



Advancing STEM-Focused Innovative High Schools In North Carolina

The North Carolina New Schools Project (NCNSP), in partnership with others in business, government, philanthropy and education, is building a new vision of teaching and learning to prepare students for work and life in this century. A globally competitive, knowledge-based economy is a fact of life for North Carolina's high school students – now and for the foreseeable future – and science, technology, engineering and mathematics (STEM) are critical drivers in that economy. To reduce a potentially crippling workforce knowledge gap and to prepare more students – especially those who traditionally have been underrepresented – for STEM careers, North Carolina must make these disciplines accessible and relevant and fundamentally change approaches to teaching. To this end, NCNSP is working with local educators and others to enhance the development of a small network of innovative high schools focused on STEM by strengthening instructional practice and building more effective, challenging curriculum.

NCNSP works with 14 STEM-focused high schools that represent important first steps toward this goal. These schools aim to raise student performance and engagement by changing students' perceptions of science and mathematics as well as their perceived and achieved abilities in these disciplines.

A Vision for STEM-Focused Schools

A model STEM school provides the tools and space for exploration and invention and fosters a culture of collaborative inquiry among faculty and students. The curriculum emphasizes connections within and between the fields of mathematics and science with heavy and meaningful integration of technology. Courses that introduce and engage students in the engineering design process span the high school course sequence. The arts and humanities further integrate the STEM disciplines, and all courses highlight the role of STEM in the global society and economy.

Throughout the school, teachers engage students in learning through active solving of real problems, bolstering student motivation and understanding. Students regularly engage in deep discourse, marked by discipline-based justifications. Beyond content knowledge, these schools value and cultivate creativity and develop the problem solving, communication and collaboration skills that drive innovation. Extracurricular activities, summer programs, and internships provide learning experiences that increase students' awareness of and interest in STEM.

In addition to standard measures of achievement, indicators of success include student excitement about coming to school, enthusiasm for learning and a passionate interest in the world. Students exhibit confidence and perseverance when faced with a challenge and further demonstrate the ability to gather and analyze relevant information and synthesize knowledge and skills to solve authentic problems.

Partnerships for Success

NCNSP has formed key partnerships that support its work to create a network of highly successful STEM-focused schools. NCNSP collaborates with North Carolina State University (NCSU) and local school districts on two math and science partnership (MSP) grants from the North Carolina Department of Public Instruction. One grant supports implementation of *Core-Plus Mathematics*, a problem-based, integrated mathematics curriculum and instructional model in six turnaround STEM schools. This school year, NCNSP partnered with the Science House at NCSU on another MSP grant to support implementation of the Arizona State University-developed *Modeling Instruction* science curriculum materials and approach to teaching. These grants fund professional development through residential summer workshops, school year follow up meetings, and school-based instructional coaching.

The Bill and Melinda Gates Foundation provides additional instructional coaching through the Teaching Institute for Excellence in STEM (TIES) in five STEM schools. TIES also coordinates an annual Student STEM Symposium, sponsored by the Burroughs Wellcome Fund, which provides an opportunity for teams of up to four students from each STEM school to present their original research and projects and to hear prominent scientists and engineers speak in meaningful and relevant ways about their own experience as researchers. The opening session for the 2nd Annual Student STEM Symposium featured David Finkel from Youth Technology Corps (YTC), whose mission is “to engage youth to be agents of change at home and globally through teamwork, technology education, and community service.” YTC, TIES, and NCNSP have partnered to launch YTC in North Carolina with our STEM schools. This summer, seven STEM schools will host YTC students from Chicago and Durango, Mexico, to learn how to refurbish computers and the rewards of donating, setting up, and maintaining community computer labs.

Five NCNSP STEM teachers have received a highly competitive two-year fellowship through the Kenan Fellows Program for Curriculum and Leadership Development, which provides a stipend, professional development on curriculum writing, and a university or private sector STEM mentor. Each fellow collaborates with his or her mentor on a STEM-related research project and the development of related, inquiry-based classroom lessons.

GlaxoSmithKline and AT&T have provided generous financial support for 10 STEM schools to subsidize the districts’ costs for NCNSP support services for three and two years respectively and to provide STEM curriculum resources and implementation support. Progress Energy has provided seed money for NCNSP, working together with the Science House, FREEDM Systems Center, Kenan Institute, and Alliance to Save Energy, to develop a plan to layer sustainable energy curriculum into the course of study in the STEM schools.

NCNSP continues to form strategic partnerships to coordinate efforts to enhance STEM education. The NCSU Cooperative Extension is helping to connect STEM schools with related business and industry partners in their communities. NCNSP is collaborating with Dr. Len Annetta in the College of Education at NCSU to write a grant to support student development of educational science video games and to increase student awareness of STEM careers. We are in active conversations with the Science Education for Public Understanding Program (SEPUP) and Lab Aids, as well as the Geographic Data in Education (GEODE) Initiative, to provide innovative curriculum materials and supporting professional development for biology and earth/environmental science.

Early Results

Early results from the turnaround STEM schools that share campuses and enrollment zones with struggling comprehensive high schools indicate the power of STEM education to engage and motivate students and teachers and to raise their performance.

EOC Performance Composite: The 10 turnaround STEM schools had an End-of-Course Performance Composite of 62 percent in their first year, compared to 37 percent at the comprehensive high school from which they were created. Half of these schools had Performance Composites equal to or greater than 80 percent. Nine of the 10 schools had a higher Performance Composite than the school from which they were drawn.

Early Leaver Rate: The 10 turnaround STEM schools had an “early leaver” rate, which historically have correlated closely to annual dropout rates, of 2 percent, compared to 7 percent in the comparison high schools. Five of the 10 schools reported no early leavers.

Teacher Satisfaction: 77 percent of turnaround STEM school teachers “strongly agree” with the statement, “My school is a good place to teach and learn,” on the teacher working conditions survey, compared to 36 percent in the comprehensive high schools.

Looking Ahead

As part of a three-day Summer Institute in June, teams from 11 STEM schools will visit Centennial Campus at NCSU to stretch their thinking about what it means to prepare students for work and life in the 21st century. Participants will engage in a demonstration science lesson at the Science House, learn about the FREEDM Systems Center and Kenan Fellows Program, interact with Kenan fellows, and tour the Advanced Energy facilities.

In partnership with NCNSP, Wake County Public School System and NCSU are planning a STEM-focused early college high school that will serve as a lab school for development of STEM curriculum, a model for other STEM schools across the state, and a pipeline to increase the number of students, particularly those from traditionally underrepresented populations, who graduate high school prepared for and interested in undergraduate STEM study.

Additionally, NCNSP will provide opportunities for teachers to collaborate with partners from NCNSP, higher education, and business on curriculum development, as well as facilitate the organization of lesson study groups to refine lessons and improve teaching. A math teacher in one of the STEM schools organized a math and science PBL conference this past spring to provide an opportunity for teachers across the state to share the projects they have developed. NCNSP aims to create formal systems to enable teachers to collaborate and share resources.

As North Carolina moves forward in STEM education, the NCNSP STEM schools will serve as models for the development of additional schools, as well as for reform in all schools across the state. Quality STEM education prepares all students to compete in the 21st century economy, not just future scientists or engineers. Increasingly, graduates require more flexible and adaptable understanding and competence in math, science and technology, no matter the future paths they choose. A rigorous and relevant high school STEM education provides the foundation for college, work and life in the 21st century that should be the mission of all North Carolina schools.