jobs
  – 11% of the jobs added in the state through 2022

• STEM occupations are projected to increase at a more rapid rate than for all occupations in Tennessee.

• Of core STEM occupations, nearly 40% of job growth will come from the Computer and Mathematical occupational group.
Ensuring a Future Ready Tennessee

• STEM education produces exactly the kind of thinkers a global economy demands, it is the key to positioning Tennessee for future success.

• STEM is a direct response to the realization that Tennessee’s future will be built on technological leadership, knowledge creation and innovation.

• A sustained focus on STEM will deepen Tennessee’s talent pool and spur additional investment, growth and job creation in the state.

• A competitive workforce will attract investment and jobs, and good jobs and economic opportunity will, in turn, retain world-class talent that is hopefully home-grown.

–TSIN Strategic Plan
Occupation Gaps

- A workforce prepared to tackle STEM is critical to driving future growth and innovation.
Academic Gaps

Gaps

- 72% of AP takers did not earn a qualifying score on a STEM AP test.

Math Gaps

- 43% of ACT-tested 2014 graduates met the ACT College Readiness Benchmark in math.

Science Gaps

- 37% of ACT-tested 2014 graduates met the ACT College Readiness Benchmark in science.
ACT Benchmarks

- The Benchmarks are scores on the ACT subject-area tests that represent the level of achievement required for students to have a:
  - 50% chance of obtaining a B or higher or
  - 75% chance of obtaining a C or higher in corresponding credit-bearing first-year college courses.

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<tr>
<th>Subject</th>
<th>Benchmark</th>
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<tr>
<td>English</td>
<td>18</td>
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<tr>
<td>Mathematics</td>
<td>22</td>
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<td>Reading</td>
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<td>Science</td>
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“Nothing is more costly to the nation than untapped potential, and that’s why we must do more to ensure that all students understand the career opportunities that match their interests, particularly those that exist in important STEM fields. If we can identify students earlier and then keep them engaged, they may be more likely to choose a STEM career.”

- There is a gap between the students’ expressed interest in STEM and their intentions to pursue STEM careers.

- Students are not be connecting the dots between their innate interests and a potential STEM-related career.

- Data suggest that Tennessee is not currently awarding, and is not anticipated to award, enough STEM post-secondary degrees to meet the impending STEM job demand.
For many, the decision to study STEM starts before college.

Nearly 4 in 5 STEM college students (78%) say that they decided to study STEM in high school or earlier. One in five (21%) decide in middle school or earlier.

More than half (57%) of STEM college students say that, before going to college, a teacher or class got them interested in STEM.
Minority Gaps

**STEM Facts on Women & Girls**

- **74%** of STEM workers are male. Only 26% are female.

- **26%** of STEM workers are women.

- **74%** of STEM workers are white, **17%** are Asian, and **9%** are other minorities.

- **20%** of engineering school graduates are women, yet only **11%** of practicing engineers are women.

- **21%** of women were 28% of all workers in S&E occupations in 2010, up from **21%** in 1993.

- **<25%** of STEM jobs are held by women.

- **$1** was earned by men, **$0.92** by women.

- The wage gap between women and men is much smaller in STEM occupations than other occupations. In STEM fields, women earn $0.92 for $1 earned by men, compared to $0.77 for other fields.

- Of 100 female bachelor students, 12 graduate with a STEM major but only 3 continue to work in STEM fields 10 years after graduation.

- Women with STEM jobs earned **33%** more than comparable women in non-STEM jobs, considerably higher than the STEM premium for men. As a result, the gender wage gap is smaller in STEM jobs than in non-STEM jobs.
Tennessee’s Department of Education Strategic Plan
STEM education is for all students – not just a select, privileged few.

- STEM is not highly specialized education for an elite group of students; when fully realized, STEM will impact all students in schools across Tennessee.

- STEM education is a transformative way to think about teaching and learning, recognizing that not all students learn in the same way or at the same pace. For that reason, STEM places a strong emphasis on personalizing educational experiences to best suit students’ individualized learning styles and interests.
Tennessee STEM Innovation Network

• First round winner of Race to the Top and implemented a $500 million plan establishing the Tennessee STEM Innovation Network as a vehicle for ensuring college and career readiness.

• It is a public-private collaborative between the Tennessee Department of Education and Battelle.

• Designed to promote and expand the teaching and learning of STEM education in the K-12 public schools across Tennessee.

• Brings together stakeholders in a collaborative effort to identify, leverage and spread STEM education practices, program and partnerships.
The STEM Leadership Council was established in June 2014 to address the issue of STEM–related gaps. The council formed to address how to provide primary and secondary students in Tennessee access and exposure to rigorous STEM-related learning pathways leading to postsecondary achievement and the development of a diverse, robust, and dynamic pipeline of future STEM professionals who are highly skilled across industries and in academic research.
STEM Leadership Council

Mission

To promote rigorous STEM-related learning opportunities for all students that lead to postsecondary achievement and high quality careers.

