North Carolina's Science, Technology, Engineering, and Mathematics (STEM) Education Strategic Plan

Executive Summary

North Carolina has arguably the finest business climate in America. However, the state is undergoing a critical economic transformation, moving rapidly from a low-skill, low-wage economy to a high-skill, knowledge-based economy driven by technology and innovation. These changes demand an adaptable workforce - one with the science, technology, engineering and mathematics (STEM) skills embedded within the critical 21st Century skills required for successful citizenship. To maintain North Carolina's supremacy, future workers must have the STEM skills leading companies demand and the citizenship the 21st Century now requires for success.

Fortunately, North Carolina can boast a high number of statewide and local STEM education initiatives, as well as strong education standards and public and private organizations promoting education innovation in their communities and regions. No matter their geographic, political, or economic disposition, North Carolina's leaders agree that **a coordinated, statewide STEM Education Strategic Plan** with clear direction, support and goals is needed to ensure a workforce that is prepared for the high-skill, high-wage and high-demand jobs of a knowledge-based and innovation economy.[1] The plan must be built on a shared vision that leverages public and private resources in the most effective and efficient manner possible, moving North Carolina further and faster toward a world-class workforce and sustained economic growth and development in a global market.

North Carolina is poised to lead the nation with vibrant STEM-based education and economic systems. It is time for North Carolina to connect the many "islands of excellence" across the state into a bright future for all its citizens and communities. To build and maintain the world-class workforce needed to ensure economic prosperity in a global market, North Carolina must focus on the following three priorities and measure our progress against these strategies:

Priority 1: Increasing our student, educator and institutional STEM Achievement

Strategy: Adopt a set of attributes for STEM schools and programs, aligned with 21st Century Skills, to assist public and private organizations to align, coordinate and advance STEM skills for all students.

Strategy: Measure a set of student achievement indicators along the education-to-workforce continuum to guide the current and future implementation of the STEM Strategy.

Strategy: Implement a designation for STEM Schools and Programs, aligned with the STEM Attributes, to drive the goals and measures outlined within this STEM Strategic Plan.

Strategy: Identify high-quality tools and supports – such as rubrics, self-assessments – to enable schools, programs and businesses to advance consistent understanding and application of the adopted STEM Attributes.

Priority 2: Gaining and sustaining broader community understanding and support for education innovations that support our economic needs

Strategy: Coordinate a public awareness campaign to 100 counties utilizing public/private partnerships, to inspire and engage North Carolina citizens in this economic challenge.

Strategy: Identify and convene leading programs, partners and schools to advance and highlight best practices to every county

Strategy: Provide a one-stop action-oriented resource for students, educators, parents, and businesses to get involved in the STEM initiative.

Priority 3: Connecting, leveraging & increasing STEM Resources across public and private sectors to improve our citizens and their economic future

Strategy: Invest public and private funds over the next ten years to scale effective STEM programs, policies and practices throughout every economic development region of North Carolina

Strategy: Identify and fund a public/private partner that coordinates, evaluates and monitors STEM Education programs and initiatives

Strategy: Incentivize collaborations based on evidence-based policies, programs and practice that greatly increases the number of students gaining STEM skills and continuing in STEM fields of work.

Strategy: Establish a STEM Council to facilitate and coordinate the implementation of North Carolina's comprehensive STEM Strategic Plan.

intended to directly engage students, as well as programs and activities designed to recruit, prepare, and retain effective educators in the STEM areas. North Carolina has strong pockets of promising practices and many strengths to be leveraged across the state.

This critical workforce need combines with a large number of programs and high rate of innovation requires a coordinated STEM Education Strategic Plan. This strategy aligns, innovates, and advances the STEM skills all students need to ensure their success in every community of North Carolina.

Aligning K12 with K20 and Economic Needs

North Carolina has not been idle in STEM education. Through *Career and College – Ready, Set, Go!* and programs such as *Career & College Promise*, North Carolina is leading the transformation of our state's system of public education to ensure all students graduate from high school equipped to succeed in a career, in a two- or four-year college, or in technical training, and prepared to compete successfully in a global, knowledge-based and innovation economy. The Standard Course of Study has been updated based on nationally-recognized Common Core standards, essential standards and international standards. Teachers and principals are being provided tools and access to professional development that will help them reach all students, and technology is being used to support student learning. Because excellence in STEM skills are essential for our workforce in a global, knowledge-based, and innovation economy, a crucial component of the transformation includes improving STEM Education for all students.

North Carolina recognizes our workforce needs are not that of a single organization, institution or sector. Many of the initiatives to reach these goals should directly connect and leverage existing or future efforts across institutions along the education-to-workforce continuum.

