

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

**Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM).
(15 points, all or nothing)**

To meet this priority, the State's application must have a high-quality plan to address the need to (i) offer a rigorous course of study in mathematics, the sciences, technology, and engineering; (ii) cooperate with industry experts, museums, universities, research centers, or other STEM-capable community partners to prepare and assist teachers in integrating STEM content across grades and disciplines, in promoting effective and relevant instruction, and in offering applied learning opportunities for students; and (iii) prepare more students for advanced study and careers in the sciences, technology, engineering, and mathematics, including by addressing the needs of underrepresented groups and of women and girls in the areas of science, technology, engineering, and mathematics.

The competitive preference priority will be evaluated in the context of the State's entire application. Therefore, a State that is responding to this priority should address it throughout the application, as appropriate, and provide a summary of its approach to addressing the priority in the text box below. The reviewers will assess the priority as part of their review of a State's application and determine whether it has been met.

**SETTING THE CONTEXT FOR SCIENCE, TECHNOLOGY, ENGINEERING, AND
MATHEMATICS (STEM) EDUCATION IN CONNECTICUT**

Connecticut has long recognized the need for increased emphasis on student interest and achievement in the STEM areas. In 2002, Governor John Rowland committed \$125 million in state funding to support the design and construction of the Connecticut Science Center, the state's flagship science center, in Hartford whose mission is to inspire youngsters and support teachers in making science an integral part of the curriculum. In late 2005, Governor M. Jodi Rell called for a coordinated and comprehensive plan to measurably improve PK-16 student interest and achievement in STEM to better meet Connecticut's 21st century economic development, quality of life, and workforce preparation needs. More than 100 citizens, business, policy, and education leaders contributed to crafting the 2006 CONNvene Plan that included goals and strategies for increasing student STEM interest and achievement.

Though geographically small in size, Connecticut has a large concentration of STEM businesses and industries. Particular strengths include biotechnology, pharmaceutical research and development, aerospace, stem cell research, fuel cell research and, most recently, green technologies. Our biotech sector includes corporate giants, such as Pfizer, Bristol-Myers Squibb and Boehringer

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

Ingelheim, as well as more than 36 startups in the last 20 years that have attracted billions in state, federal and private investment and opened doors to 63,000 Connecticut jobs. Engineering giants in the state include United Technologies Pratt & Whitney, Sikorsky Aircraft, Hamilton Sunstrand, General Electric and General Dynamics/Electric Boat.

In addition to our significant STEM industry resources and premier research universities, Yale University and the University of Connecticut (UCONN), Connecticut has a strong system of higher education, a technical high school system with STEM career clusters (Computer Technologies, Arts, Audio/Video Technology and Communication, Health Technology, and Manufacturing), 16 Agri-Science and Technology high schools that offers STEM career preparation in areas such as agri-science and marine science, and dozens of STEM-focused interdistrict magnet schools. Informal learning and work opportunities abound as well: Connecticut hosts the internationally renowned Mystic Aquarium and Institute for Learning and the Norwalk Maritime Center and is host to over 70 science museums, including the flagship, Connecticut Science Center in Hartford.

To address their deep concern about the STEM pipeline (Section (A)(1)), our elected officials and Connecticut-based STEM-related businesses, museums, research centers and higher education institutions, in collaboration with the CSDE, have invested significant resources to bolster STEM education. These efforts have included professional development for teachers, provision of engaging STEM student materials and teacher resources, and providing a variety of applied learning opportunities for students. Some of these include the following:

- \$2.7 million National Science Foundation grant recently awarded to the UCONN School of Engineering to place its undergraduate and graduate students in Connecticut's 17 technical high schools to model the professional practices of engineers, while conducting research.
- \$13.2 million over six years awarded to *Project Opening Doors: Connecticut's National Math and Science Initiative (NMSI)* (Advanced Placement initiative).
- \$40 million investment by in-state corporations, such as Pfizer, General Electric and United Technologies, in the construction of the new Connecticut Science Center that will serve 375,000 individuals and 65,000 students annually.

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

- \$2 million investment by General Electric to support teacher professional development in inquiry science pedagogy offered by the Connecticut Science Center.
- \$4 million investment by Connecticut biotechnology and pharmaceutical industry to develop biotechnology teaching materials, professional development, an equipment loan program, and a mobile laboratory (BioBus). Since 2001, the BioBus has served 445 schools, 60,000 students in grades 4-12, and more than 700 Connecticut teachers.
- \$1.1 million three-year grant from Boehringer Ingelheim to develop Science Quest, an elementary science program that features curriculum units, professional development, a mobile laboratory, applied learning opportunities, an equipment loan program, and a family science activity package.
- A National Science Foundation grant to participate in Project Kaleidoscope (PKAL), managed by the Connecticut Conference of Independent Colleges (CCIC). This is an ongoing effort to enhance STEM faculty's teaching skills. PKAL has a large collection of online resources that provide faculty with ideas, strategies, resources and advice for engaging students in science learning. (Section (D)(5)).

