INTRODUCTION

I. COMMONWEALTH STEM INVENTORY: WHERE WE ARE

Some of this work has already begun. Below, we will take stock of the Commonwealth's existing STEM-oriented programs, both public and private.

A. EDUCATION

i. University Level

a. Public

1. Generally

- John and Abigail Adams Scholarships
    - These scholarships provide tuition waivers for eight semesters of undergraduate education at any Massachusetts state college or university. Graduates of public secondary schools who scored "advanced" or "proficient" on the ELA and Mathematics MCAS tests and had a combined score that places them in the top 25% of their district qualify.[1]
- Secondary Post-Secondary Career/Vocational Technical Education (CVTE) Linkage Consortium
    - The Linkage Consortium program creates partnerships between Massachusetts community colleges and secondary schools with the goal of increasing performance in technological fields. The consortium program was created and is funded under the federal Carl D. Perkins Career and Technical Education Improvement Act of 2006 (20 U.S.C. 2301 et seq.).[2] That law makes grant funds available to the states to support the program, which is administered by the Department of Elementary and Secondary Education.[3]

2. Community Colleges

- Berkshire Community College, Pittsfield
    - Member of the Secondary Post-Secondary CVTE Linkage Consortium
        - Participating with Berkshire Hills Regional School District (RSD), Central Berkshire RSD, Mt. Greylock RSD, North Adams School District (SD), Northern Berkshire Regional Vocational and Technical School District (RVTSD), So. Berkshire RSD, and Pittsfield SD

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[1] See http://www.doe.mass.edu/mcas/adams.html. Students must also maintain a 3.0 cumulative GPA in college to retain their scholarship. Some scholars have criticized the scholarships for failing to close the achievement gap; see http://www.civilrightsproject.ucla.edu/news/pressreleases/merit_policy_brief.pdf.

[2] The law is available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:s250enr.txt.pdf. (It is also known as Perkins IV.) For more information on the Commonwealth's implementation of the law, see http://www.doe.mass.edu/cte/techprep/consortiummanual.pdf.

[3] See http://finance1.doe.mass.edu/Grants/grants09/rfp/468.html for details.

  - Workforce Development Program.
    - Provides technical, occupational training in the sciences for employees of private firms as well as business consulting services. The program was developed through a grant from the National Science Foundation.

- Bristol Community College, Fall River
  - Member of the Secondary Post-Secondary CVTE Linkage Consortium
    - Participating with Attleboro SD, Bristol County Agricultural SD, Bristol-Plymouth RVTSD, Dighton-Rehoboth RSD, Fall River SD, Greater Fall River RVTSD, Greater New Bedford RVTSD, New Bedford SD, Old Colony RVTSD, Somerset SD, Taunton SD
- Bunker Hill Community College, Boston
  - Member of the Secondary Post-Secondary CVTE Linkage Consortium
    - Participating with Boston SD, Brookline SD, Cambridge SD, Medford SD, Somerville SD, Watertown SD
- Cape Cod Community College, West Barnstable
  - Member of the Secondary Post-Secondary CVTE Linkage Consortium
    - Participating with Barnstable SD, Cape Cod RVTSD, Martha's Vineyard RSD, Plymouth SD, Upper Cape Cod RVTSD, Wareham SD
- Greenfield Community College, Greenfield
  - Member of the Secondary Post-Secondary CVTE Linkage Consortium
    - Participating with Franklin County RVTSD, Northampton-Smith SD
- Holyoke Community College, Holyoke
  - Member of the Secondary Post-Secondary CVTE Linkage Consortium
    - Participating with Amherst-Pelham RSD, Chicopee SD, Easthampton SD, Gateway SD, Hampshire RSD, Holyoke SD, Lower Pioneer Valley Career and Technical Education Center (Agawam SD, East Longmeadow SD, Hampden-Wilbraham RSD, Longmeadow SD, Ludlow, SD, Southwick-Tolland SD, West Springfield SD), Pathfinder RVTSD, Quaboag RSD, So. Hadley SD, Springfield SD, Tantasqua RSD, Westfield SD
- Massachusetts Bay Community College, Wellesley Hills
  - Member of the Secondary Post-Secondary CVTE Linkage Consortium
    - Participating with Blackstone Valley RVTSD, Framingham SD, South Middlesex RVTSD, Milford SD, Newton SD, Tri-County RVTSD, Waltham SD
- Massasoit Community College, Brockton/Canton
  - Member of the Secondary Post-Secondary CVTE Linkage Consortium

        - Participating with Blue Hills RVTSD, Brockton SD, Hull SD, Marshfield SD, Norfolk County Agricultural SD, Quincy SD, Silver Lake RSD, Southeastern RVTSD, South Shore RVTSD, Stoughton SD, Weymouth
- Middlesex Community College, Bedford/Lowell
    - Member of the Secondary Post-Secondary CVTE Linkage Consortium
        - Participating with Greater Lowell RVTSD, Lowell SD, Minuteman RVTSD, Nashoba Valley RVTSD
- Mount Wachusett Community College, Gardner
    - Member of the Secondary Post-Secondary CVTE Linkage Consortium
        - Participating with Ashburnham-Westminster RSD, Fitchburg SD, Leominster SD, Lunenburg SD, Montachusett RVTSD, Narragansett RSD, Winchendon SD
- North Shore Community College, Danvers
    - Member of the Secondary Post-Secondary CVTE Linkage Consortium
        - Participating with Beverly SD, Essex Agricultural & Technical SD, Gloucester SD, Lynn SD, Northeast Metro RVTSD, North Shore RVTSD, Peabody SD, Salem SD
- Northern Essex Community College, Haverhill
    - Member of the Secondary Post-Secondary CVTE Linkage Consortium
        - Participating with Greater Lawrence RVTSD, Methuen SD, Shawsheen Valley RVTSD, Whittier RVTSD
- Quinsigamond Community College, Worcester
    - Member of the Secondary Post-Secondary CVTE Linkage Consortium
        - Participating with Assabet Valley RVTSD, So. Worcester County RVTSD, Spencer-East Brookfield RSD, Webster SD, Worcester SD
- Roxbury Community College, Roxbury
- Springfield Technical Community College, Springfield
    - RDE-FRI: Improving Access to STEM for Community College Students with Disabilities in Universally Designed Learning Communities
        - "The primary goal of this project is to create and test the effectiveness of a student learning community model for community college students with disabilities in science, technology, engineering and mathematics (STEM). Building on earlier work funded by NSF (HRD-0004326, DRL-0618182) and the U.S. Education Department (P333A020021) this experienced project team is placing students with disabilities in a universally designed STEM learning community (UDLC) at Springfield Technical Community College, Greenfield Community College and Quinsigamond Community College, in order to study the impact of the UDLC on student academic

performance, retention and confidence to be successful in STEM. The UDLCs include a group of students who are enrolled in a STEM-specific college success course and a STEM academic course. Over the three (3) years of this project there will be approximately 65 students with disabilities and 510 students without disabilities in two control groups, and a comparison will be made between the control group subjects and approximately 50 students with disabilities and 65 students without disabilities who will receive the UDLC intervention as part of their experimental group status. The project addresses one (1) of the FRI track goals: To investigate effective instructional methods and practices for people with disabilities in STEM. The project includes a formative and summative project evaluation process conducted by a team from the University of Massachusetts's Donahue Institute, as well as plans to create and publish the 'Best Practices Electronic STEM Study and Learning Guidebook' and the 'Guide for Developing a UDL STEM College Success Course.' The project team is leveraging resources with other projects, including the NSF-funded National Center for Telecommunications Technologies (DUE-0302548) and the RDE-funded EAST Regional Alliance at the University of Southern Maine (HRD-0333316), to provide web-based resources for applying universal design learning to community college STEM courses so that students with disabilities can fully participate in STEM education."[4]

- This project is funded in part by the NSF, with a grant in the amount of $359,586, Sept. 2007-Aug. 2010.

- Increasing the Participation and Success of Community College Faculty in NSF Grant Programs
  - "This project is delivering a series of professional development workshops designed to assist community college science, technology, engineering, and mathematics (STEM) faculty in preparing successful proposals to the National Science Foundation (NSF) programs. The project represents collaboration between the Council for Resource Development (CRD), an affiliate council of the American Association of Community Colleges (AACC), and the National Center for Telecommunications Technology (NCTT). NCTT brings its expertise in the delivery of online and web-based professional development programs to support expanded faculty outreach via special content webinars.
  - "Intellectual Merit: The activities continue a highly successful model of faculty professional development focusing on NSF grant programs and the production of high quality grant applications by community college faculty. CRD is using its regional structure to leverage the identification of host colleges while ensuring the participation of large numbers of STEM faculty.

[4] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0726473.

- "Broader Impact: The selection of sites and the scheduling of workshops are national in scope. Particular attention is being given to those states whose community colleges are underrepresented among NSF awardees. A key goal is to increase the submission rates of faculty as well as increase the likelihood of success. An evaluation is assessing the longitudinal impact of the project. A research study is designed to assess factors that promote faculty success."[5]
- This program is funded in part by a grant from the NSF in the amount of $36,650, Apr. 2007-July 2009.

3. State Colleges

- Bridgewater State College, Bridgewater
- Fitchburg State College, Fitchburg
- Framingham State College, Framingham
  - The Christa McAuliffe Center
    - This center "supports teachers in their work by offering exciting science and math programs designed for both students and teachers, all closely based on the Massachusetts Science and Technology/Engineering Curriculum Frameworks. Some of these programs are created onsite to fulfill educational needs specific to Massachusetts educators. Others are part of networks that impact hundreds of thousands of students and teachers across the US, Canada, and the UK."[6]
  - Building a Presence for Science
    - "The goal of BaP is to identify science educators across the state of Massachusetts who will become Key Leaders and Points of Contact resources in their school, and to increase teacher awareness of the National Science Education Standards. BaP Key Leaders and Points of Contact work together online with NSTA, the McAuliffe Center, and the BaP State Coordinator to disseminate current science news and information. The McAuliffe Center is the lead partner in Massachusetts for this project. Other partners include Framingham State College, Massachusetts Department of Elementary and Secondary Education, Massachusetts Association of Science Teachers, and the Massachusetts Association of Science Supervisors."[7]
- Massachusetts College of Art and Design, Boston
- Massachusetts College of Liberal Arts, North Adams
- Massachusetts Maritime Academy, Buzzards Bay
- Salem State College, Salem

[5] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0702909.
[6] See http://www.massachusetts.edu/stem/programs.html; see also http://www.christa.org/main_page.htm.
[7] See http://www.massachusetts.edu/stem/programs.html; see also http://bap.nsta.org/.

- Westfield State College, Westfield
- Worcester State College, Worcester

4. University of Massachusetts
   - Generally
     - Donahue Institute Workforce Development
       - "We provide information and services to help employers, job seekers, and organizations achieve their hiring, employment, and economic development goals. We partner with government and community organizations to provide specialized training, educational programs, job-search assistance, and career resources to employers and job seekers. As part of our clients' overall economic development strategy, we create programs to address worker shortages in key industries such as health care. When businesses seek to relocate or hire people with new skills, we help them understand a region's workforce and what it's trained to do. We currently partner with the Brockton Area Workforce Investment Board to run CareerWorks, one of the Commonwealth's thirty-two One-Stop Career Centers."[8]
   - UMassOnline
   - University of Massachusetts System Office
   - University of Massachusetts Amherst
     - Commonwealth Alliance for Information Technology Education (CAITE)
       - "The University of Massachusetts Amherst is leading a Commonwealth Alliance for Information Technology Education (CAITE) to design and carry out comprehensive programs that address under representation in information technology (IT) education and the workforce. CAITE will focus on women and minorities in groups that are underrepresented in the Massachusetts innovation economy; that is, economically, academically, and socially disadvantaged residents."[9]
     - STEMTEC (Science, Technology, Engineering and Mathematics Teacher Education Collaborative)
       - (Unclear whether still active.)[10]
     - STEM Education Institute
       - "Improve K16 education by fostering interactions among school and college faculty interested in outreach, teacher improvement, educational research, and curriculum development. (Broker/facilitator)."[11]
     - CITI (Commonwealth Information Technology Initiative)

[8] See http://www.donahue.umassp.edu/services/workdev/careerworks/index.
[9] http://www.massachusetts.edu/stem/programs.html; http://caite.cs.umass.edu/.
[10] http://www.massachusetts.edu/stem/programs.html; http://k12s.phast.umass.edu/~stemtec/index.html
[11] http://www.massachusetts.edu/stem/programs.html; http://www.umassk12.net/stem/

- This program "is a public/private partnership to increase the number of "information technology-fluent" workers. The initiative brings together industry and public education institutions to improve information technology (IT) education at the K-12 and postsecondary levels."[12]

- Member of Northeast Alliance For Graduate Education and the Professoriate (NEAGEP)[13]
  - "The Northeast Alliance for Graduate Education and the Professoriate (NEAGEP) at UMass Amherst sponsors a number of activities to address the shortage of U.S. students, particularly underrepresented minority students, who receive Ph.D.s in the science, technology, engineering and mathematics (STEM) and become professors. NEAGEP works closely with Partner and other institutions to encourage and prepare students for graduate work. Students accepted into STEM programs at UMass Amherst are offered financial support and supportive mentoring to ensure that their graduate school experiences are rewarding. Students in this program are encouraged to consider entering the professoriate once they have received their Ph.D.
  - "To achieve our goal of increasing diversity in STEM disciplines, NEAGEP at UMass Amherst provides the following resources to students and faculty members:
  - *"Recruiting and Capacity Building*
    - "A fully staffed NEAGEP recruitment and retention unit within the Graduate School
    - "Funds for UMass Amherst faculty and graduate students to recruit at other institutions
    - "Summer Program for Undergraduate Research (SPUR)
    - "Post-baccalaureate one-year NEAGEP Internships
    - "Partner Institution Summer Residencies at UMass Amherst
  - "*Graduate Student Support*
    - "Stipend and fellowship support through the entire graduate career
    - "Monthly formal and informal mentoring activities
    - "Funds for student travel to professional meetings
    - "NEA Science Day, a meeting for minority graduate students and their mentors from all Alliance Institutions
    - "Inter-institutional professional development programs within NEAGEP
  - "*Graduate Program Support*

[12] http://www.massachusetts.edu/stem/programs.html; http://citi.mass.edu/
[13] *See* http://www.neagep.org/details.asp for the text below and more information

        - "Funds to bring in prospective minority students for interviews
        - "Funds to host minority seminar speakers
        - "Support for discipline-specific UMass Amherst Recruiting Weekends
    - *"NEAGEP Internship Program*
        - "NEAGEP Internship Program available now at UMass Amherst.
    - *"NEAGEP Fellowship Program*
        - "NEAGEP Fellowship Program available now at UMass Amherst."
    - NEAGEP also sponsors summer programs with Boston University and the Massachusetts Institute of Technology.[14]
- Integrative Graduate Education and Research Traineeship (IGERT): Interdisciplinary Research Training in Cellular Engineering
    - "This Integrative Graduate Education and Research Traineeship (IGERT) award establishes a novel interdisciplinary training program at the University of Massachusetts-Amherst to address the emerging field of Cellular Engineering. Engineering cellular form and function is the basis for many ventures in the biomedical and biotechnology industries, including design of bioremediation processes, generation of artificial organs/tissues, production of biologics from cell culture, design of new and improved protein-based pharmaceuticals and targeted drug delivery. Students matriculate in one of 12 degree programs with a research focus in one of three interrelated cellular engineering thrust areas: 1) Applied Systems Biology, 2) Cell Delivery and 3) Protein Engineering. Key features include a novel unifying lecture/laboratory course to train both life scientists and engineers/physical scientists in cellular engineering fundamentals, interdisciplinary research involving "supergroup" projects in which students seek out collaboration with a related training laboratory; interactions with industry through the established UMass-Amherst Institute for Cellular Engineering; weekly research seminars with a mentoring component; and formal professional development activities.
    - "This IGERT has all-female leadership and significant numbers of female faculty participants. Underrepresented students are recruited through the NEAGEP, an NSF-funded project co-led by UMass-Amherst and including ten research-extensive and six minority-serving institutions that collaborate to increase the number of underrepresented students who receive doctoral degrees in science, technology, engineering and mathematics disciplines. This IGERT encourages novel research collaborations in cellular engineering among faculty, creating new bridging programs among departments and providing unique learning opportunities for trainees. Purposeful alignment with the Institute for

[14] See http://www.bu.edu/urop/ and http://web.mit.edu/odge/admissions/summer.html for more information.