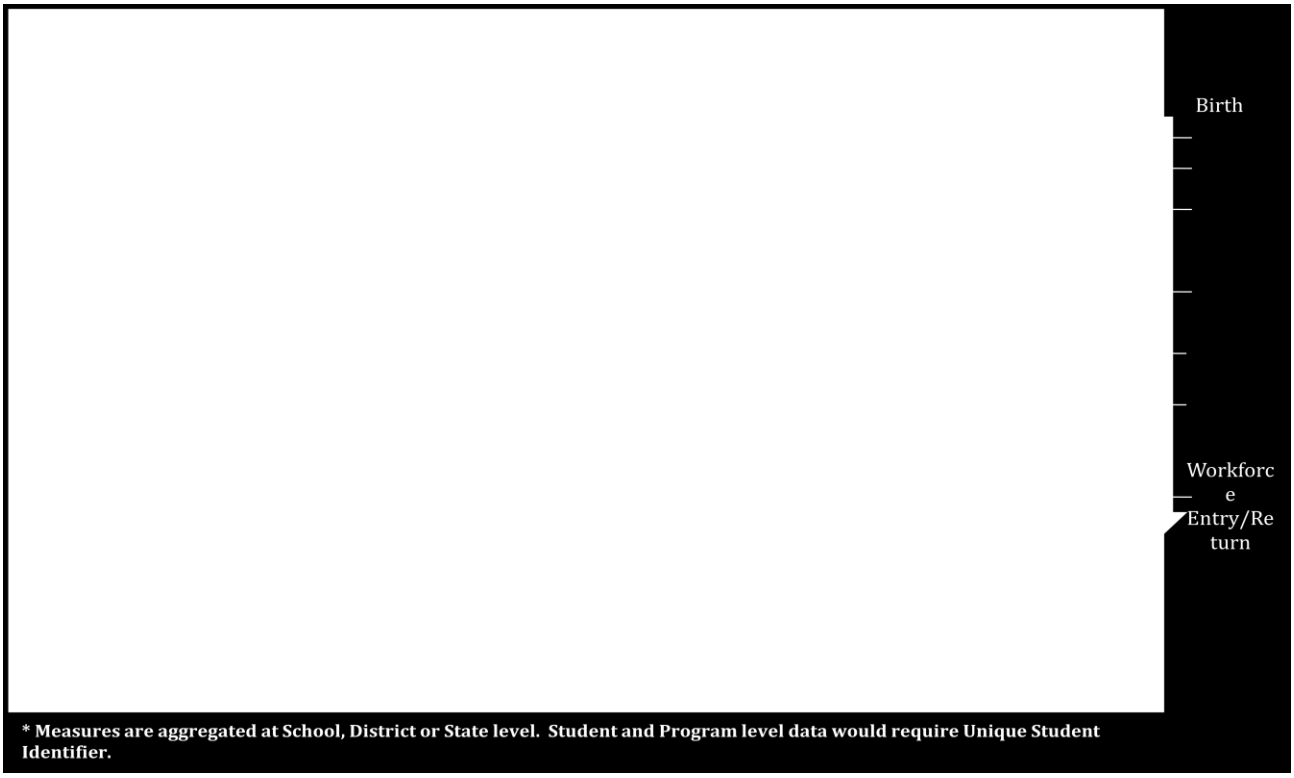
The Framework for the STEM Education Strategic Plan

Students and educators are the focal point of every effective education strategy, but North Carolina understands these critical resources are a vital part of a larger system and environment. Through extended conversation with K20 education system leaders, research of hundreds of local, state and national initiatives, and deliberate engagement of private sector, foundations, economic development and other non-education stakeholders, North Carolina has created the first statewide STEM Education Strategic Plan. The STEM Education Strategic Plan focuses on three immediate and reinforcing priorities, outlines measurable goals and twelve corresponding strategies. These twelve corresponding strategies have been vetted through multiple lenses to position North Carolina as a leader, both educationally and economically.

The North Carolina Department of Public Instruction and NCCCS have produced a list of Current and Needed STEM Initiatives associated with the three priorities, provided in Appendix I.

Indicators to Guide State STEM Strategic Plan

The following measures are recommended for compilation in reviewing students' achievement. These are listed as aligned with the education-to-workforce continuum:



The measures listed in black are currently collected, and may be compiled to prepare a baseline. Those listed in "red" are needed and should be prioritized. These measures are aligned and agreed to by K-20 systems. However, until a common unique identifier for students is utilized by all K20 systems, measurement will only be possible in the aggregate (School, District, Region or State level), not the program or student level.