Rigorous and Engaging STEM Education for All Connecticut Students -- A Coordinated and Comprehensive Effort

Despite these substantial resources and promising trends on National Assessment of Education Progress (NAEP) mathematics proficiency (Section (A)(3)), all of our students are not adequately prepared with the STEM skills needed for success today. Connecticut's previous STEM efforts have lacked the organizational coherence needed to link schools, colleges, and businesses into a seamless delivery system of resources and learning opportunities. To this end, we will use Race to the Top (RTTT) funding, our P-20 Shared Leadership Council, and two critical partnerships - the Partnership for Curriculum Innovation and Technology, and the Partnership for High School, College, and Workforce Alignment - to organize and secure the infrastructure needed to unite what has been a fragmented, albeit rich set of initiatives. With the Partnership for High School, College, and Workforce Alignment as our lead group, the activities described throughout this application will form the basis of a comprehensive plan for STEM education and innovation linked: to secondary school reform; magnet school innovation and expansion; technical high school and community college

Connecticut Race to the Top Phase 2 Application

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

collaboration; teaching excellence, and genuine engagement of all next generation learners, particularly elementary school children and underrepresented groups like girls, students of color and English language learners (ELL) students.

Connecticut's STEM goals and comprehensive plan for achieving them will allow all students to attain strong STEM skills and prepare more Connecticut students for advanced study and careers in the sciences, technology, engineering and mathematics. Components of this plan are described below and throughout our application.

21st Century STEM for Middle and High School Students

The *Connecticut Plan for Secondary School Reform* (Appendix B(3)(a)) and Public Act 10-111 (Appendix (A)(1)(c)) now mandates increased credit and specific course requirements for both math and science for high school graduation (Section (B)(3)). There is an additional requirement for at least one more credit in STEM, with the flexibility to add more credits in these areas to accommodate student interests and goals as established in individualized student success plans. Districts will be required to create plans as to how they will provide these extra classes and associated teachers (Section (D)(3)).

Model curricula and end-of-course assessments will be created (Section (B)3)), in Biological/Life Sciences, Algebra I and II, Geometry, Probability & Statistics, and hybrid courses (online and face-to-face) BIO21, CHEM21, and PHYS21, which will offer a 21st century update of traditional high school science courses (Section (D)(5)). Model curricula in Scientific Inquiry & Experimentation for students in grades 6-8 will also be developed. These model curricula and end-of-course assessments will help to ensure that every Connecticut student will take STEM courses where content is rigorous and lesson activities are relevant and engaging. Our sponsorship of 15 Board Examination pilot schools (Section (B)(3)) will secure a prominent place in our quest to make rigorous STEM content a vital part of our future curriculum linked to internationally benchmarked standards and assessments.

In order to increase the number of highly-qualified teachers in mathematics, Connecticut has established an Alternative Route to Certification (ARC) for middle and secondary mathematics teachers (Section (D)(1)). In an effort to promote advanced STEM learning in schools where a highly-qualified teacher or a particular advanced STEM course may not be available, our RTTT proposal includes

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

scholarships for low-income students to take high-quality online STEM courses (Section (B)(3)). Our increased emphasis on advanced placement course participation included in our RTTT Memorandum of Understanding with LEAs (Appendix (A)(1)(f)) and in Project Opening Doors, also have a STEM subject emphasis.

Programs will be expanded that provide problem-based, STEM-centered, career-focused learning experiences and challenges. These efforts will be facilitated by: (1) the Center for 21st Century Skills @ Education Connection; (2) the Connecticut Career Choices (CCC) Program sponsored by the Connecticut Employment and Training Commission (CETC); and (3) the Connecticut Education Network Learning Community (CENLC), an online learning management system that allows for online and hybrid course delivery, resource dissemination, online professional development, improved home-school communication and more.

The Whitney Group: A New STEM School Consortium

A critical part of Connecticut's plan will be to draw together principals from Connecticut's 27 STEM magnet schools (Appendix (G)(1)(a)) to establish a new consortium to be called the **Whitney Group** (in honor of Eli Whitney, Connecticut inventor). STEM magnet school principals will be joined by the principals of Connecticut's 17 regional technical high schools and representatives from the Partnership for High School, College, and Workforce Alignment operating under the aegis of the Connecticut Employment and Training Commission (CETC). The group will meet monthly to exchange ideas, arrange for teacher exchanges, mutually plan professional development and provide best practices for STEM education to schools statewide. The Whitney Group will be assisted by the Connecticut Association of Schools and the Connecticut Academy for Education of Mathematics, Science, and Technology (CAEMST). It will be convened by November 2010 and will help with the dissemination of the CCSS for mathematics. The new CCSS for science will be released in 2011 through the National Research Council/AAAS/NSTA/Achieve Inc. collaboration, and the International Society for Technology in Education National Educational Technology Standards for Students, Teachers, and Administrators (Section (B)(3)). The ISTE et al. are internationally-agreed upon common standards that include technology and other

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

21st century skills. (Connecticut has already received written approval from ISTE for using these sets of standards statewide. All model curricula developed through CSDE and the Center for 21st Century Skills will include the integration of the ISTE standards.)