Cellular Engineering enables substantial interaction with regional cellular engineering companies, significantly broadening student training. IGERT is an NSF-wide program intended to meet the challenges of educating U.S. Ph.D. scientists and engineers with the interdisciplinary background, deep knowledge in a chosen discipline, and the technical, professional, and personal skills needed for the career demands of the future. The program is intended to catalyze a cultural change in graduate education by establishing innovative new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries."[15]

- This program is funded in part by a grant from the NSF in the amount of $1.8 million, Aug. 2007-Jul. 2010

- Summer REU Site on Cellular Engineering
  - "This award for an REU site at the University of Massachusetts Amherst will engage 10 undergraduate students each year for three years in research experiences in the area of Cellular Engineering. The specific objectives of the program are to: 1) encourage and motivate students to pursue graduate studies in cellular engineering; 2) train students to transition from dependent to independent researchers; 3) enable students to communicate effectively across disciplines through active participation in 'supergroup' research projects and meetings involving faculty and students from life sciences and the engineering/physical sciences; and 4) provide students with strategies for professional success, including activities centered on career guidance, ethics, identifying mentors, and honing "soft skills". Understanding cellular function and manipulating cells/tissues to perform in a particular manner is the basis for many ventures in the biomedical, biotechnology and pharmaceutical industries.
  - "Recruitment efforts will be targeted to undergraduate students majoring in chemical engineering, bioengineering, chemistry, biology, and biochemistry, with special emphasis placed on recruitment of students from underrepresented groups. Students will be recruited with the assistance of the Northeast Alliance for Graduate Education and the Professoriate (NEAGEP). NEAGEP includes ten research-extensive and six minority-serving institutions that actively collaborate to increase the number of domestic students who receive doctoral degrees in science, technology, engineering and mathematics (STEM) disciplines. NEAGEP places particular emphasis on recruiting and retaining underrepresented students and encouraging their entrance into the professoriate."[16]
  - This program is funded in part by the NSF in the amount of $319,714, June 2007-May 2010.

- University of Massachusetts Boston

[15] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0654128
[16] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0649041.

- Boston Science Partnership
  - "The Boston Science Partnership (BSP) is an NSF funded program bringing together Northeastern University, University of Massachusetts Boston and Boston Public Schools with the aim of raising student achievement in science, beginning with 6th grade and all the way through the university level."[17]
- COSMIC
  - "The Center of Science and Mathematics in Context (COSMIC) serves as a bridge among the various Colleges of the University of Massachusetts Boston campus. COSMIC sees, as one of its roles, insuring that students receive the best educational experience possible and provides support for science teachers beginning with their teacher training at UMass and continuing with professional development through their teaching career path. For pre-college students, COSMIC develops innovative science curriculum materials and conducts research studies on their effectiveness."[18]

- University of Massachusetts Dartmouth
  - Noyce Scholars Program
    - "The University of Massachusetts Dartmouth recruits high-achieving and motivated undergraduate Science, Technology, Engineering and Mathematics (STEM) majors into the Robert Noyce Teacher Scholarship Program in order to help overcome the chronic shortage of highly qualified math and science teachers and greatly increase the knowledge base and capability of students in these subject areas in high-need urban districts of southeastern Massachusetts. The Noyce Scholars are recruited in their sophomore year and provide math and science tutoring in high needs schools in their junior year. In their senior year, they receive a $10,000 scholarship while gaining teaching experience in high needs schools by interning with middle school and high school math and science teachers. Upon graduation, the Noyce Scholars receive another $10,000 scholarship to complete an accelerated teacher licensure and support program (TEACH!) leading to an MAT. A total of 28 scholars in four cohorts of seven scholars are being supported by Noyce Scholarships. The initial cohort of seven Noyce Scholars receives support for one year of their MAT program and the three additional cohorts of seven scholars (twenty-one additional scholars) will receive support for their senior year and one year of their MAT program. The Noyce Scholars then receive 3 years of mentoring and professional support when they become classroom teachers."[19]

[17] http://www.stem.neu.edu/programs.htm; http://www.bostonscience.org/
[18] http://www.massachusetts.edu/stem/programs.html; http://www.cosmic.umb.edu/
[19] *See* http://nsf.gov/awardsearch/showAward.do?AwardNumber=0833266

        - "A new School of Education, Public Policy, and Civic Engagement at the University of Massachusetts Dartmouth is committed to strengthening the educational and social fabric of southeastern Massachusetts. Within the new school, an interdisciplinary STEM Department comprised of STEM content faculty and STEM education faculty works with K-12 educators to improve teaching practices and student attainment. Arts and Sciences and Education faculty members from this school serve as content coaches for the Noyce Scholars and continue to offer enrichment seminars after the Noyce Scholars begin their STEM teaching careers. As a result, each of the four cohorts of seven Noyce Scholars is a cohort of teachers with an unusual degree of content strength, instructional mentoring, and affiliation with the STEM professional and academic community."
        - This program is partially funded by a grant from the National Science Foundation in the amount of $749,596, Oct. 2008-Sept. 2013.

- University of Massachusetts Lowell
    - Performamatics
        - This program "is a collaboration between the UMass Lowell Computer Science, Art, Music, and English departments in the area of exhibition and performance technologies. The project is funded by the National Science Foundation to revitalize undergraduate computer science education in ways that will both attract and help retain CS majors. The common thread in performamatics projects is that many tasks, performed by multiple people, must come together on a tight schedule by a specific date to achieve a desired result. Performamatics also implies that each team member must "perform" his or her task in a way that can be integrated into a final product, regard-less of whether that team member participates visibly in the culminating event."[20]
    - UMass Lowell Design Camp
        - This program provides "hands-on Science and Engineering workshops for grades 5 - 10."[21]
    - The TEAMS Academy
        - This program "gives regional high school students the opportunity to explore various career fields as they take creative, specially-designed college courses for advanced students."[22]
    - GK-12: Vibes and Waves in Action: A Cross-disciplinary Collaborative Network for GK-12 Education
        - "This project connects researchers from the Colleges of Engineering, Education and Arts & Sciences at the University of Massachusetts Lowell to high-school teachers and students in school districts of Lowell and

[20] http://www.massachusetts.edu/stem/programs.html; http://teaching.cs.uml.edu/Performamatics/
[21] http://www.massachusetts.edu/stem/programs.html; http://designcamp.uml.edu/
[22] http://www.massachusetts.edu/stem/programs.html; http://gse.uml.edu/academy/

Lawrence, MA. The project theme, Vibes and Waves in Action, is focused on the science, technology, engineering and mathematics (STEM) of sound and electromagnetic vibrations and waves and their interaction with the environment. It anchors the research topics of GK-12 fellows and provides a context for relating core high school Physics and Mathematics curriculum to the research. The project goals are to: (i) connect graduate fellows in interdisciplinary research programs through activities that elicit common learning experiences while delivering science education in urban high schools; (ii) provide leadership training that emphasize mentorship, social impacts and diversity education; (iii) engage visionary teachers to help develop synergy between targeted high school curriculum content, Massachusetts state curriculum frameworks, and the fellows' research projects; and (iv) provide high school students experience in use of high technology equipment and cyber enabled platforms. An industry mentor network will be developed as a resource to the graduate fellows and the high school community. Cyber-infrastructure will be utilized to maintain a dynamic online presence, afford virtual collaboration, and to connect University computer servers, databases and lab instruments to high school classrooms for web based experiments. The program activities will be integrated into Creating Waves: a graduate course available for training all graduate students in STEM programs. This project will enhance STEM teaching and learning in school districts with high level of underrepresented students in STEM disciplines and create sustainable programs linking local school districts, colleges and regional industry together to improve the scientific and technical literacy of Massachusetts's workforce."[23]

        - Funded in part by a grant from the National Science Foundation in the amount of $485,166, Apr. 2009.

    - Research Experiences for Teachers (RET)

        - "The Research Experiences for Teachers (RET) program at Northeastern University and University of Massachusetts-Lowell is a six-week summer research experience funded by the National Science Foundation for middle and high school mathematics and science teachers and Community College STEM faculty."[24]

- University of Massachusetts Worcester Medical Center

b. Private

- Franklin W. Olin College of Engineering (Needham, MA)
    - Generally

[23] *See* http://nsf.gov/awardsearch/showAward.do?AwardNumber=0841392
[24] http://www.stem.neu.edu/programs.htm; http://www.ret.neu.edu/

- Founded in 2002, this innovative engineering college emphasizes hands-on, project-based learning. It is funded in part by a commitment from the F.W. Olin Foundation of more than $400 million, "one of the largest grants in the history of American higher education."[25]
- From the College's curriculum site: "Olin's innovative curriculum is the result of broad-based efforts to update engineering education for the 21st Century. Among the reforms urged by groups like the NSF and the leaders of the engineering community were increased emphasis on business, teamwork, interdisciplinary design and communications skills. Olin incorporated these reforms and other creative ideas into a new curriculum created from a clean slate with the help of 30 student 'partners.' The curriculum is based on the 'Olin Triangle,' a combination of rigorous science and engineering fundamentals, entrepreneurship and the liberal arts. There is a deep commitment at all levels to active learning and interdisciplinary courses built around hands-on projects. At Olin, learning and doing go together from the start. This real-world approach culminates in SCOPE (Senior Consulting Program for Engineering), a significant, year-long engineering project for an actual client. At Olin, it's all about providing a context for the technical education necessary to be a good engineer. It's about learning how to design products that really meet customer's needs. It's about nurturing your creativity and inventiveness. It's about knowing how to plan, finance and market products. It's why we support 'Passionate Pursuits' and 'co-curriculars' to help students cultivate their personal interests. The Olin curriculum offers exceptional preparation for an engineering career, as well as for many other professions, including law, medicine and business. Our curriculum will never be a finished product--we'll keep adapting it in pursuit of our vision of continual improvement."[26]

- GSE/RES: Does Project-Based Learning Matter to Undergraduate Women in Engineering? A Study of Performance, Interests, and Participation in Gateway Technical Courses
  - "Project-Based Learning (PjBL), is an increasingly implemented, yet controversial pedagogical technique in undergraduate education. PjBL is broadly promoted in science and engineering training, yet the benefits and drawbacks of learning, motivation, and participation have not been rigorously studied. There are few reliable studies on the impact of PjBL on women, and even fewer studies that describe successful PjBL-related innovations to guide the design and implementation of successful programs at other institutions. This project will help to address these critical gaps in the educational research literature.

    "The study that will identify gendered patterns of performance, interests, and participation in engineering in relation to teaching methods and

[25] See http://www.olin.edu/about_olin/overview.asp
[26] See http://www.olin.edu/academics/curriculum.asp

curricula undergraduates receive in their "gateway" or introductory technical courses. Specifically, the PIs will examine how engineering-related (i.e., physics, mathematics, and engineering) classrooms that emphasize PjBL compare with classrooms that emphasize other innovative or traditional methods, in terms of their effects on women. Over three years, the PIs will conduct an in-depth, qualitative and quantitative study on the experiences of 600 female and male students in twelve classrooms across four high-caliber engineering schools with high percentages of women (32% to 43%, compared to the national average of 22%): California Institute of Technology, The Cooper Union, Franklin W. Olin College of Engineering, and Harvey Mudd College.

"Intellectual Merit: The study may advance knowledge about the effectiveness of PjBL relative to traditional and other methods in terms of student performance, interests, and participation as well as provide advanced knowledge of how curricular and pedagogical structures influence academic and social experiences of undergraduates. This project will generate and advance the knowledge about issues related to the participation of undergraduate women in science and engineering and will bring immediate and long-term contributions to theory development.

"Broader Impacts: This study may contribute knowledge about ways of creating more equitable and welcoming environments to encourage more women to participate in engineering. Results and analyses will be shared with institutional partners through workshops. Findings will also be disseminated through national conferences, journal publications, and other national outlets."[27]

- This research project is funded in part by a grant from the NSF in the amount of $354,287, Sept. 2006-Aug. 2009.

- Harvard
  - Project Success: Opening the Door to Biomedical Careers
    - "This is a program for students to participate in paid, mentored, summer research internships at Harvard Medical School and its affiliated institutions. It is augmented by seminars and workshops given by faculty and administrators, site visits, and career counseling."[28]
  - Opening the Pipeline for Native High Schools
    - "The Program's major goals are to improve the opportunity for, (1) Native American high school students to engage in science education and pursue careers in the biomedical sciences at leading institutions and, (2) to provide training to their teachers in the content and pedagogical methods

[27] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0624738.
[28] See http://www.massachusetts.edu/stem/programs.html; see also http://www.communityservice.harvard.edu/programs/project-success-opening-door-biomedical-careers.

of biomedical sciences. The students and teachers will be housed in Cambridge and attend classes at HMS. The program, building upon earlier smaller programs, will consist of two three-week sessions, each accommodating 20 students and 4 teachers."[29]

- Education with New Technologies (ENT)
  - This program is "is a networked community designed to help educators develop powerful learning experiences for students through the effective integration of new technologies."[30]
- Wide World: Inspiring Great Teaching through Online and On-site Learning (Graduate School of Education)
  - "Our goal is to transform school systems by developing professional communities of teachers and school leaders with interactive online courses and on-site support programs that enable schools to cultivate the critical learning students need for the 21st century world."[31]

- MIT
  - The MIT Women's Technology Program (WTP)
    - "The MIT Women's Technology Program (WTP) is a four-week summer academic and residential experience where female high school students explore engineering through hands-on classes, labs, and team-based projects in the summer after 11th grade . Students attend WTP in either Electrical Engineering and Computer Science (EECS) or Mechanical Engineering (ME). 60 students (40 EECS, 20 ME) are admitted each year from a nationwide pool."[32]
  - InvenTeams - Lemelson – MIT
    - "$10,000 grant to foster inventiveness in high school students in-class or extracurricular."[33]
  - The Saturday Engineering Enrichment and Discovery (SEED) Academy
    - This program "is an academic enrichment and career exploration program for public high school students from Boston and Cambridge, Massachusetts. SEED Academy's primary mission is to motivate promising local youth to pursue technical careers by equipping them with foundational mathematics, science and communication skills."[34]
  - STEM Program at MIT

[29] http://www.massachusetts.edu/stem/programs.html; see also http://www.ncrrsepa.org/projects/Grant.asp?GrantID=R25RR020406. Funded in part by the National Institutes of Health.
[30] http://www.massachusetts.edu/stem/programs.html; http://learnweb.harvard.edu/ent/home/index.cfm.
[31] See http://learnweb.harvard.edu/wide/en/prog/index.html.
[32] http://www.massachusetts.edu/stem/programs.html; http://wtp.mit.edu/.
[33] http://www.massachusetts.edu/stem/programs.html; http://web.mit.edu/inventeams/.
[34] http://www.massachusetts.edu/stem/programs.html; http://web.mit.edu/seed/.