The business sector has often repeated the mantra "what gets measured gets done". By initiating these measures along the education-to-workforce continuum, North Carolina will guide the Statewide STEM Strategic Plan at multiple levels. As soon as possible, the following additional steps need to be taken to increase local and state alignment with this strategy:

- Programs, policies and partnerships in current or new initiatives to advance the Statewide STEM Strategic Plan focus on at least one of the above indicators
- Common measures and indicators for public and private investments in STEM education need to be identified and compiled
- Where and when possible, North Carolina and its partners need to utilize the data compiled to guide and prioritize resources, policies and efforts towards agile decision-making to ensure the largest possible student progression in this STEM pipeline

School of Government Professor Shannon Tufts and her team, resulted in a report of the nice-to-have and need-to-have features of a STEM Portal for the different stakeholders.

- Surveys of other States' sites and interviews of State personnel regarding the service, features, costs and lessons learned through similar endeavors have been compiled by Stephanie Wright, graduate intern in mathematics and social sciences.
- Private sector support and partnerships have been successfully sought (over $25,000 from two different companies) to support the design and implementation of such a resource.

A STEM Portal is a tangible, useful tool to attract and activate those who wish to connect and advance STEM skills in their area. These previous efforts should be built upon, and it appears private sector funding and expertise combined with public sector endorsement and hosting would provide a comprehensive, action-oriented web-based resource for stakeholders to advance the Statewide STEM Strategic Plan. Appendix IV

effort. Finally, as public sector coffers return either flat or fewer resources, the state will require identification of partners and sharing of responsibility, expertise and models to reach a growing number of students and educators.

In 2010, a number of public and private partners such as The North Carolina Board of Science & Technology recommended an initiative that would include:

- A challenge grant from the State to encourage private sector investments in scaling.
- Identification of and focus on hands-on STEM learning experiences for K-12 grade, with a particular focus on the first 8 years of schooling.
- Success measured through identified student achievement, growth or expansion of programs, increase of access of high-quality programs to all regions, and alignment of programs with ongoing workforce and economic cluster needs of the state and its regions.

The State of Massachusetts, consistently referenced by experts and researchers as a leader in STEM education, recently announced a similar program called "@Scale", to identify programs of high-quality and value to different economic development regions of the state. At the time of launch, public sector funds were in the process of identification, and private sector investments were under consideration once supported publicly.

Given the rapid expansion of North Carolina's knowledge-based economy, the multitude of high-quality programs, and the current environment, a set of public and private sector investments directly focused on scaling programs, policies and practices to every economic development region of North Carolina over the next decade must be identified and coordinated to dramatically increase the STEM skills of North Carolina's workforce.

Strategy: Identify and fund a public/private partner for the coordination, evaluation and monitoring of STEM Education programs and initiatives.

Leveraging public, private, and technology resources will allow North Carolina to achieve the greatest possible impact for its investments. This will require coordination, evaluation, and monitoring of STEM Education programs and initiatives. In addition, this will require formal and informal collaboration among schools, school systems, business and industry, and other private and public sector partners eliminating redundancies, inefficiencies, and inequities.

This will require a public/private partner with:

- Sufficient access to and in-house STEM expertise and business management
- A unique, established network of local, state and national STEM partners, networks and experts
- A willingness to prioritize the scaling and connectivity of high-quality and effective programs across the K20 education-to-workforce continuum above any single program
- The endorsement, support, guidance and input of public and private leaders from across the local, state, and national STEM education, education policy and innovation landscape
- The capacity to accept public or private resources and quickly disperse them, in consultation with NC DPI and other partners, to a network of partners, schools and programs.

Endnotes

This document serves as a ***Draft Framework for this Statewide STEM Strategic Plan***, with the concurrence of the Governor's Education Cabinet, North Carolina's education systems' leadership, the Joint Legislative Joining Our Business & Schools (JOBS) Commission, the NC STEM Advisory Panel, and other public and private partners. The information, recommendations and findings of this report are informed by a broad set of research, reports, data, interviews, initiatives and efforts, including but not limited to:

- *Career & College: Ready Set Go!* North Carolina's K20 Education Plan, The Honorable Governor Beverly Perdue
- Statewide meetings and research of the NC Joining Our Business & Schools (JOBS) Commission, chaired by The Honorable Lt. Governor Walter Dalton
- The Governor's Education Cabinet, North Carolina General Assembly "SL 2010-41 Education Cabinet to Set STEM Priority & Goals", and research conducted by Education First Consulting
- The Career-Ready Commission Report, 2010, chaired by Superintendent June Atkinson
- UNC Tomorrow Report (2008), Inventory of University STEM Programs For K12(v2, 2009), and other research of the University of North Carolina System and its institutions
- NC Community College System Listening Tour, SuccessNC (2010), interviews and other data of NC Community College System and its institutions
- Advancing Innovation in NC (2009), Letter to Governor Beverly Perdue on STEM Needs (2010) and other research and data from the NC Department of Commerce and the NC Board of Science and Technology
- Interviews, research, findings and recommendations of the NC STEM Advisory Panel as well as 600+ local, state and national leaders from public and private organizations, conducted by the NC STEM Community Collaborative
- Publications from the Presidential Office of Science & Technology, US Department of Education, National Governor's Association, US Chamber of Commerce, Business-Higher Education Forum, Manufacturing Institute, Battelle, the Bill & Melinda Gates Foundation and others.

12. Provide staff development with teacher education instructors, teachers, counselors and school leaders on:
    a. STEM curriculum
    b. Community and industry engagement
    c. Connections with postsecondary
13. Create, recruit, hire, train, and retain NC STEM teachers initiative to produce the best and brightest professional educators
14. Collaborate with teacher education to support the lateral entry program to recruit teachers to teach in STEM areas

Community Colleges

15. Increase opportunities for entry level job training and degree attainment tied to industry certifications and licensure, and integration with Career Readiness Credentials and employability skills training.
16. Develop model for degree completion to support joint statewide targets with UNC System.

Priority II: Bolster Community Support

Current Initiatives

K-12

1. MCNC NC STEM Community Collaborative provides a single organizing unit for both public and private organizations to support scaling what works in STEM education.
2. Regional Education Services Alliances (RESA) provide coordination of regional activities in educational areas and the Economic Development Education Regions coordinate economic development in seven regions with State Board of Education members participating in each region.
3. The NC New Schools Project (NCNSP) collaborates with the private sector and higher education in the development of networks of STEM schools and districts, including on-going work and leadership through economically themed Industry Innovation Councils. NCNSP also convenes state and national conferences to build support and understanding for the need for comprehensive innovation in schools to ensure students graduate college and career ready.

Needed Initiatives and Actions

K-12

1. Build a Statewide STEM website for all North Carolina
   - Identify and connect schools
   - Identify resources and programs
   - Create a communication portal for schools
2. Build marketing plans on STEM career opportunities, course needs in school, and postsecondary options to recruit students, educators, parents and the community
3. Market the National Association of Engineers 14 Grand Challenges for Engineering to K-12 educators to:
   - Promote an awareness of STEM related issues

22. Percentage of first-time fall community college credential-seeking student graduation, transfer, or still enrolled with 36 hours after six years
23. Percentage of community college associate degree completers and those who have completed 30 or more credit hours with a GPA of 2.00 or better at a four-year college or university after two consecutive semesters within the academic year.

Bolster Community Understanding

1. Website portal is developed to connect schools identifying resources and create an communication portal for schools
2. Marketing plan is developed for :
    - Career opportunities
    - Postsecondary options
    - 14 Grand Challenges
    - Community Understanding
3. Data systems are established to measure student success and inform school personnel and legislature about how to improve the delivery of STEM education
4. Collaboration among interested groups is evident

Leveraging & Connecting Resources

1. Directory of programs and resources and professional development is defined for school use
2. Curriculum in STEM areas has infused project-based activities for all teachers
3. Aerospace; Health Sciences; Pre-engineering; and Agriscience and Biotechnology curriculum are developed for schools
4. There is an increase in the number of resources available to the schools for STEM education
5. There is an increase in the number of STEM out-of school programs available

Appendix III
STEM Schools Rubric (Draft)

Appendix IV

Appendix IV – Web-based Resource Design Documents

(pdf)

References

[1] Education First, *North Carolina Education Cabinet: STEM Stakeholder Interview Findings*, March 8, 2011.
Additional References

[2] President Barack Obama, *State of the Union Address*, January 25, 2011

[3] White House Press Release, *President Obama to Announce Major Expansion of "Educate to Innovate" Campaign to Improve Science, Technology, Engineering and Math (STEM) Education*, September 16, 2010

[4] Change the Equation, *Why STEM?* www.changetheequation.org, 2011

[5] NC Commission on Workforce Development, *State of the North Carolina Workforce 2011-2020*: " *Preparing North Carolina's Workforce and Businesses for the Global Economy, "* June 2011.

[6] NC Office of the Governor, *Jobs Now*, www.governor.state.nc.us, 2011

[7] NC Commission on Workforce Development, *State of the North Carolina Workforce 2011-2020*: " *Preparing North Carolina's Workforce and Businesses for the Global Economy, "* June 2011.