Vision

To advance Tennessee as the leading state in STEM education, developing a workforce able to compete and succeed in the current and emerging global economy.
**STEM Leadership Council**

**STEM** is the seamless integration of science, technology, engineering mathematics, and 21st century skills used to innovatively solve real-world problems.

- **In education:** STEM is a unique way of teaching and learning

  - **In industry:** STEM innovations drive the economy
Members Include:

- Elementary, Middle and High School Teachers
- Postsecondary Teachers
- Counselors
- School District Administrators
- Business/Industry Experts
- Members of the Tennessee Department of Education
- Members of the Tennessee STEM innovation Network
STEM Strategic Plan
An Integrated K–12 STEM Proposal for Tennessee
Office of Career and Technical Education | Division of College, Career and Technical Education | September 2016
Under the direction of the STEM Leadership Council and in partnership with the Tennessee Department of Education, the following recommendations have been developed to address the full integration of STEM education in K-12 learning. These recommendations reflect the promotion of a fully integrated approach, targeting four priority areas to drive the integrative work of state math and science standards with broader STEM-related focuses. These four priority areas are: curriculum and instruction, student achievement, educator professional development, and community and postsecondary partnerships.

Successfully addressing the four priority areas within the K-12 STEM strategic plan depends heavily on dedicated and integrated science instruction, as mandated by our new science standards. The Tennessee Science Standards require the integration of technology and engineering within and beyond the science context. This, alongside the intentionally aligned mathematics standards will result in a STEM instructional plan for all students.
STEM Leadership Council Strategic Priorities

- Curriculum and Instruction
- Achievement
- Professional Development
- Community and Postsecondary Partnerships
Integrative Approach

- Achievement
- Professional Development
- Curriculum & Instruction
- Science, Technology, Engineering, Math (STEM)
- Community & Postsecondary Partnerships
Create an integrated STEM curriculum K–12 using the Tennessee math and science standards as the focus to develop key STEM instruction functions to support the curriculum.

Key Recommendations:

1. Create K–12 modules that utilize the new Tennessee math and science standards and incorporate STEM instructional practices and career exploration for students

2. Provide instructional and community resources for the integration of K-12 classroom learning and external-based learning opportunities, focusing on project-based, hands on learning and applications
Achievement

Incorporate math and science assessment results as part of a designation that recognizes schools for STEM promising practices.

Key Recommendations:

1. Develop an integrative guidance for districts that incorporates math and science student achievement along with other components essential to the development of strong school STEM cultures and focuses

2. Create a designation, in partnership with the Tennessee STEM Innovation Network, which recognizes schools for promising practices in integrative STEM instruction
Professional Development

Design professional development that provides support in implementing and continuing the integration of the Tennessee math and science standards and STEM applications and strategies for all teachers K–12.

Key Recommendations:

1. Provide and support consistent funding for high-quality STEM professional development in conjunction with the rollout and ongoing support of the state math and science standards
2. Adopt guidelines for quality STEM educator professional development
3. Establish quality STEM-related teacher preparatory guidelines and attach targeted license endorsements and incentives for more effective teachers
4. Implement a system of periodic reviews of state STEM-related professional development practices and monitor effectiveness
Community and Postsecondary Partnerships

Establish community and postsecondary academic STEM partnerships which provide meaningful connections between the academic standards and practical applications outside of the school day.

Key Recommendations:

1. Partner with postsecondary institutions to create seamless STEM pathways ensuring all students are postsecondary and career ready.

2. Advocate for policies and legislation that provide incentives for the creation and sustainability of partnerships, CTE opportunities, and hands-on learning opportunities. This will be accomplished through student work-based learning experiences, teacher externships, and student and teacher research opportunities.

3. Develop the ability to access and exchange information across the state regarding STEM partnerships in order to track outcomes and support partnership creation and development.
Your Role as Leaders in Postsecondary

• Become acquainted with the STEM Strategic Plan
• Provide time within the schedule to incorporate STEM
  – Embrace the natural integration opportunities and entry points within the content in your areas
• Help facilitate professional development in areas of need:
  – Incorporating engineering into the classroom
• Administrators can support your instructors through:
  – Resource allocation
  – Time to experiment
  – Space to collaborate
  – Flexibility to “cross-pollinate”
• Encourage collaboration within and across networks
Integrative Approach

- Achievement
- Professional Development
- Curriculum & Instruction
- Science, Technology, Engineering, Math (STEM)
- Community & Postsecondary Partnerships
Questions or Comments
Districts and schools in Tennessee will exemplify excellence and equity such that all students are equipped with the knowledge and skills to successfully embark on their chosen path in life.