- "The Office of Engineering Special Programs in the MIT School of Engineering, in partnership with the Center for the Advancement of Hispanics in Science and Engineering Education (CAHSEE)**,** has launched the STEM Program at MIT for local middle school students. The program is composed of three elements: 1) a five-week summer academic program; 2) an academic-year mentoring component that pairs STEM Program participants with MIT undergraduates; and 3) parent workshops designed to inform and empower parents in their efforts to support their children's academic success."[35]

- Northeastern University
  - Center for STEM Education at Northeastern
    - "This newly-established Center aspires to serve as the connecting link between all the University STEM Departments and the School of Education. Our main goal is to play a key role in shaping the GK-20 STEM Education vision at Northeastern and put the University on the national map in this field. This will be accomplished in part by consolidating and coordinating existing outreach programs and by creating new ones that will have a significant impact on the STEM pipeline, on STEM teaching and learning in GK-20, on GK-12 STEM outreach, and on STEM Education Research."[36]
  - Greater North Shore Science Partnership
    - "A program which provides intensive professional development (PD) and support activities to middle school (MS) and high school science teachers with the goal of improving student outcomes in science. The PD courses lead to a Master's Degree (MEd in MS Science) at NU. Core Partners: Northeastern University, Lynn & Malden Public Schools. Supporting Partners: UMass Boston and the Educational Development Center."[37]
  - Boston Science Partnership
    - "The Boston Science Partnership (BSP) is an NSF funded program bringing together Northeastern University, University of Massachusetts Boston and Boston Public Schools with the aim of raising student achievement in science, beginning with 6th grade and all the way through the university level."[38]
  - Boston Summer Advanced Math/Bridge to Calculus
    - "Boston Summer Advanced Math prepares underserved urban high school students for their calculus course in their senior year in high school. The program also links rising seniors with one-on-one counseling to prepare for college. Reform precalculus prepares students for calculus in their high

[35] http://www.massachusetts.edu/stem/programs.html; http://web.mit.edu/stem/
[36] http://www.massachusetts.edu/stem/programs.html; http://www.stem.neu.edu/programs.htm
[37] http://www.stem.neu.edu/programs.htm; http://www.stem.neu.edu/gnssp.htm
[38] http://www.stem.neu.edu/programs.htm; http://www.bostonscience.org/

schools, and for college. Counseling from Bottom Line prepares for college."[39]

- ExxonMobil Bernard Harris Summer Science Camp (BHSSC)
  - "The Bernard Harris Summer Science Camp (BHSSC) is a program of The Harris Foundation, and is currently funded by Exxon Mobil. The foundation takes an active role in shaping education in students in middle and high school through college. The mission of this program is to enable youth, entering grades 6th, 7th, and 8th, to develop and achieve their full potential through support of social, recreational and STEM-based educational programs."[40]
- GK-12 Plus
  - "This program supports fellowships and associated training that enable graduate students in NSF-supported science, technology, engineering, and mathematics (STEM) disciplines to acquire additional skills that will broadly prepare them for professional and scientific careers in the 21st century. Through interactions with teachers in K-12 schools, graduate students can improve communication and teaching skills while enriching STEM instruction in K-12 schools."[41]
- North Shore Science Partnership (NSSP)
  - "The North Shore Science Partnership (NSSP), a collaboration between the Revere, Somerville, and Saugus Public Schools, and Northeastern University, is a new program funded by the Massachusetts Department of Education offering middle and high school science and math teachers an intensive course of study leading to the completion of 8 out of 10 of the courses required in Northeastern University's Masters of Education in Middle School Science program. Teachers have the option of taking individual courses as needed."[42]
- Science, Technology, Engineering and Mathematics Talent Expansion Program - University Partnership (NU STEP-UP)
  - This program "is a partnership between Northeastern University, two NSF-supported research centers and three Boston-area community colleges (Massachusetts Bay Community College, Middlesex Community College, and Northern Essex Community College) to increase the number of students receiving degrees in STEM disciplines. NU STEP-UP is focused on developing a sustainable STEM model that provides a seamless transition between two- and four-year institutions. Using research as the catalyst for engagement, NU STEP-UP is: (1) creating a sustainable STEM partnership between the university's STEM departments and local community colleges, (2) creating a Partner Faculty

[39] http://www.stem.neu.edu/programs.htm
[40] http://www.stem.neu.edu/programs.htm; http://www.stem.neu.edu/bhssc.htm
[41] http://www.stem.neu.edu/programs.htm; http://www.gk12.neu.edu/
[42] http://www.stem.neu.edu/programs.htm; http://www.northshore.neu.edu/

Network, with representatives from all stakeholders, (3) providing community college faculty the opportunity to immerse themselves in a research environment, (4) providing community college students access to extensive research experiences, (5) developing a transfer bridge program for community college students transitioning to Northeastern University; and (6) providing academic mentoring and research activities for all STEM students throughout the partnership. Participants in the Partner Faculty Network are involved in working seminars helping them implement the latest pedagogical approaches in their own classrooms. They are sharing innovative STEM instructional models and practice and collaborating to bring STEM courses at community colleges in alignment with comparable courses at four-year institutions. A multi-faceted approach to program evaluation aims to assess progress toward achieving established benchmarks, as well as to understand the contribution of various program elements. The evaluation plan includes: (1) tracking student transfer rates, retention rates and student performance, (2) surveys of stakeholders, including students, faculty and alumni, (3) focus groups with transfer students and with faculty, and (4) cohort analysis of transfer students. Results and outcomes are being disseminated through publications, a project web site, and presentations at regional and national conferences."[43]

- This program is funded in part by a grant from the NSF in the amount of $1,594,425, July 2007-June 2011.

- Research Experiences for Teachers (RET)
  - "The Research Experiences for Teachers (RET) program at Northeastern University and University of Massachusetts-Lowell is a six-week summer research experience funded by the National Science Foundation for middle and high school mathematics and science teachers and Community College STEM faculty."[44]
- STEP-UP
  - "This initiative aims to assist with the design and delivery of STEM professional development and student support for 10 partner schools as identified by the City of Boston and the coordination of programs and services across five university partners--Boston College, Boston University, Harvard University, Northeastern University and Tufts University."[45]
- Young Scholars Program (YSP)

[43] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0653090; http://www.stem.neu.edu/nsfstepup.htm
[44] http://www.stem.neu.edu/programs.htm; http://www.ret.neu.edu/
[45] http://www.stem.neu.edu/programs.htm; Lauren Marshall, "City of Boston, Harvard and Area Universities 'Step UP,'" *Harvard Gazette*, Sept. 29, 2006. Available at http://www.news.harvard.edu/gazette/2006/10.05/99-publicschool.html.

        - "The Young Scholars Program offers future scientists and engineers a unique opportunity for hands-on experience while still in high school. The program is open to Boston area applicants who have completed either their sophomore or junior year in high school."[46]
    - Math*POWER*
        - "Math*POWER* at Northeastern University is a non-profit organization dedicated to the improvement of math education for urban students. There is a growing need for advanced mathematical literacy, yet many students in Boston are currently struggling to achieve the state's "proficiency" standards. Math*POWER* aims to prepare students to not only reach a level of proficiency, but also to achieve competency in advanced mathematics through a variety of programs and services. *Taken from MathPOWER's website 9/2007."*[47]
    - Robotics: Fundamentals of Information Tehcnology and Engineering
        - "TechBoston and Northeastern University are working collaboratively in this comprehensive project to integrate an innovative robotics curriculum into science, technology, engineering and mathematics (STEM) courses in the Boston Public Schools and in other racially diverse and economically disadvantaged Massachusetts school districts. *Taken from ITEST website 9/2007."*[48]
    - Connections
        - Connections "strengthens the pathway for girls and women to pursue college majors and careers in engineering and science."[49]
        - A partnership between Northeastern University and Patriots' Trail Girl Scout Council.
- Worcester Polytechnic Institute
    - K-12 Outreach Program
        - This program "provides learning opportunities and resources for teachers and students in kindergarten through high school."[50]
    - Project Lead the Way at WPI
        - "Fully developed pre-engineering curriculum for high schools and middle schools. Summer training institutes are hosted at WPI."[51]
        - Project Lead the Way Summer Training Institute

[46] http://www.stem.neu.edu/programs.htm; http://www.youngscholars.neu.edu/
[47] http://www.stem.neu.edu/programs.htm; http://www.mathpower.neu.edu/
[48] http://www.stem.neu.edu/programs.htm; http://itestlrc.edc.org/
[49] http://www.massachusetts.edu/stem/programs.html; http://www.coe.neu.edu/connections/
[50] http://www.massachusetts.edu/stem/programs.html; http://www.wpi.edu/Admin/K12/
[51] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Admin/K12/PLTW/.

- "As the Massachusetts Affiliate for Project Lead the Way, we will be hosting the 2009 Summer Training Institute from Sunday, July 19, 2009 through Friday, July 31, 2009. We will be offering the following courses: Aerospace Engineering, Engineering Design & Development, Introduction to Engineering Design, Principals of Engineering and Digital Electronics Update."[52]

- On-Site Professional Development in K-5 Engineering Curriculum
  - "During the 2008-2009 academic year, the Office of K-12 Outreach at WPI will offer six teacher workshops on the Engineering is Elementary (EiE) curriculum sets. Each workshop will be held on-site in the district of the applicant school and occur during planned professional development time."[53]
- Building a Better Background
  - "Physics and Engineering Courses for grade 5-9 teachers to provide theory, hands-on projects, and discussions around implementation."[54]
- Camp Reach
  - "Three middle school teachers in Worcester County work with WPI's Camp Reach 2-week summer program for 7th grade girls."[55]
- Counselor Outreach to Underrepresented students in eNgineering and Technology (COUNT)
  - "Various activities are offered to help high school guidance counselors reach out to young women and students of color and encourage them in STEM areas."[56]
- Engineering is Elementary (EiE)
  - "This curricular resource supplements the K-4 science curriculum to supply engineering education material. WPI offers 1-day workshops focused on the EiE curriculum."[57]
- Focus on Math
  - "Offers educators professional development to implement more rigorous lessons in their mathematics curriculum."[58]
- Mathematics in Industry Institute

[52] http://www.wpi.edu/Admin/K12/; http://www.wpi.edu/Admin/K12/PLTW/sti-2009.html
[53] http://www.wpi.edu/Admin/K12/; http://www.wpi.edu/Images/CMS/K12/EiEWorkshopPacket.pdf
[54] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Admin/K12/Educators/buildi331.html
[55] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Admin/Women/Girls/Reach/people.html
[56] http://www.wpi.edu/Admin/K12/Educators/index.html
[57] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.mos.org/eie/
[58] http://www.wpi.edu/Admin/K12/Educators/index.html

- "The goal of this program is to prepare middle and high school teachers to motivate women and underrepresented minorities to take advanced mathematics courses and to pursue STEM careers."[59]

- NSF Research Experiences for Teachers
  - "Teachers will work alongside faculty and graduate students, participating in high-level research projects in fields such as tissue engineering, regenerative medicine, and infection control on biomaterials."[60]
- Partnerships Implementing Engineering Education (PIEE)
  - "Focuses on development of human resources to support K-6 math, science, and technology/engineering education. Curricular materials developed are available."[61]
  - Partnered with Worcester Public Schools
- Pre-College Engineering for Teachers (PCET)
  - "Supports K-12 educators implementing engineering design in the classroom. Summer content workshops offered."[62]
  - Partnership between the Museum of Science (Boston), and UMass Lowell, Tufts, and WPI
- Propose a WPI Student Team Project
  - "Work with a WPI undergraduate team on a year-long project at your school."[63]
- Reading and Math Stars
  - "RMS is a K-4 Supplement for Math & Literacy instruction, based on a set of 8 biographical characters."[64]
- TeachEngineering
  - "Online web-resource for math, science, and technology/engineering. All activities are mapped to MA Frameworks and developed/tested by teachers."[65]
- TeachScheme! Projects/Workshops

[59] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Academics/Depts/Math/CIMS/Teachers/
[60] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Academics/Depts/BME/RET/index.html
[61] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Academics/PIEE/
[62] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.mos.org/eie/pcet.php
[63] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Admin/K12/Educators/project.html
[64] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.wpi.edu/Admin/K12/Educators/rmstars.html
[65] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.teachengineering.org/

- "A curriculum for introductory computing that provides a design-oriented focus has been designed through a multi-university effort."[66]

- Savage Soccer (First Robotics)
  - "Savage Soccer began in 1995 and has continued since as an annual event hosted at WPI. Initially created as part of a university project (IQP), it is now coordinated each year by WPI students in their free time. Savage Soccer is designed to help students learn about basic robotics principles and teamwork. The original focus was a way to get students 'psyched up' for the *FIRST* Robotics Competition. From its inception through the 2001 game, it challenged students to modify a radio controlled car with authorized parts that could best perform certain tasks like moving ping pong balls into goals while avoiding obstacles and other hazards. In 2002, the kits became more advanced as we started using the Robovation/Vex kits to make for a better competition and a more realistic version of *FIRST*. Each year the game is modified to present new goals and challenges for teams to test their creative abilities. One of the missions of Savage Soccer is to give high school students a learning environment different from the typical classroom where they can learn to work as a team through all aspects of the robot design and construction process. It takes the model of the *FIRST* Robotics Competition program where the students work with engineers to brain storm, design, and assemble a full sized robot in a very short and intense six week period, and modifies it to work on a smaller scale. Students work with college mentors or school teachers and have about 4 weeks to make their creations. Starting in 2002, the Savage Soccer staff began encouraging other *FIRST* teams with kits to participate in our event along with the Mass Academy teams. During the first offering, only one team (FRC88) joined the fun. Over the next few years, the event would grow tremendously to include a number of *FIRST* teams. In 2005, another university IQP brought the event to local schools who were not involved in *FIRST*. It was not long before we were getting a large number of registrations from schools just interested in having a robotics program that could easily be done in house. As this popularity continued to grow, so did requests from groups outside New England as to how they could bring any event like Savage Soccer to their area. Since then, WPI has been making all the rules and field drawings available to groups as well as webcasting and recording the kickoff for all events."[67]
  - NB: Program run by WPI for high school students.
- Frontiers
  - "Frontiers is a summer residential program for soon-to-be [high school] juniors and seniors interested in science, mathematics, engineering, and robotics."[68]

[66] http://www.wpi.edu/Admin/K12/Educators/index.html; http://www.teach-scheme.org/
[67] http://users.wpi.edu/~savage/About/.
[68] http://admissions.wpi.edu/Frontiers/index.html.

