NCTAF LEARNING STUDIOS

REINVENTING STEM EDUCATION

The world economy is rapidly outpacing America's development of STEM talent. Our students must learn more, do more, and create more. To meet this challenge, thousands of STEM professionals are ready to join forces with new and accomplished teachers to develop the next generation of innovators, entrepreneurs, and leaders we need to thrive in a global economy.

Tom Friedman has suggested that "We might be able to stimulate our way back to stability, but we can only invent our way back to prosperity. We need everyone at every level to get smarter." A century before him, John Dewey observed that "If we teach today's students as we taught yesterday's, we rob them of tomorrow." Getting smarter in schools means inventing a better way for teachers and STEM professionals to engage students in deeper learning. It's time to stop fixing the schools of the past so we can create the schools of the future – we don't have the time or resources to do both.

TEAM UP FOR 21ST CENTURY TEACHING

Learning Studios are innovation incubators that mobilize educators, business partners, and community leaders to remake STEM education for the 21st century. STEM professionals, teachers, and young people join forces in cross-generational teams that tackle significant community problems.

- **NCTAF** facilitates Learning Studio design workshops and develops well-structured partnerships among teachers, STEM professionals, and students who work together on year-long projects.
- **Studio students** become curious, thoughtful learners as they work on year-long inquiry projects with a team of four to six teachers and a STEM industry partner. Students develop the 21st century skills they need to truly prepare for college, careers, and life by learning STEM the way STEM is done: in hands-on, solution-focused teamwork.
- **Studio teachers** develop deeper content mastery in the sciences and engineering as they work with their STEM partners to design rigorous inquiry projects, and they become more effective teachers as they team up with colleagues to engage students in deeper learning.
- **Studio partners** discover how to translate their professional STEM expertise into well-structured and engaging student investigations, with coaching and support from accomplished Studio teachers who understand how children learn.

ABOUT NCTAF

The National Commission on Teaching and America's Future (NCTAF) was founded in 1994 to ensure that every child in America has access to quality teaching in schools organized for success. NCTAF is mobilizing educators, business partners, and community leaders to remake America's schools for the 21st century. We conduct research and develop demonstration programs to support deeper student learning with more effective teaching and higher impact community engagement.

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Studios are research based. With grants from the National Science Foundation, MetLife, NASA, Gates Foundation, Pearson Foundation, and Carnegie Corporation of New York, NCTAF has developed six core principles that we use to train and deploy teams of teachers and STEM professionals who have well-structured responsibilities for engaging students in deeper student learning.

Studios are partnerships. Working with NASA Goddard Space Flight Center, Northrop Grumman, Boeing, the U.S. Naval Academy, the National Institutes of Health, and others, NCTAF has launched sixteen STEM Learning Studios in nine high schools and six middle schools in four Maryland school districts. Over 100 teachers are collaborating with twenty-one STEM professionals on sustained investigations with approximately 1,500 students.

Studios are problem-focused. Similar to studios in other fields, NCTAF Learning Studios organize teachers, professionals, and students into teams that draw on their diverse skills and expertise to design innovative responses to complex learning challenges. Studio themes, which vary across schools, include trans-disciplinary concepts and "big questions" that teachers and students team up to address in real-world inquiry projects.

Studios are constantly evaluated. NCTAF trains Studio teams to participate in quarterly performance reviews, and we use outside evaluators to collect teaching effectiveness and student achievement data. We are seeing increased student engagement, with gains in STEM content mastery, higher order thinking skills, and collaborative problem-solving abilities. Teachers are gaining STEM proficiency, and STEM professionals are making higher impact contributions to student learning.

SNAPSHOTS

At Lindale Middle School in Anne Arundel County, a Studio team of teachers and students is working with the U.S. Naval Academy and Boeing to investigate "how air travel impacts our environment" – a problem especially relevant to the students whose school is located on the Baltimore-Washington International Airport flight path. Students examined flight pattern maps in math class and corresponded with airport officials in English class to gather authentic data on noise pollution. This Learning Studio built air quality sensors with the help of U.S. Naval Academy faculty that were placed around the school to collect real-time data. Students check air quality readings daily and raise a color-coded flag corresponding with E.P.A. air quality scales.

At Central Middle School in Anne Arundel County, two Studio teams (an 8th grade and a 7th grade) are investigating "the impact of our environment on water quality." In collaboration with a parent volunteer from the Annapolis Public Works Department and representatives of the Arlington Echo Outdoor Education Center, they are exploring design solutions for a rain garden to solve water runoff problems around their school. Teams of teachers and students are using Google Earth satellite images to measure and analyze their community's changing landscape over time, with a focus on understanding how housing developments and the expansion of paved surfaces around their school are affecting vegetation and runoff in their community. To help reduce erosion and water runoff into the Chesapeake Bay, the students decided to plant more than 100 trees on their school grounds – with assistance of a parent who works in forestry. In subsequent years, teachers and students will monitor the growth of these trees to catalyze Studio explorations of "Evolving Land Use" in the Maryland Earth Science curriculum.

At Gwynn Park High School in Prince George's County, the Studio is focused on "the effects of urbanization on soil quality and plant growth," which they are investigating in partnership with a NASA-Goddard soil scientist. To support their research, the students chose to renovate an abandoned greenhouse on the school's campus, only to discover that the soil and compost pile was contaminated by broken glass from the old structure. This solution-focused inquiry team expanded their Studio to include a team of students from the school's industrial arts and technology classes and reached out to a local cement plant owner who helped them design devices that could separate the glass from the soil. The students are now using their greenhouse to study simulated landfills, which they monitor for effects on soil organisms and plant growth. Students are also using their simulations to calculate the environmental impact of recycling in landfills. Teachers intend to expand student-to-student peer-teaching and learning to increase this Studio's effectiveness.

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