The Whitney Group will cooperate with industry experts, museums, universities and others to increase the availability of applied learning opportunities for students. These could include internships, work-study programs, research assistant positions and other efforts to allow students the chance to develop skills and apply learning to real world, job-embedded situations.

Additionally and as a prototype for other LEAs, the group will develop a new model for funding magnet schools via an initiative with the Danbury public schools (through business and private contributions). This model will be used by the State Board of Education's Ad Hoc Committee to Study Funding for Public School Choice Programs as part of its deliberations on better ways to support the expansion of magnet and schools statewide. Finally, the group will capitalize on the CAEMST extensive network of professional groups, such as the Connecticut Association of Physics Teachers, to assist districts in their efforts to recruit and retain effective teachers in STEM subject areas, particularly middle schools, through Crandall and Olmsted competitive grants (Section (D)(3)).

Preparing for Advanced STEM Study – Concurrent and Dual Course Enrollment

With this application, our expectation is that more of our students will be prepared for success in college-level STEM courses and rewarding STEM careers. The High School, College and Workforce Partnership described in Section (B)(3) will build and/or expand relationships between high schools and two- and four-year colleges that result in concurrent and dual course enrollment programs, particularly focusing on the STEM content areas.

Capturing Next Generation Learners

Clearly, a great STEM education requires great STEM teachers. Significant professional development will be offered to elementary teachers in effective strategies teaching mathematics and science and connecting these content areas to the other subjects they teach. Secondary STEM teachers will learn strategies to better engage and excite their students. As part of the Math-Science

Connecticut Race to the Top Phase 2 Application

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

Instructional Coaching Academy outlined in (D)(5), teacher leaders will be prepared to help their colleagues utilize excellent STEM teaching practices. Through the Teaching and Assessing Next Generation Learners initiative (TANGL), moreover, professional development on integrating technology and other 21st century skills will be available to all teachers, PK-12. This extensive professional development, paired with enhanced CEU requirements, will assure that all teachers who teach STEM subjects are well prepared to do so. (See Section (D)(5))

The CAEMST will also play a key role in capturing next generation learners by implementing CONNverge, a statewide, corporate funded effort aimed at helping students become more interested and engaged in mathematics and science. CONNverge's purpose is to:

1. Establish a culture where all students, especially historically under-achieving populations, understand *why* they must learn mathematics and science and accept learning as a personal responsibility; and
2. Foster stronger family support for children to succeed in challenging mathematics and science courses, and heighten teacher and community expectations that all children can and must learn more STEM to secure their future in the modern world.

Part of increasing student STEM interest is providing more STEM opportunities (Section (B)(3)), including activities in-school, after-school (Section (A)(2)), at-home and in the community. Through RTTT proposed activities, all elementary schools in participating LEAs will be provided with access to online multimedia science resources designed specifically to engage young learners in the content (Section (B)(3)). Teachers will be provided with professional development in effective use of standards-based resources (Section (D)(5)). Additionally, participating LEAs have agreed through their MOU to increase STEM program offerings like the Connecticut Pre-Engineering Program (CPEP), Tech-4-All-CT, the Connecticut Girls Collaborative Project, Project Lead the Way, and regular use of the Connecticut Science Center.

Connecticut STEM Goals

CSDE and the partnerships must be focused on clear goals driven by the overarching purpose of making STEM and innovation essential parts of Connecticut's future and its future workforce. These goals will frame our coordinated, comprehensive efforts over

Connecticut Race to the Top Phase 2 Application

Priority 2: Competitive Preference Priority -- Emphasis on Science, Technology, Engineering, and Mathematics (STEM)

the next four years. We believe these goals, and the integrated activities to achieve them described here and throughout our application will move us toward rigorous and exemplary STEM education – and high student interest and achievement – statewide.

CT STEM Goal 1: Increase student interest, engagement and achievement in STEM disciplines by:

- a) Providing all students with challenging and relevant STEM curriculum, instruction, and assessments;
- b) Improving teachers' abilities to engage students in accessing, synthesizing and evaluating information to collaboratively solve authentic problems;
- c) Providing teachers and administrators with guidance and models for integrating STEM content across subject areas and grade spans;
- d) Providing students in all CT schools with equitable access to STEM resources, learning materials and highly effective teachers; and
- e) Increasing awareness among students, parents, educators and the greater community on the importance of all students having strong skills in STEM subjects.

CT STEM Goal 2: Inspire and prepare more students, especially those who are traditionally underrepresented in STEM fields, for success in college-level STEM courses and rewarding STEM careers by:

- a) Assuring that all students have access to a sustained, coherent and rigorous K-12 STEM education program that nurture curiosity in elementary students, inspire career interests in middle grades and foster in-depth studies in high school and
- b) Increasing access to STEM opportunities, including after school and community programs, internships, apprenticeships, mentors and other authentic experiences that develop workforce competencies.