- Worcester Regional Science and Engineering Fair
  - "On March 12, 2010 the 55th annual Worcester Regional Science and Engineering Fair will be held at Worcester Polytechnic Institute. High schools (public, private, and parochial) from the central Massachusetts region are invited to send students with their research projects to compete. Judges are invited from universities, corporations, hospitals, and community organizations. Approximately 150 projects are entered annually, and about 120 professionals participate as judges. Monetary awards are presented to the top 40 projects and the donors are recognized when the award is presented and in the program booklet. The Worcester Regional Science and Engineering Fair (WRSEF) is a registered nonprofit orgainization and is run by a Board of Directors. There is no paid staff. Each Board members performs the community a service by donating their time and efforts on behalf of the orgainization. The Board raises funds by soliciting donations from corporations and community organizations. The WRSEF is now one of six regional fairs held throughout Massachusetts that culminate in an annual State Fair held at Massachusetts Institute of Technology in May. The purpose of our organization is to support and encourage the process of research and experimentation among young people. The Fair provides an arena where students proudly display the fruits of their labor and interact with the professional scientists and engineers who interview and evaluate each project. Through fairs such as this students gain the confidence to pursue careers in the sciences and become productive members of society."[69]
- Beswick Dinner with Entrepreneurs Series
  - A dinner series held by the university that brings together local technology entrepreneurs and university and high school students for networking and interaction with professional scientists, engineers, and entrepreneurs.[70]
- WPI Collaborative for Entrepreneurship & Innovation
  - "The Collaborative for Entrepreneurship & Innovation (CEI) is Worcester Polytechnic Institute's (WPI) university-wide entrepreneurship program. McRae C. Banks, Ph.D. founded the program in 1999 with a mission to inspire and nurture people to discover, create, and commercialize new technological products and services, and to create new organizations based on those products and services, thereby advancing economic development and improving society. Programs, education, and services of the CEI are available to the WPI community and alumni(ae), with some programs designed as well for High School students and the wider business community. Our network includes technology entrepreneurs, investors, service providers, incubators, small business organizations and agencies, private foundations, and government organizations. The CEI supports technology entrepreneurship in the classroom, in business, and

[69] http://wrsef.org/index.php?option=com_content&task=view&id=19&Itemid=45.
[70] See http://www.wpi.edu/Academics/Depts/MGT/CEI/Programs/dinner.html.

among the general public by providing model programs, publications, resources, membership organizations, lecture and workshop series, networking events, competitions, and individual and team mentoring. The Department of Management offers undergraduate and graduate courses in entrepreneurship and innovation and an Entrepreneurship Minor for WPI students that are not business majors."[71]

- WPI Invitational Mathematics Meet
  - "We invite your school to send to the meet a team of four students, accompanied by a faculty advisor. The members of your team may be chosen from any grade level in your school. The contest will consist of two rounds of competition. The first round will be individual competition and the second round will be a team effort. Both rounds will consist of interesting and challenging questions based on the secondary mathematics curriculum up to, but not including, calculus. We are also planning a short program to introduce the students to WPI, as well as a talk about pursuing degrees and careers in the mathematical sciences. In addition, WPI will provide lunch and free WPI Mathematics Meet T-shirts to all the participants and their advisors."[72]
  - The highest scorers in the meet are awarded scholarships to WPI.
- WUNDERS (Women, Understanding New Dimensions in Engineering Related Sciences)
  - "WUNDERS is a hands-on exploration of engineering, math and science for young women. You will be able to learn more about potential careers in these areas by engaging in labs facilitated by a dedicated team of WPI faculty and students. Although labs change every year to accommodate repeat participants, in the past they have included comparing the quality of water from various sources and testing different techniques for making it potable, building a robot that responds to sound, and learning about the process of making artificial skin. In addition to labs, participants work in teams on a week-long engineering design project. Last year the project involved using a wheelchair to determine what tasks are difficult for a disabled person to accomplish. The teams then each redesigned their chair and presented the results, using CAD drawings, to an audience of their peers. This year's project will focus on a different aspect of how engineering helps people. WUNDERS isn't all work! The evenings are filled with opportunities for you to have fun with your fellow participants, who come from all over the country. Bowling, an art party, a chance to drive a Segway™, and karaoke were highlights of last year's evening activities. A schedule of activities will be provided to successful applicants. We think you'll find the WUNDERS program to be a once-in-a-lifetime learning experience!"[73]

[71] http://www.wpi.edu/Academics/Depts/MGT/CEI/About/index.html.
[72] http://www.wpi.edu/News/Events/MathMeet/advisor.html.
[73] http://www.wpi.edu/Admin/Women/Girls/WUNDERS/index.html.

- Introduce a Girl to Engineering Day
  - "A fun introduction to engineering and related fields. A chance to participate in engineering design activities, tour various labs on campus, ask engineering students what it's like to study engineering. An opportunity for parents/guardians to hear about the college admissions process."[74]
  - Open to female high school students for a $25 fee.
- Understanding Engineering Roadshows
  - "WPI offers a two-hour introduction to engineering workshop to groups of young women and/or underrepresented minorities within a two-hour radius of campus. These high school 'road shows' include hands-on projects, an overview of engineering, and interaction with WPI students."[75]
- Strive
  - "Simply put, engineering is solving problems using math and science. Engineers make artificial organs and limbs; create robots to carry out tasks too dangerous for humans; devise ways to treat waste to keep it from polluting the environment; produce materials that are flame resistant; and improve the design of tools and toys we use every day. It's impossible to go through a single day without using something an engineer has helped to create. Strive is a hands-on exploration of engineering, math and science for African American, Latino and American Indian high school students. You will be able to learn more about potential careers in these areas by engaging in labs facilitated by a dedicated team of WPI faculty and students. Strive isn't all work! The evenings are filled with opportunities for you to have fun with your fellow participants, who come from all over the country. We think you'll find the Strive program to be a once-in-a-lifetime learning experience!"[76]
- Math and Science Technology Education Resource (MASTER)
  - "The high tech world is low on diversity, and leaders in industry, government and academia are looking at our ever-changing global outlook to place minority youth in line for science and technology jobs. The Math And Science Technology Education Resource (M.A.S.T.E.R.) program is a collaboration between Worcester Polytechnic Institute (WPI) and the Worcester Higher Education Resource Center. The program's goal is to strengthen minority high school students' skills and abilities in the fields of math and science. The program will help African American, Latino, and American Indian urban high school students explore the engineering, math

[74] http://www.wpi.edu/Admin/Women/ignite.html.
[75] http://www.wpi.edu/Admin/K12/Students/roadshows.html.
[76] http://www.wpi.edu/Admin/Diversity/K12/Strive/.

and science fields of study to increase their likelihood of pursuing further education in these areas after high school graduation."[77]

- National Engineers Week: GADGET (Google a Deeper Grasp of Engineering and Technology)
  - "GADGET (Google a Deeper Grasp of Engineering and Technology) is a fun introduction into science and engineering fields. The program will meet once a week during February for a month-long celebration of National Engineers Week. You'll be exposed to many different science and engineering careers to learn more about what they involve and you'll have a chance to meet with some current underrepresented WPI students. You'll participate in various fun hands-on activities to explore several different types of science and engineering. …Underrepresented students who are in grades 6,7, or 8 and their parents/guardians/teachers who are interested in finding out more about engineering and related fields."[78]
- FIRST LEGO League Competition: RoboNautica
  - "The Massachusetts *FIRST* LEGO® League Alliance exists to encourage and enable students aged 9 to 14 and their mentors to participate in the *FIRST* LEGO® League (FLL) and official events, and potentially qualify for the World Festival held annually. Coordinated by western Massachusetts FLL partner, Worcester Polytechnic Institute, the alliance organizes MA FLL events, manages registration, does outreach to bring in new teams and build program awareness, and provides resources for existing teams to improve upon their successes."[79]
  - RoboNautica is the annual FLLA competition held at WPI; it is co-sponsored by Raytheon.[80]
- Intellect Quest
  - "Intellect rich and fun activities based on the best of the Academy's highly acclaimed SPLISH Day. Lots of science, math, robotics, and art."[81]
  - For fifth- through eighth-graders.
- Junior Achievement Groundhog Job Shadow Day
  - "This nationwide program operated by Junior Achievement takes students into the workplace to learn about careers. The Groundhog Job Shadow Day is a one-day, on-site orientation program that show students how education and training relate to success on the job, and stresses the understanding that a good education is key to getting a job. At WPI, the program includes a FIRST robot demonstration."[82]

[77] http://www.wpi.edu/Admin/Diversity/K12/Master/.
[78] http://www.wpi.edu/Admin/Diversity/K12/new.html.
[79] http://mafll.wpi.edu/;
[80] http://www.wpi.edu/News/Events/Robonautica/index.html.
[81] http://www.massacademy.org/Camps/intellectquest.html.
[82] http://www.wpi.edu/Admin/K12/Students/groundhog.html.

- SPLISH
  - "SPLISH! is an adventure for 6th, 7th, 8th and 9th grade students who enjoy hands-on, minds-on learning in an alternative setting. Each of the workshops offered will be presented by a pair of Academy students under the guidance of the faculty at the Academy. The day begins at 7:50 a.m. with a short introduction and then moves on to the workshops - each an hour long adventure in active learning. Starting at 8:00 A.M., each attendee will take part in four sessions of his/her choice. The day will end at 12 noon. Transportation is not included, so each attendee will need to plan his/her own means of transport. Lunch is not included."[83]
- Camp Reach
  - "Engineering and technology are being used to find solutions to the world's big problems. At Camp Reach, girls who are interested in learning more about careers in engineering and technology will explore some of today's most pressing issues. Camp Reach is a summer residential program for girls in Massachusetts and Providence RI county, who are entering 7th grade and who are interested in learning more about careers in engineering and technology. The 2009 program will be held July 19 to July 31. Campers are expected to participate for the entire program."[84]
- Exploradreams
  - "Exploradreams program provides Friendly House youth from 8 to 13 years old with help in homework, tutoring, mentoring and exposure to college life. WPI students have the opportunity to share their exceptional math and science skills with a child, as well as bond through fun recreational activities. Currently the program aims to offer youth with opportunities to exert their energy through physical activities for half of the time that they are here at WPI. The remaining time is spent focusing on homework or craft activities. In addition, mentors are encouraged to utilize their strengths to help with planning program ideas for upcoming terms for the calendar of activities. From this program you are sure to gain valuable skills through your outreach and have the unique opportunity to make a difference in a child's life as a mentor!"[85]
- Kids to College Program
  - "Kids to College is an early awareness for college planning program for 6th graders. K2C contains many of the elements which have shown to build a foundation and instill a "can-do" attitude in children and their families. The program includes many hands on activities involved around preparing academically as well as financially for college; a visit to a college campus; interactions with college students; faculty; and administrators. The WPI and Harlow Street Elementary School K2C

[83] http://www.massacademy.org/Camps/splish.html.
[84] http://www.wpi.edu/Admin/Women/Girls/Reach/program.html.
[85] http://www.wpi.edu/Admin/SAO/Service/exploradreams.html.

program is a collaborative effort of: The Association of Independent Colleges and Universities in Massachusetts; The Higher Education Information enter; Massachusetts Board of Higher Education; Massachusetts Board of Education; Sallie Mae; WPI, and Harlow Street Elementary School."[86]

- ALANA Student Support Network
  - "The ALANA (African-American, Latino/Hispanic, Asian, and Native-American) Student Support Network is a group of administrators from several colleges and universities within the Worcester consortium. While we come from different areas of college administration, central to our work is a concerted effort to support the recruitment and retention of ALANA students. The network has proven to be an excellent means for its members to support each other's work through the sharing of information and resources. One of the goals of the network is to develop a stronger connection between all the ALANA students in the Worcester Consortium of Colleges and Universities. Our hope is to expand support and resources for our ALANA students, provide opportunities for them to meet and dialogue, and then for them to develop genuine supportive relationships with each other."[87]
- Louis Stokes Alliance for Minority Participation
  - "The overall missions of the Louis Stokes Alliance for Minority Participation (LSAMP) is to contribute to the national agenda by increasing the number of underrepresented minorities receiving baccalaureate degrees in science, mathematics, engineering and technology (SMET) disciplines. The alliance is comprised of the University of Massachusetts Amherst, Northeastern University, The University of Rhode Island, and Worcester Polytechnic Institute (WPI)."[88]
- ASSISTment System and Partnership Implementing Mathematics and Science Education (PIMSE)
  - "The goal of the Partnership Implementing Mathematics & Science Education (PIMSE) project is to promote the development of graduate students into Science, Technology, Engineering, and Mathematics (STEM) professionals whose knowledge and skills will support them in their professional and scientific careers. This project provides computer science graduate students -- GK-12 Fellows -- with teaching experience in science or math by being involved in developing and testing the ASSISTment System -- a web-based intelligent tutoring system (http://www.assistment.org/). As part of their Fellowship, GK-12 Fellows are paired with participating GK12 teachers the Worcester Public Schools (WPS) to develop new content for the ASSISTment System. This System

[86] http://www.wpi.edu/Admin/Diversity/commnetwork.html.
[87] http://www.wpi.edu/Admin/Diversity/commnetwork.html.
[88] http://www.wpi.edu/Admin/Diversity/commnetwork.html. See http://www.nelsamp.neu.edu/ for more.

innovatively uses the amount of tutoring a student needs to answer questions as an assessment of their understanding of mathematics and science. The students working with the Fellows will learn about implementing technology and how to conduct Learning Sciences experiments in classrooms. The cooperating teachers will increase their content knowledge, and this will contribute to their professional growth. Society will gain by having more scientists and academicians who have a deep understanding of the challenges and needs of public schools. Finally, the inquiry tutoring that the Fellows develop will be available to all middle schools students via the ASSISTment web-site. Special web-site based tools will be available for teachers on the best ways to use the data derived from the ASSISTment System and how to use it to improve their teaching."[89]

- NSF Noyce Scholarship Program at WPI with Worcester Public Schools
  - "This phase 1 project is increasing the supply of high-quality STEM teachers at the middle and high school level for inner-city districts. With five new Noyce undergraduate scholarships per year (each scholarship to support students during both the junior and senior years) and a total of 10 Noyce Scholarships during any one year this project will produce a total of 25 new middle or high school teachers.

    Intellectual merit: This project builds on a strong academic program in science, technology, engineering and mathematics coupled with an interesting newly emerging state accredited program in teacher education. It is being advised by a committee that includes a number of key administrators from both the university and the school district involved and one faculty member each from the biology, mathematics, chemistry and physics departments. Formative and summative assessments by the Donahue Institute of the University of Massachusetts are guiding the development of the program and providing knowledge about effective means of developing STEM teachers for inner city middle and high schools. The induction program for new teachers is supported by the Worcester School District through its comprehensive Mentor/Induction Program. This program provides 1) an in-depth orientation, 2) a trained mentor, and 3) a 16 week, 40 hour beginning teacher institute for both years one and two.

    "In addition to the knowledge to be gained concerning effective ways of preparing science and mathematics teachers for inner city schools, the broad impacts resulting from this project include the classroom experiences of the many high school and middle school students who will be taught by the 25 teachers graduating from the 'NSF Noyce Scholarship Program at WPI with Worcester Public Schools.'"[90]

[89] *See* http://nsf.gov/awardsearch/showAward.do?AwardNumber=0742503
[90] *See* http://nsf.gov/awardsearch/showAward.do?AwardNumber=0733809

        - Funded in part via a grant from the National Science Foundation in the amount of $694,289, Jan.2008-Dec. 2011.

- Lesley College
    - Science in Education On-Line Master's Degree program for K-8 educators
        - "TERC, in partnership with Lesley University, has developed an innovative degree program for K-8 educators that is: focused on inquiry, aligned with national science standards, and fully accredited. Each course is team taught by a scientist and an educator. Program participants take all courses online, but much of their learning takes place away from the computer. Science learning happens through hands-on investigations -- engaging participants in firsthand scientific inquiry. In the context of online study groups, participants report investigation findings, analyze, debate, and deepen science content understanding. Our program provides a supportive space to rethink ideas about teaching. During each module participants examine case studies of inquiry in action, then try out new strategies in their own classrooms."[91]
- Colleges of the Fenway (Simmons, Wheelock, Wentworth, Emmanuel, Massachusetts College of Art and Design, Massachusetts College of Pharmacy and Health Sciences)
    - COF STEM Scholars
        - Provides four-year scholarships to twenty incoming freshmen annually who have committed to majoring in STEM fields.
        - The program also includes "research and internship opportunities, career planning assistance, mentoring and peer support. Students conduct summer research or participate in internships at universities or companies in the area and meet regularly to share insights."[92]
        - "Students qualifying for scholarships meet the following requirements: financial need, strong academic record, and a commitment to pursue a STEM major."[93]
        - Program is funded in part by a grant from the National Science Foundation ($586,262) in June 2009.
- Boston University
    - Research Experience for Undergraduates Site: Expanding Minority Research Opportunities in Cross-disciplinary Biology
        - "This Boston University REU Site will provide research internships to undergraduate students during the summers of 2009-2012. This REU Site is supported by the NSF REU Program and by the Department of Defense through the Awards to Stimulate and Support Undergraduate Research

[91] http://www.massachusetts.edu/stem/programs.html; http://scienceonline.terc.edu/
[92] *See* http://nsf.gov/awardsearch/showAward.do?AwardNumber=0850160
[93] Ibid.

Experiences (ASSURE) program. The program, coordinated by the Undergraduate Research Opportunity Program (UROP) will award Summer Undergraduate Research Fellowships (SURF) to ten students, especially those from underrepresented minority groups, who will be provided support for a 10-week research experience each summer. Applications from well-qualified students within all STEM disciplines (Science, Technology, Engineering and Mathematics) are welcome. Research projects available to students use cross-disciplinary approaches to biological problems, primarily as they relate to effects of environmental cues on organismal or cellular responses. Molecular, cellular, behavioral, ecological, chemical, computational, and engineering methods are used to address biological problems. Students will acquire in-depth knowledge of a number of related areas and learn skills required to integrate information from several disciplines. Students will be matched to research teams consisting of a faculty and graduate student mentor within a given research lab. Students will attend weekly summer workshops on scientific publication, graduate school admissions, and scientific ethics. Students will also give several oral presentations during the summer and will return to Boston University in the fall semester to present at the Annual Undergraduate Research Symposium. Social events designed to integrate students into the research environment are included. Research stipends, housing and travel are provided. More information is available from Professor Tom Gilmore, Director (Tel 607-353-5444, gilmore@bu.edu) or Kate Sutlive, Program Manager (Tel 617-353-2020, urop@bu.edu), or by visiting http://www.bu.edu/surf."[94]

- Funded in part by a grant from the National Science Foundation in the amount of $90,430, March 2009.

- Research Experience in Science and Engineering

  - This program "is a six week high school honors program held during the summer. The program offers internships in a research settings to thirty highly talented students who are entering their senior year. These students join active research groups in physics, engineering, astronomy, chemistry, and biology. Faculty members and their research staff serve as mentors to the interns, providing the guidance and background needed for them to become active members of a research team."[95]

- LERNet

  - This program "provides educational and enrichment activities for middle-school and high-school students. The purpose of these activities, which range from language competitions to science days, are to share the university's resources with pre-college students and stimulate their interest in various academic disciplines. They also bring qualified pre-college

[94] *See* http://nsf.gov/awardsearch/showAward.do?AwardNumber=0851711
[95] See http://www.massachusetts.edu/stem/programs.html; see also http://www.bu.edu/summer/high-school-programs/research-internship/index.shtml.

students to the campus. This affords the university an opportunity to favorably impress these students with our resources and faculty."[96]

- Improving the Teaching of Physics (ITOP)
  - This program "merges physics content with readings from the history of physics, the philosophy of science and the education research literature. The courses are offered at Boston University at the graduate level through the College of Arts and Science. Project ITOP receives funding from the Massachusetts Board of Higher Education and the Improving Teacher Quality State Program."[97]
- Project STAMP and Boston Urban Fellows
  - "National Science Foundation (NSF) GK12 - Project STAMP and Boston Urban Fellows are NSF-funded programs that partners graduate and undergraduate fellows in biology, chemistry, engineering, mathematics and physics with teachers in K-12 classrooms in Boston, Quincy, Chelsea, and Newton. The fellows collaborate with their partner teachers on ways to enhance the content of the curriculum by developing new modules, designing new activities, providing demos, assisting with labs and helping students with science fair projects."[98]
- City Lab
  - This program offers "teacher workshops and student hands-on activities."[99]
  - There are also City Lab satellites at Bridgewater State College.

- Tufts
  - Tufts University School of Engineering Center for Engineering Educational Outreach
    - "Tufts University School of Engineering Center for Engineering Educational Outreach has multiple Programs including: LEGO Summer Program; Robotics and Art; Coed Robotics; LEGO Summer Program for Early Elementary Students."[100]
  - Fulcrum Institute for Education in Science
    - "Fulcrum Institute for Education in Science aims to prepare a group of Educators in Science who will implement and lead research-centered science learning and teaching in their schools and districts."[101]
  - Women in Engineering: Science, Engineering and Technology

[96] See http://www.massachusetts.edu/stem/programs.html; see also http://www.bu.edu/lernet/programs/.
[97] See http://www.massachusetts.edu/stem/programs.html; see also http://physics.bu.edu/teachers/.
[98] http://www.massachusetts.edu/stem/programs.html; see also http://www.bu.edu/gk12/.
[99] http://www.massachusetts.edu/stem/programs.html; see also http://www.bumc.bu.edu/citylab/.
[100] http://www.massachusetts.edu/stem/programs.html; http://www.ceeo.tufts.edu/; http://www.legoengineering.com/
[101] http://www.massachusetts.edu/stem/programs.html; http://fulcrum.tufts.edu/.

- "Women in Engineering: Science, Engineering and Technology for middle school girls to promote interest and aptitude in science, engineering and technology."[102]

- Computer Science, Engineering and Mathematics Scholars (CSEMS)

  - "The goal of the CSEMS program at Tufts is to encourage the students to become members of the high technology workforce following completion of a baccalaureate degree in *computer science*, *engineering*, *or mathematics* at Tufts University, thus meeting the anticipated workforce needs in these areas and reducing the dependence on foreign nationals to fill open positions. CSEMS at Tufts promotes the academic advancement and degree achievement of talented undergraduate students from potentially low income backgrounds, with a particular emphasis on minority and female students and/or first-generation college-goers."[103]

  - "The program provides students with scholarships that replace the need to seek remunerative work during the academic year. The project involves the Departments of Electrical and Computer Engineering, Computer Science, Mechanical Engineering, Civil and Environmental Engineering, Chemical and Biological Engineering, and Mathematics. Together, they offer seven accredited professional bachelor's degrees, and a variety of combined-degree programs. One other degree, the Bachelor of Computer Science, offered jointly by the College of Arts and Sciences, and the School of Engineering is also included."[104]

ii. K-12 Level

- Generally

  - Summer Professional Development Institutes

    - The summer institutes provide free training to Massachusetts public educators—particularly those in "high need" districts—in the fields that they teach, including STEM fields.[105] Professional development credit and even graduate school credit are awarded for completed participation. The program is run by the Department of Elementary and Secondary Education.

    - The programming for summer 2009 includes 11 programs in mathematics and six programs in science, technology and engineering.[106]

  - Massachusetts Curriculum Frameworks

[102] http://www.massachusetts.edu/stem/programs.html; http://www.engineering.tufts.edu/wieo/index.html.
[103] *See* http://www.cs.tufts.edu/research/csems/
[104] Ibid.
[105] See http://www.doe.mass.edu/frameworks/cinstitute/09/info.html.
[106] See http://www.doe.mass.edu/frameworks/cinstitute/09/.

- The Curriculum Frameworks "articulate statewide guidelines for learning, teaching, and assessment" in the core academic subjects, including mathematics and science and technology/engineering.[107]
- The Frameworks were created and are continually revised by a public-private partnership between educators, universities, museum staff, business leaders, and government officials, led by the Department of Elementary and Secondary Education.[108]

o Secondary Post-Secondary CVTE Linkage Consortium

- *See* description above, under the *Public Universities* heading.

o High Schools That Work

- "High Schools That Work (HSTW), an initiative of the Southern Regional Education Board, is the nation's first large scale effort to combine challenging academic courses and modern vocational technical studies to raise the achievement of high school students. It began in 1987 with 28 sites in 13 states. There are now more than 1100 sites in 32 states."[109]
- Participating schools in the Commonwealth:[110]
  - Blackstone Valley Regional Vocational Technical School (Upton)
  - Chicopee Comprehensive High School
  - Chicopee High School
  - Keefe Technical High School (Framingham)
  - McCann Technical High School (No. Adams)
  - Montachusett Regional Vocational Technical School (Fitchburg)
  - Nashoba Valley Regional Vocational Technical School (Westford)
  - Northeast Metropolitan Regional Vocational Technical School (Wakefield)
  - Pathfinder Regional Vocational Technical School (Palmer)
  - Tri-County Regional Vocational Technical School (Franklin)

o Boston Science Partnership (Boston Public Schools)

- "The Boston Science Partnership (BSP) is an NSF funded program bringing together Northeastern University, University of Massachusetts Boston and Boston Public Schools with the aim of raising student

[107] David Driscoll, "Commissioner's Foreword," *Massachusetts Science and Technology/Engineering Curriculum Framework*, Massachusetts Department of Education (Malden: 2006) iii. Available at http://www.doe.mass.edu/frameworks/scitech/1006.pdf. Copies of current versions of the frameworks are available at http://www.doe.mass.edu/frameworks/current.html.
[108] See http://www.doe.mass.edu/frameworks/
[109] http://www.doe.mass.edu/cte/resources/hstw/about.html
[110] Ibid.

achievement in science, beginning with 6th grade and all the way through the university level."[111]

- STEM High Schools[112]
  - Boston Public Schools
    - The Engineering School (Hyde Park Education Complex)[113]
    - John D. O'Bryant School of Mathematics and Science[114]
    - Community Academy of Science and Health (Hyde Park Education Complex)[115]
    - Odyssey High School (South Boston Education Complex)[116]
    - Parkway Academy of Technology and Health (West Roxbury Education Complex)[117]
    - Urban Science Academy (West Roxbury Education Complex)[118]
    - TechBoston Academy (Dorchester Education Complex)[119]
    - Madison Park High School Nursing and Medical Assistant Programs[120]
    - Health Careers Academy[121]
    - Media Communications Technology High School (West Roxbury High School)[122]
  - Lawrence Public Schools
    - Lawrence High School for Math, Science, and Technology (Lawrence)[123]
    - Lawrence High School for Health and Human Services (Lawrence)[124]
  - Springfield Public Schools
    - Science and Technology High School (Springfield)[125]
  - Worcester Public Schools

[111] http://www.stem.neu.edu/programs.htm; http://www.bostonscience.org/
[112] List adapted from http://media.umassp.edu/massedu/stem/STEMSchools&Academies%2007-08.pdf
[113] For more information, see http://www.bostonpublicschools.org/files/reportcards/SCH1102.pdf
[114] See http://www.bostonpublicschools.org/files/reportcards/SCH1030.pdf
[115] See http://www.bostonpublicschools.org/files/reportcards/SCH1103.pdf
[116] See http://www.bostonpublicschools.org/files/reportcards/SCH1163.pdf
[117] See http://www.bostonpublicschools.org/files/reportcards/SCH1251.pdf
[118] See http://www.bostonpublicschools.org/files/reportcards/SCH1253.pdf
[119] See http://www.bostonpublicschools.org/files/reportcards/SCH1460.pdf and http://techbostonacademy.org/
[120] See http://www.boston.k12.ma.us/Madisonpk/technical-programs/health-academy/index-health.html
[121] See http://www.bostonpublicschools.org/files/reportcards/SCH1440.pdf and http://healthcareersacademy.org/HCA/HOME.html
[122] See http://www.bostonpublicschools.org/files/reportcards/SCH1252.pdf
[123] See http://www.lawrence.k12.ma.us/pdfs/MSTASR.pdf
[124] See http://www.lawrence.k12.ma.us/pdfs/HHSASR.pdf and http://www.lawrence.k12.ma.us/index.html
[125] See http://sps.springfield.ma.us/schoolsites/scitech/index.html

- Engineering Technology Academy (Worcester, Doherty High School)[126]
- Patriot Academy of Math and Science (Worcester, Burncoat High School)
- Worcester Technical High School (Worcester)[127]
- Massachusetts Academy of Math and Science (at Worcester Polytechnic Institute)[128]

- STEM Charter Schools[129]
  - Berkshire Arts and Technology Charter School (Adams)[130]
  - Advanced Math and Science Academy Charter School (Marlborough)[131]
  - Hampden Charter School of Science (W. Springfield)[132]
- STEM Middle and Elementary Schools
  - Young Achievers Science and Mathematics Pilot K-8 School (Jamaica Plain)[133]
  - Pioneer Charter School of Science (Revere)[134]
  - Goddard School of Science and Technology (Worcester)[135]

iii. Museums/Education NFPs

- Museum of Science (Boston)
  - Engineering is Elementary
    - "The *Engineering is Elementary* (EiE) project aims to foster engineering and technological literacy among children. EiE is creating a research-based, standards-driven, and classroom-tested curriculum that integrates engineering and technology concepts and skills with elementary science topics. EiE lessons not only promote K-12 science, technology, engineering, and mathematics (STEM) learning, but also connect with literacy and social studies."[136]

B. GOVERNMENT

[126] See Danielle Williamson, "Hands-on at Doherty," *Worcester Telegram and Gazette*, Jun. 8, 2009.
[127] See http://portal.techhigh.us/Pages/default.aspx (highly recommended)
[128] See http://www.massacademy.org/
[129] For more information regarding the charter process in Massachusetts, see http://www.doe.mass.edu/charter/. For a study regarding the Horace Mann charter option, see http://www.renniecenter.org/research_docs/0604_RoadNotTaken.html
[130] See http://www.bartcharter.org/
[131] See http://www.amsacs.org/
[132] See http://www.hcsscience.org/AboutHCSS/index.html
[133] See http://www.bostonpublicschools.org/files/reportcards/SCH4600.pdf and http://www.youngachieversschool.org/
[134] See http://www.pioneercss.org/
[135] See http://www.wpsweb.com/goddard/
[136] http://www.mos.org/eie/index.php

- The Commonwealth
  - STEM Pipeline Fund
    - "Since 2003, the Department of Higher Education has administered the STEM Pipeline Fund, established in Economic Stimulus Trust Fund legislation. The STEM Pipeline Fund was established in Economic Stimulus legislation for the following purposes: to increase the number of Massachusetts students who participate in programs that support careers in fields related to science, technology, engineering and mathematics (STEM); to increase the number of qualified STEM teachers; and to improve the STEM educational offerings available in public and private schools."[137]
  - Regional PreK-16 Networks
    - "The Regional PreK-16 Networks bring together K-12, public and independent higher education, businesses, and regional and community organizations around science, technology, engineering and mathematics (STEM) education to address the need for systemic change. In addition to administering regional projects, the Networks regularly communicate information about funding opportunities, events, announcements, and training sessions."[138]
  - Robert H. Goddard Council
    - "Established in the 2006 Economic Stimulus legislation, the Robert H. Goddard Council is comprised of 27 high-level representatives from business and industry, state government, and K-12 and higher education in the Commonwealth. The Council was created to advise the Board of Higher Education and the legislature on STEM workforce development programs and policy. The Council is named for Robert H. Goddard, who is credited with being the first to construct and successfully launch a liquid-propelled rocket in Auburn, Massachusetts, in 1926."[139]
    - The Council was established by Part I, Title II, Chapter 15A Section 4A of the Massachusetts General Laws.[140]
  - Massachusetts Life Sciences Center/Massachusetts Life Sciences Initiative
    - "The Massachusetts Life Sciences Center (MLSC) is a quasi-public agency of the Commonwealth of Massachusetts, created by the Massachusetts legislature in June 2006. The MLSC is closely affiliated with the Executive Office of Housing and Economic Development but is not subject to its direct supervision or control. The MLSC was established to promote the life sciences within the Commonwealth of Massachusetts.

[137] http://www.mass.edu/forinstitutions/prek16/pipeline.asp.
[138] http://www.mass.edu/forinstitutions/prek16/pipelinenetworks.asp. See this site for the websites for the individual regional networks. Some have a more well-developed web presence than others.
[139] http://www.mass.edu/forinstitutions/prek16/goddardcouncil.asp.
[140] See http://www.mass.gov/legis/laws/mgl/15a/15a-4a.htm.

It is tasked with investing in life sciences research and economic development. This work includes making financial investments in public and private institutions growing life sciences research, development and commercialization as well as building ties between sectors of the Massachusetts life sciences community. On May 8, 2007, during a speech at the BIO 2007 conference, Governor Deval Patrick announced a new Massachusetts Life Sciences Initiative. The Initiative includes a $1 billion investment package (over ten years) to enhance and strengthen the state's internationally recognized leadership in the life sciences. The Patrick Administration's strategy brings together industry, academic research hospitals and public and private colleges and universities to coordinate this effort, spur new research, strengthen investments, create new jobs and produce new therapies for a better quality of life. The Governor's initiative is focused on five points of the development cycle to ensure a comprehensive statewide strategy: funding, planning, research, development and commercialization. The MLSC is a key component and the primary agency tasked with realizing the vision of Governor Patrick's Life Sciences Initiative, intended to focus on scientific and economic development, strategic investments at critical stages of the development cycle and collaboration with the private sector to create innovation infrastructure critical to both researchers and companies. This initiative is intended to strengthen Massachusetts as a global leader in life sciences research, innovation and employment."[141]

- Commonwealth Covenant Fund
  - "The Commonwealth Covenant Fund is an innovative program that provides accessible tuition loan repayments to undergraduate students who attend public universities or colleges in Massachusetts and stay to pursue careers in the STEM (Science, Technology, Engineering and Math) fields."[142]
- Commonwealth Information Technology Initiative (CITI) (Higher Education)
  - "The Commonwealth Information Technology Initiative (CITI) is a statewide public/private partnership that invests strategically in higher education to prepare IT-fluent graduates to participate, lead and innovate in the knowledge-based economy of Massachusetts. CITI addresses information technology (IT) taken broadly to include software, hardware, communications, and applications across all industry sectors. CITI, since its founding in 2000, has provided state leadership and leverage funds for strategic investment in the following activities: Curriculum Development, Professional Development, Information Technology Across the

[141] http://www.masslifesciences.com/mission.html. See Massachusetts General Laws Chapter 231; Chapter 130 of the Acts of 2008.

[142] http://www.mass.gov/?pageID=treagencylanding&L=4&L0=Home&L1=Affiliated+Programs&L2=Commonwealth+Covenant+Fund+(CCF)&L3=Commonwealth+Covenant+Fund&sid=Ctre. Based out of Treasurer's office.

Curriculum (ITAC) and Regional Collaborations. The Higher Education grant program is administered by UMass, Amherst."[143]

- Commonwealth Information Technology Initiative (CITI) (K-12)
  - "The Commonwealth Information Technology Initiative (CITI) is a statewide public/private partnership that invests strategically in K-12 to prepare IT-fluent graduates to participate, lead and innovate in the knowledge-based economy of Massachusetts. CITI addresses information technology (IT) taken broadly to include software, hardware, communications, and applications across all industry sectors. CITI, since its founding in 2000, has provided state leadership and leverage funds for strategic investment in the following activities: Curriculum Development, Professional Development, Information Technology Across the Curriculum (ITAC) and Regional Collaborations. The K-12 grant program is administered by the UMass Donahue Institute."[144]
- Commonwealth Alliance For Information Technology Education (CAITE)
  - "The University of Massachusetts Amherst is leading a Commonwealth Alliance for Information Technology Education (CAITE) to design and carry out comprehensive programs that address under representation in information technology (IT) education and the workforce. CAITE will focus on women and minorities in groups that are underrepresented in the Massachusetts innovation economy; that is, economically, academically, and socially disadvantaged residents."[145]
  - "The project is piloting a series of outreach programs supported by educational pathways in four regions aiding students from rural, suburban, and urban areas. The project includes work with high school teachers, staff, and counselors. CAITE will identify best practices and disseminate, deploy, extend and institutionalize these best practices statewide and nationally. Community colleges are the centerpiece of CAITE because of the central role they play in reaching out to underserved populations and in serving as a gateway to careers and further higher education. This project will build a broad alliance based on its leadership in and partnership with the Commonwealth Information Technology Initiative (CITI), the Boston Area Advanced Technological Education Center (BATEC), regional Louis Stokes Alliances and NSF EGEP programs, and other partnerships and initiatives focused on information technology education and STEM pipeline issues."[146]
- Office for Mathematics, Science and Technology Engineering (OMSTE)

[143] http://www.massachusetts.edu/stem/programs.html; see http://www.citi.mass.edu/.
[144] http://www.massachusetts.edu/stem/programs.html; see http://www.citi.mass.edu/k-12/overview.html.
[145] http://www.massachusetts.edu/stem/programs.html; http://caite.cs.umass.edu/.
[146] http://caite.cs.umass.edu/about/index.html.

- "Office for Mathematics, Science and Technology Engineering (OMSTE) handles information about professional development, curriculum and assessment partnerships, resources, research and evaluation."[147]
- Part of the Massachusetts Department of Elementary and Secondary Education.

- Massachusetts Technology Collaborative
  - "The Massachusetts Technology Collaborative is the state's development agency for renewable energy and the innovation economy, which is responsible for one-quarter of all jobs in the state. MTC administers the John Adams Innovation Institute and the Renewable Energy Trust. We work to stimulate economic activity in communities throughout the Commonwealth."[148]
  - The John Adams Innovation Institute
    - "At MTC's John Adams Innovation Institute, our goal is to enhance innovation as an integral process of the Massachusetts economy. We want to strengthen and grow institutions and industries that comprise the Commonwealth's knowledge economy. We recognize that innovation is a forward-looking process, not a product. As an agent of the Commonwealth, the Innovation Institute serves as a broker, a convener and a catalyst."[149]
    - "The Innovation Institute seeks to improve our understanding of changing technological, institutional and market conditions that affect innovation in Massachusetts. On our own and through our partners, we pursue targeted research and analysis efforts that generate qualitative, validated insights and quantitative information about the performance of the Massachusetts Innovation Economy and its industries. Insights and information generated through these efforts inform our work and that of our partners in industry, academia, government, and civil society throughout the state."[150]
    - Innovation Initiatives
      - The institute attempts to bring "strategic initiatives with statewide impact to a level of maturity which allowed them to become independent, legitimized, and self-sustaining entities with a clear mission of enhancing innovation in Massachusetts."[151] These include the founding of the Life

[147] http://www.massachusetts.edu/stem/programs.html; see http://www.doe.mass.edu/omste/.
[148] http://www.massachusetts.edu/stem/programs.html; see http://www.masstech.org/index.asp.
[149] http://www.masstech.org/institute2009/index.html.
[150] http://www.masstech.org/institute2009/understand.html.
[151] http://www.masstech.org/institute2009/support.html.

Sciences Collaborative, which is now independent, as well as the Massachusetts Broadband Institute.

- "The Innovation Institute's research and analysis achievements are most noted in the ***Index of the Massachusetts Innovation Economy*** and the R&D Scorecard: Federal Investments and the Massachusetts Innovation Economy. To complement the state-wide, quantitative Index perspective, we partner with other to conduct field-based industry- and context-specific research and analysis efforts. Our goal is to better understand established or emerging technology and industry sectors in Massachusetts. Invariably, we pursue our industry-specific interests through partnerships with researchers that add to our capacity and bring the best expertise to inform our work and that of our stakeholders."[152]

- Massachusetts Broadband Institute
  - "The mission of the Massachusetts Broadband Institute (MBI) is to extend affordable high-speed Internet access to all homes, businesses, schools, libraries, medical facilities, government offices and other public places across our state. Governor Deval Patrick created the Massachusetts Broadband Institute when he signed the Broadband Act into law in August 2008. The Act gives the MBI the authority to invest up to $40 million of state bond funds in necessary and long-lived infrastructure assets—such as conduits, fiber-optic cable and wireless towers—according to a comprehensive broadband plan that the MBI is designing and will execute."[153]

- Renewable Energy Trust
  - "The Renewable Energy Trust seeks to maximize environmental and economic benefits for the Commonwealth's citizens by pioneering and promoting clean energy technologies and fostering the emergence of sustainable markets for electricity generated from renewable sources. The Trust provides financial assistance to individuals and businesses for solar panels and wind turbines at their homes and facilities, works with communities to incorporate green design into schools, helps emerging clean energy businesses flourish in the Commonwealth, and much more."[154]

- eHealth
  - FAST Initiative
    - "NEHI, MTC, and HTC have jointly established the *FAST* Initiative as a way to promote the adoption of promising,

[152] http://www.masstech.org/institute2009/analysis.html.
[153] http://www.massbroadband.org/about/about.html.
[154] http://www.masstech.org/renewableenergy/index.html.

innovative technologies. Our goal is to create and test methods by which payers and providers can actively speed the uptake of selected innovations that are valuable to patients. The *FAST* Initiative will provide a vehicle for payers and providers to: select from emerging technologies those with potential for improved patient outcomes and cost savings; identify each selected technology's highest value applications (by patient groups, treatment settings, or appropriate organizational preparation and support); define the barriers to adoption of the innovation in large populations; and accelerate the pace of dissemination with those applications. The *FAST* Initiative builds upon the technology forecasts and value analyses conducted by both NEHI and HTC. *FAST* will draw upon the expertise and extensive collections of technology reviews of both NEHI and HTC to select the most promising innovations to be considered."[155]

- Generally (From Massachusetts Biotechnology Council)
  - "Massachusetts receives vast amounts of federal grants that advance the biotechnology industry. The Commonwealth has received 10% or more of annual NIH funds since 2005 and consistently ranks #1 in NIH funding per capita. Massachusetts has also received over 13% of national SBIR funding since 2003, and ranked #1 in SBIR funding per worker in 2006."[156]
  - "Massachusetts is a hub for biotechnology investment. In 2006, Massachusetts venture capitalists invested almost $760 million *(PwC MoneyTree Report, 2006)* in biotechnology companies, comprising 18% of biotechnology venture capital investment in the United States."[157]
  - "For every biopharmaceutical manufacturing job created, five additional supporting jobs are created in other industries *(Northeastern University Labor Market Study, 2007)* There are 42,917 biotechnology employees in Massachusetts. They earn an average salary of more than $100,000 and are responsible for over $5 billion of in-state payroll *(US Census Bureau, 2005)*."[158]
  - In 2005, Massachusetts' 122 colleges & universities awarded over 4,500 degrees/certificates in biotechnology related fields of study. Massachusetts ranks #2 in post-secondary education degrees per capita of the 50 states *(National Center for Education Statistics, 2006).*[159]
- Job Creation Incentive Payment

[155] http://www.masstech.org/ehealth/fast.html.
[156] http://www.massbio.org/economic_development/massachusetts_by_the_numbers.
[157] http://www.massbio.org/economic_development/massachusetts_by_the_numbers.
[158] http://www.massbio.org/economic_development/massachusetts_by_the_numbers.
[159] http://www.massbio.org/economic_development/massachusetts_by_the_numbers.

        - "For life science manufacturers, Massachusetts offers a rebate of 50% of the payroll withholding taxes paid by the new employees to the state. These rebates are available to companies hiring 10 or more new workers in a calendar year."[160]

- Emerging Technology Fund (ETF)
    - "MassDevelopment, the state's development and finance authority, offers the ETF, which supports innovation and growth in Massachusetts by providing loans and guarantees for technology-based manufacturing facilities and equipment at low-cost rates."[161]
- Massachusetts Life Science Fund
    - "This new $1 billion program will provide a variety of financial incentives to life science companies that are adding jobs in Massachusetts. The funds can be used to support a number of different growth activities, from equipment purchases to research activities to relocation costs. The initial Matching Grant program consists of three solicitations:
        - "The Cooperative Research Solicitation
            - "The Cooperative Research Solicitation seeks to increase industry-sponsored research at universities and colleges in Massachusetts in order to facilitate scientific discoveries and inventions that lead to beneficial medical applications. A successful applicant will receive a grant of $250,000 per year for up to three years, in a 1:1 match with its industry partner.
        - "The New Faculty Startup Solicitation
            - "The New Faculty Startup Solicitation targets investments to attract and retain nationally prominent faculty at Massachusetts' colleges and universities. A successful applicant will receive a grant of $250,000 per year for up to three years, in a 1:1 match with the academic institution.
        - "The New Investigator Solicitation
            - "The New Investigator Solicitation seeks to spur innovative new research and advance the careers of new investigators who are working on cutting-edge life sciences research at Massachusetts academic research centers and institutions. A successful applicant will receive a grant of $100,000 per year for up to three years."[162]
- Workforce Support

[160] http://www.massbio.org/economic_development/massachusetts_incentives.
[161] Ibid. (Mass incentives)
[162] Ibid. (Mass incentives)

- "Massachusetts has an exceptional workforce assistance system that assists businesses seeking to recruit the best employees to meet workforce needs. Many of our regional career centers have received national awards for performance. These free services are an added benefit for doing business in Massachusetts:
  - "Workforce Training Fund (WTF)
    - "The WTF provides grants up to $250,000 to upgrade skills of new or incumbent workers. For exceptional opportunities, participating businesses can receive up to $1,000,000. These funds can be used to provide multiple training needs from manufacturing processes to sales force to management. The WTF has two components, the Express Program and the larger General Fund.
  - "Hiring Incentive Training Grant
    - "Employers can receive up to $2,000 in training funds for hiring eligible unemployed workers."[163]

- "Research and Development Tax Credit
  - "Massachusetts has a favorable R&D tax incentive. Costs that qualify for the Federal R&D tax credit are eligible for a 10% Massachusetts R&D Tax Credit. In addition, a 15% R&D Tax Credit is available for costs related to donations and contributions made to research organizations such as hospitals and universities."[164]
- Sales & Use Tax Exemption
  - "The Sales & Use Tax Exemption is for manufacturers and companies engaged in R&D."[165]
- Investment Tax Credit (ITC)
  - "Massachusetts offers a 3% ITC for investments in tangible depreciable assets to all state manufacturers."[166]
- Single Sales Tax Treatment
  - "A significant cost advantage to Massachusetts manufacturers is the Single Sales Factor Tax Apportionment, which provides a relative advantage to Massachusetts companies with significant out-of-state sales. It apportions corporate income based solely on the ratio of in-state sales to total sales. Other states often use three factors in apportionment and double or triple weight in-state sales."[167]

[163] Ibid. (Mass incentives)
[164] Ibid. (Mass incentives)
[165] Ibid. (Mass incentives)
[166] Ibid. (Mass incentives)
[167] Ibid. (Mass incentives)

- Economic Development Incentive Program
  - "Many communities in Massachusetts are Economic Target Areas (ETAs). Job creation projects within ETAs are potentially eligible to receive several types of tax benefits through the EDIP such as:
    - "The TIF
      - "An ETA community may offer a Tax Increment Finance (TIF) agreement to a job-creating business. A TIF provides an exemption on property taxes on the additional value added to the property by the participating company. The exemptions can be from 1 to 100% of the added value of the property for a period of 5 to 20 years. In addition, under a TIF agreement an exemption of 100% of the value of any personal property is provided to the business. Benefits of the TIF and EDIP program can also be achieved in circumstances in which businesses lease facilities.
    - "The EOA-ITC
      - "Once a TIF is negotiated, the Commonwealth can extend an EOA Investment Tax Credit of 5%. Investments in depreciable facilities or equipment are eligible in the calculation of the investment tax credit. This credit can be applied directly against any Massachusetts tax obligation.
    - "Abandoned Building Renovation Deduction
      - Businesses can deduct up to 10% of the costs incurred in renovating buildings that have been 75% vacant for two or more years in ETA communities."[168]

- Federal Government
  - American Recovery and Reinvestment Act
    - "Educational Technology Grants: Massachusetts will receive an additional $10,576,105 to support state, district, and school technology investments in K-12 schools to supplement the amount that the state currently receives annually ($4,250,448 in 2008). Funding for the integration of technology into curricula will be used for technology hardware, software applications, professional development, and related instructional technology staff and services. *Funding will be available beginning in fall 2009, and will be conditional upon receipt of further information that will be outlined in future guidance."*[169]

[168] http://www.massbio.org/economic_development/massachusetts_incentives.
[169] http://www.mass.gov/?pageID=eoeterminal&L=4&L0=Home&L1=Federal+Stimulus+Funds&L2=Recovery+and+Reinvestment+-+Education&L3=ARRA+Education+Overview&sid=Eeoe&b=terminalcontent&f=arrafactsheet052109&csid=Eeoe. See http://www.mass.gov/?pageID=stimhomepage&L=1&L0=Home&sid=Fstim for updates.

- WGBH
  - Teachers' Domain: Pathways II
    - "The WGBH Educational Foundation is expanding the reach, impact, and stability of the Teachers' Domain Pathway to the NSDL, through an integrated set of research, development, and dissemination activities. This project is extending the stewardship of rich-media materials customized for K-12 STEM educators (and post-secondary audiences as well), a service successfully initiated through a NSDL Pathways award in 2004 and supplemented by recent additional support from NSF and other funding agencies."[170]
  - NOVA scienceNOW
    - "WGBH Educational Foundation is requesting funds to produce the third and fourth seasons of "NOVA scienceNOW," a multimedia project addressing a wide array of science, technology, engineering and mathematics subjects via multiple platforms including national PBS broadcast, the PBS Web site and innovative outreach initiatives. Project goals are to help the general public understand the value and importance of scientific ressearch and to encourage an interest in STEM careers among younger viewers.
    - "INNOVATION/STRAGEGIC IMPACT: The series provides a significant opportunity to develop a new format for science journalism building on brand recognition but potentially reaching a broader and more diverse national audience. The new host will be Dr. Neil deCgrasse Tyson, an accomplished astrophysicist and charismatic science communicator whose partipation will help the series reach out to a broader demographic. NOVA is planning a new scheduling configuration for these future seasons to maximize audience for the six new programs per year, i.e. the programs iwll run consecutively in the NOVA slot during June and July.
    - "COLLABORATION: NOVA has developed a new consortium of PBS stations to advise on the series and to contribute editorially to the programs. This will give the program greater geographic coverage and will provide local contacts with researchers at major universities and institutions connected to these stations. The project will also partner with the American Library Association and Sigma Xi and the Astronomical Society of the Pacific in the outreach effort. Multimedia Research, Inc. and Goodman Research Group will conduct formative and summative evaluations, respectively."[171]
    - This program is funded in part by a grant from the NSF in the amount of $2.5 million, Mar. 2007-Feb. 2010.

[170] *See* http://nsf.gov/awardsearch/showAward.do?AwardNumber=0840737
[171] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0638931.

C. PRIVATE SECTOR

- Raytheon
    - MathMovesU
        - "Raytheon's MathMovesU program is an innovative initiative designed to engage middle school students in math by illustrating the connection between math, their passions and interests and 'cool' careers. Since its inception in 2005 to help spur interest in math and science, Raytheon's MathMovesU program has touched the lives of more than 700,000 students, teachers and parents. Through interactive learning programs, contests, live events, scholarships, tutoring programs and more, MathMovesU engages and inspires students. Raytheon believes that tomorrow's engineers and technologists need to be excited by and interested in math today. In 2009, Raytheon is celebrating the year of 'Math in Action.' Core components of the MathMovesU program include:
            - *"'The Sum of All Thrills'* at INNOVENTIONS at Epcot at the Walt Disney World Resort in Lake Buena Vista, Florida. Opening in Fall 2009, the interactive, math-based exhibit will engage children through a fun and educational experience that helps instill a lifelong passion for math, science and technology.
            - "The Hall at Patriot Place presented by Raytheon, which promotes math and science education through football for the thousands of school children expected to visit each year. Raytheon has developed an interactive learning display named "In the Number" inside the Hall.
        - "Developed in partnership with the Kraft family, Patriot Place is the official home of the New England Patriots Hall of Fame
            - "Title sponsorship of the MATHCOUNTS National Competition held annually in May, the culmination of an enrichment and coaching program that promotes middle school achievement in every U.S. state and territory, Raytheon also supports MATHCOUNTS teams and sponsors multiple state competitions.
            - "MathMovesU, a virtual space to educate and entertain middle school students through games and activities that showcase the math behind students' favorite pastimes. The interactive website also includes MathMovesUniversity, which offers information on scholarships, a homework helper and a math dictionary.
            - "A scholarship and grants program that awards $1 million annually to students, teachers and schools. Middle school students are eligible to receive a $1,000 award to attend math and science summer camps and programs across the country, or save the money for college. Math teachers and volunteers are eligible to

receive a $2,500 Math Hero award for improving math education. A matching grant is awarded to each winner's school."[172]

- STEM Model Project
  - "In the fall of 2006, Raytheon engineers, who were training to become chief systems engineers, undertook a project that used systems engineering methodology to examine and model the country's educational system. The goal: To create a tool to help policymakers, researchers and educators model scenarios to improve STEM learning. With the generous support of the Bill and Melinda Gates foundation, Raytheon, the Business Higher Education Forum (BHEF) and Ohio State University are now working with a network of researchers and modelers to refine the model and make it available as an open source tool."[173]
- Retirees' School Volunteer Association (RSVA)
  - "The Retirees' School Volunteer Association, RSVA was formed as a nonprofit organization by retired Raytheon engineers and technical staff to assist and enhance the education of K-12 New England public school students in response to requests from the schools. Retirees are now involved in the education field in many communities in various roles, teaching, tutoring, planning, helping teachers and more. Recent Raytheon and other retirees with math, science or technology backgrounds are needed to be Town Captains and school volunteers."[174]

- Biogen, Inc.
  - Biogen Community Laboratory
    - "Located within the company's research buildings, the Biogen Idec Community Lab is designed to help transform today's young students into the discoverers of tomorrow. The Community Lab, open to local middle and high school students and teachers, operates teaching laboratories at Biogen Idec's headquarters in Cambridge, MA and at its research and corporate campus in San Diego, CA. All programs are offered at no cost to the community. A unique aspect of the Community Lab program is that it takes students out of the classroom and brings them into a working environment where science is applied everyday. By giving students a chance to interact with scientists and providing an opportunity to do science using sophisticated equipment, the community Lab can impact a larger number of students in a small way and a few students profoundly. Scientists and teachers lead the instruction and offer insights on working at one of the world's leading biotechnology companies. Biogen Idec employees also volunteer as lab assistants, speakers, and mentors. Throughout the academic school year, the Community Lab hosts class

[172] http://www.raytheon.com/responsibility/stem/mmu/index.html.
[173] http://www.raytheon.com/responsibility/stem/model/index.html.
[174] http://www.rsva.org/.

visits, professional development seminars for teachers, and student mentoring."[175]

- Biogen Idec Foundation
  - "The mission of the Biogen Idec Foundation is to improve the quality of people's lives and contribute to the vitality of the communities where we operate, with a special emphasis on innovative ways to promote science literacy and encourage young people to consider science careers. The Foundation supports projects in our geographic operating areas - Cambridge/Greater Boston, MA; San Diego, CA and Raleigh-Durham (Research Triangle Park), NC. We also support several national science education programs, such as the U.S. Biology Olympiad. All organizations selected for Foundation support are qualified as not-for-profit agencies with tax-exempt status under section 501(c) 3 of the U.S. Internal Revenue Service Code. With the exception of a few national science-education programs, we regret that we cannot support programs and agencies outside our geographic operating areas. Our emphasis on science education reflects our Core Value of "Growth, Transformation and Renewal." We are determined to help identify, educate and nurture the next generation of men and women who will make advances in the biomedical sciences and serve our society with courage and compassion. The Biogen Idec Foundation also supports an Academic Matching Gift program, under which donations by Biogen Idec employees and our Board of Directors to qualified institutions of higher education in the United States (or United States affiliates of international universities) are matched dollar-for-dollar. Contributions range between $15 to a maximum of $5,000 per employee per institution per year."[176]
- Educational Grants
  - "As a good corporate citizen, Biogen Idec has an interest in supporting medical and scientific education, patient education and patient support programs in areas of interest to Biogen Idec. In addition, Biogen Idec may also support certain nonprofit organizations in fund-raising efforts, and provide support for certain healthcare-related events or programs through sponsorships. Biogen Idec's on-line grant management system provides applicants with a streamlined process for submitting requests for educational grants, sponsorships and exhibit/display fees, and allows applicants to track the status of their requests. Applications must be submitted within 60 days of the program or event date."[177]
- Biogen Idec Pharm. D. Fellowship Program
  - "Biogen Idec, Inc., in collaboration with the Massachusetts College of Pharmacy and Health Sciences in Worcester offers a unique two-year

[175] http://www.biogenidec.com/site/community-lab.html.
[176] http://www.biogenidec.com/site/company-foundation.html.
[177] http://www.biogenidec.com/site/company-philanthropy-grants.html. See also http://grantsoffice.biogenidec.com/.

fellowship program to promote the role of the Doctor of Pharmacy within the biopharmaceutical industry. *The Fellow will gain extensive experience through various practical activities in both industrial and academic settings, which will enhance the potential for accelerated career development."*[178]

- Massachusetts Biotechnology Council
  - "The Massachusetts Biotechnology Council (MBC) provides services and support for the Massachusetts biotechnology industry and is committed to advancing the development of critical new science, technology and medicines that benefit people worldwide. Representing over 400 companies, academic institutions and service organizations involved in biotechnology and healthcare, the MBC works with public leaders to advance policy and promote education, while providing member programs and services."[179]
  - Massachusetts Biotechnology Education Foundation
    - "The Massachusetts Biotechnology Education Foundation (MassBioEd Foundation) provides engaging biotechnology education to all Massachusetts residents through school programs, workforce training and lifelong learning."[180]
    - BioTeach Grants
      - BioTeach Grants provide funding for Massachusetts public high schools to outfit their science labs with the equipment necessary for the teaching of biotechnology and provide teachers with engaging biotech curricula. Part of this program is the Life Science Career Development Initiative, designed to institutionalize life science career tracks in public schools.[181]
- PTC Corp.
  - "Free resources including software programs, instructional materials and affordable teacher training."[182]
  - "At PTC, we know that schools have limited budgets and that many teachers are pressed for time. That's why we offer no-cost or low-cost design applications, plus a complete learning program that makes it easy to bring 3D design into your classroom. PTC is working with teachers and institutions, such as the International Technology Education Association (ITEA), the Design & Technology Association and other international education organizations, to ensure that our program is aligned with global and national standards for curriculum and the Science, Technology, Engineering and Math (STEM) initiative. We used their

[178] http://www.biogenidec.com/site/fellowship.html.
[179] http://www.massachusetts.edu/stem/programs.html. See www.massbio.org.
[180] http://www.massachusetts.edu/stem/programs.html. See www.massbioed.org.
[181] See http://www.massbioed.org/educators/bioteach_grants.php.
[182] http://www.massachusetts.edu/stem/programs.html.

insight to create our project based activities and modular courses - so we know that they are flexible and will work with any teacher's classroom schedule."[183]

- Bose
  - In Harmony with Education
    - Imagine a standards-based curriculum so interesting, so engaging, so entertaining that it reaches out and grabs the imagination. Imagine a curriculum that merges the teaching of math, science and music so powerfully that each discipline comes alive with new meaning. A curriculum so compelling that it reaches students of diverse interests and backgrounds. A curriculum that brings music to life, and brings life to music. That's what we at Bose imagined, and together with MENC: The National Association for Music Education, we created the Bose In Harmony With Education® program to demonstrate our commitment to helping turn the students of today into the innovators of tomorrow. The Bose In Harmony With Education program has been a great success with students, teachers and administrators in schools throughout the country. … We sought to create an interdisciplinary music curriculum that would take students beyond mere understanding. We wanted students to see, hear and feel the power and beauty of music as it demonstrates the nature and science of the sounds that surround them in their daily lives. Students in the Bose In Harmony With Education program learn through hands-on experience, by creating and playing their own instruments. The Bose In Harmony With Education program helps students achieve all nine of the curricular goals of the National Standards for Music, as well as the standards for math and science, adopted by national consensus in 1994. Interdisciplinary by nature, the Bose In Harmony With Education program particularly emphasizes Standard 8, 'Understanding relationships between music, the other arts, and disciplines outside the arts.'"[184]
- Boston Scientific
  - Boston Scientific Foundation
    - "Founded in 2002, the mission of the Boston Scientific Foundation is to improve the lives of the economically disadvantaged in the areas of health and education. Since its inception, the Boston Scientific Foundation has donated more than $14 million to more than 350 tax-exempt organizations. In line with our corporate mission to help clinicians improve patients' lives, Boston Scientific Foundation is at work in the community, supporting national, local and international charitable efforts committed to expanding access to quality health care and educational opportunities for the underserved. An important focus for the foundation is encouraging students to pursue career paths within the fields of health, science and technology. Boston Scientific Foundation is committed to

[183] http://www.ptc.com/appserver/mkt/educational/program.jsp?&im_dbkey=52407&icg_dbkey=851.
[184] http://www.bose.com/controller?event=VIEW_STATIC_PAGE_EVENT&url=/about/harmony/index.jsp.

helping address achievement gaps in these fields through support of a variety of educational programs. By dedicating time, expertise and financial resources in the communities where Boston Scientific employees live and work, we are helping to improve health and educational opportunities for those in need."[185]

- Science Club for Girls
  - "The mission of the Boston-based Science Club for Girls is to increase the self-confidence and science literacy of K–12th grade girls belonging to groups that are underrepresented in the sciences, through free, after-school programs in experiential learning, mentorship, and leadership opportunities. Girls work with mentor-scientists who model and foster leadership, affirm college as an expectation, and promote careers in science and technology as viable goals and options. In partnership with the Boston Scientific Foundation, this grant helped to expand services into two new communities as well as allow students to participate in an end-of-year trip to the Boston Museum of Science."[186]
- Project Lead the Way
  - "Project Lead the Way is a national educational program that helps give middle and high school students the rigorous ground-level education they need to develop strong backgrounds in science and engineering. In partnership with high schools in the Spencer, Indiana area, support from the Boston Scientific Foundation will help to prepare an increasing and more diverse group of students to be successful in science, engineering, and engineering technology. With this support, students in rural Indiana get access to state-of-the art technology and curriculum that aims to ignite a passion in future innovators."[187]
- First Robotics Mentoring Program
  - The FIRST Robotics Competition, or "For Inspiration and Recognition of Science and Technology," was founded in 1989 by Segway® Personal Transporters' inventor Dean Kamen to inspire young people's interest and participation in science and technology. The program challenges teams of young people and their mentors to solve a common problem in a six-week timeframe using a standard "kit of parts" and a common set of rules. Teams build robots from the parts and enter them in competitions designed by the FIRST engineering committee. … John Abele, one of Boston Scientific's founders, is the current Chairman of FIRST, fulfilling his interest in science literacy for children, education and the process by

[185] http://www.bostonscientific.com/CorporateResponsibility.bsci/,,/method/lvl1/navRelId/1071.1077/seo.serve.

[186] http://www.bostonscientific.com/CorporateResponsibility.bsci/,,/navRelId/1077.1080/method/program/id/10113723/seo.serve.

[187] http://www.bostonscientific.com/CorporateResponsibility.bsci/,,/navRelId/1077.1080/method/program/id/10113753/seo.serve. See also http://www.pltw.org/index.cfm.

which new technology is invented, developed and introduced to society. Boston Scientific has participated in the program for several years, and provides monetary and mentoring support to seven teams in the Minneapolis/St. Paul area. Volunteer mentors do the community and industry a service by inspiring and nurturing the talents of the next generation of scientists and engineers and, in turn, strengthening schools in their communities. Students see first-hand what it takes to develop a sophisticated electromechanical device, from low-level engineering through team organization and resourcing."[188]

- Genzyme
  - Genzyme Grants
    - "One of the world's foremost biotechnology companies, Genzyme is dedicated to making a major positive impact on the lives of people with serious diseases.
    - "With many established products and services helping patients in nearly 90 countries, Genzyme is a leader in the effort to develop and apply the most advanced technologies in the life sciences.
    - **"Genzyme's Areas of Interest**
      - "Genzyme's products and services are focused on rare inherited disorders, kidney disease, orthopaedics, transplant, cancer, and diagnostic testing. Genzyme's commitment to innovation continues today with a substantial research and development program focused on these fields, as well as immune disease, infectious disease, and other areas of unmet medical need.
    - **"Grants and Charitable Contributions**
      - "In alignment with Genzyme's commitment to innovation in science and areas of unmet medical need, Genzyme supports grants and charitable donations in the following areas:
      - "Rare inherited disorders
      - "Kidney disease
      - "Orthopaedics
      - "Transplant/immune diseases
      - "Cancer adult and pediatric (leukemias and thyroid)
      - "Genetic testing
      - "Diagnostic services

188 http://www.bostonscientific.com/CorporateResponsibility.bsci/,,/navRelId/1072.1078/method/program/id/10113822/seo.serve. Why Minnesota? The Boston Scientific BestPrep eMentors is also a MN program; their science and technology fair is in Galway, Ireland.

- "Surgical therapy
- "Community relations giving

▪ **"Types of Grants that May be Awarded**

- "Genzyme will review grant requests from healthcare or science related organizations in the U.S. for the following:
- "Continuing Medical Education (accredited)
- "Educational Programs
- "Sponsorships
- "Fellowships
- "Organization funding
- "Community relations giving"[189]

o Genzyme Teacher Sabbaticals

▪ See program description under the Museum of Science Boston, below.

- Charles River Laboratories
  - o Webinars
    - ▪ "Charles River's experienced scientists, technicians, clinicians, pathologists, and veterinarians can be a valuable asset to you in creating new efficient solutions for your most challenging issues. Please join us as we share our expertise through our ongoing webinar series."[190]
  - o Charles River Courses and Seminars
    - ▪ "Keeping abreast of emerging technology, scientific advances, and regulatory changes is vital to your research and business. To help you stay informed, Charles River hosts frequent courses, seminars, and symposiums dedicated to advancing attendees' knowledge of their respective fields. In addition, you get the valuable opportunity to interact and share ideas and experiences with fellow colleagues in the scientific community."[191]
- TERC, Inc.
  - o Inside the Double Bind: A Synthesis of Literature on Women of Color in Science, Technology, Engineering, and Mathematics
    - ▪ "Women of color in STEM are rarely independent subjects of study. As a result, there is relatively little known about how they become interested in science, their systems of support or factors that could make careers in science more attractive to them. This project would synthesize existing

[189] http://www.genzymegrants.com/About-Genzyme-Grants.asp.
[190] http://www.criver.com/en-US/TrainEducation/Webinars/Pages/home.aspx.
[191] http://www.criver.com/en-US/TrainEducation/CourseSeminar/Pages/home.aspx.

research, evaluation and narrative literature concerning factors that facilitate or impede the entry of under-represented minority women into STEM professions. The work would separate effects at the college level, the graduate level, and the professional level. The project will help to illuminate factors that influence initial career choices and subsequent decisions over the course of professional life. The literature is fragmented and currently exists in multiple formats. The meta-analysis and synthesis of knowledge will enhance our understanding of the challenges that women of color encounter in pursuing scientific careers, the strategies they employ to overcome them and the contextual and organizational factors that support their professional development. The results will indicate what is known, what initial findings need to be replicated, and what research gaps need to be identified. The study will stimulate further studies by building a research agenda for scholars and graduate students."[192]

        - This program is funded in part by a grant from the NSF in the amount of $246,840, Oct. 2006-Sept. 2009.

- ExxonMobil
    - ExxonMobil Bernard Harris Summer Science Camp (BHSSC)
        - "The Bernard Harris Summer Science Camp (BHSSC) is a program of The Harris Foundation, and is currently funded by Exxon Mobil. The foundation takes an active role in shaping education in students in middle and high school through college. The mission of this program is to enable youth, entering grades 6th, 7th, and 8th, to develop and achieve their full potential through support of social, recreational and STEM-based educational programs."[193]

D. CROSS-SECTOR COLLABORATIONS / NOT FOR PROFIT ORGANIZATIONS

- Massachusetts Life Sciences Collaborative
    - "The goal of the Massachusetts *Life Sciences Collaborative* is to create a cross-sector collaboration that can both sustain dialogue among life sciences leaders in academia, industry and government and also over time develop a comprehensive, integrated strategy to grow the life sciences mega-cluster in Massachusetts. To be clear, when we use the term "cluster," we are using it in the broadest possible way to include the activities of our world-class universities, teaching hospitals and research institutions, our biotechnology, medical device and pharmaceutical companies, as well as the many software, venture capital, plastics and IT companies that contribute to the growth and vitality of the cluster. The *Collaborative* will include all of these stakeholders. Currently, Massachusetts has a myriad of public and private programs and initiatives that are supporting the

[192] See http://nsf.gov/awardsearch/showAward.do?AwardNumber=0635577.
[193] http://www.stem.neu.edu/programs.htm; http://www.stem.neu.edu/bhssc.htm

growth of individual sectors of the life sciences cluster, as well as vigorous and effective trade associations in biotechnology, medical devices and pharmaceuticals and other organizations that include teaching and community hospitals and health care research. **But the Commonwealth has yet to develop an overarching strategy that integrates the disparate elements of the cluster, identifies the obstacles to full economic and competitive potential, creates a path and direction that will ensure that Massachusetts maintains and builds upon its preeminence in life sciences research, development and commercialization, and that supports the effort with an administrative, financial and staff structure that can insure sustainability and results**. The Commonwealth must be positioned to resist and counter the aggressive efforts of other States—and countries—to challenge our position and draw away talent and resources from the state. The importance and need for this initiative has been acknowledged already by the strong financial support provided by the Boston Foundation, the University of Massachusetts, Harvard University, and the Massachusetts Technology Collaborative' Innovation Institute and also by the administrative and staff support provided by MTC's John Adams Innovation Institute. The Massachusetts Biotechnology Council, the Medical Device Industry Council, the New England Healthcare Institute, the Greater Boston Chamber of Commerce, and the Massachusetts Technology Leadership Council have endorsed the initiative. **Unlike other initiatives in the life sciences undertaken by business and trade associations as one part of their broader public policy agenda, our initiative is solely dedicated on a multi-year basis to achieving the objectives of sustainable collaboration among life sciences stakeholders and the development of a comprehensive and integrated strategic plan for life sciences growth in the Commonwealth.**"[194]

  - "Today, an independent Massachusetts Life Sciences Collaborative (LSC) is a 45-member organization comprised of leaders throughout industry, university, non-profit, and public institutions. It works closely with numerous collaborating organizations to address specific challenges facing the life sciences sector. The Collaborative is chaired by Harvard President Drew Faust, MIT President Susan Hockfield, UMass President Jack Wilson, and Genzyme Chairman and CEO Henri Termeer."[195]

- Boston Area Advanced Technological Education Connections (BATEC)
  - "The Boston Area Advanced Technological Education Connections (BATEC), a National Science Foundation Regional Center for IT, is transforming education to develop the new IT professional for the 21st century by: (1) developing curriculum that is regionally connected, advanced in content and pedagogy and industry-linked; (2) providing professional development experiences for educators so they can deliver relevant, standards-based programs of instruction that model the reality of the workplace; (3) attracting and advancing a diverse population of technology students who can effectively meet the challenges of emerging technologies and changing economies; and (4) connecting education, industry and

[194] http://www.masslsc.com/about.html.
[195] http://www.masstech.org/institute2009/lifesci.html.

community to promote mutually-beneficial partnerships that support career development, lifelong learning and regional economic growth."[196]

- "The BATEC partnership is comprised of: University of Massachusetts Boston; Bristol, Bunker Hill, Middlesex, Northern Essex, Quinsigamond, and Roxbury Community Colleges; K-12 Districts of Boston, Cambridge, Chelsea, Everett, Medford, Newton, Northeast Metropolitan, Revere, Somerville, Watertown, and Winthrop; Business and Industry Leaders; Government and Community. BATEC is engaging the region's secondary school teachers, and community college and four-year faculty in professional development for new and emerging information technologies and curriculum development focused on the design and delivery of a new IT education and workforce continuum. BATEC is also providing students with the academic, technical, and professional skills necessary to design, develop, support and manage the hardware, software, multimedia, and integrated systems used in our workplaces."[197]

- Boston Science Partnership
  - "The Boston Science Partnership (BSP) aims to improve science education in Boston from middle school through graduate school."[198]
  - "We are working toward a vision of science education in Boston in which: Challenging science courses are taught by highly qualified science teachers throughout the Boston Public Schools; Advanced science courses are accessible to all Boston Public School students; University faculty work side-by-side with Boston Public School science teachers in science education reform; Support structures are in place to promote student achievement in science, from grade six through graduate school; and The BSP's successful strategies have a broad impact on urban school systems nationwide. The BSP brings together three core partners - Boston Public Schools, Northeastern University, and the University of Massachusetts Boston as the lead organization - along with two supporting partners, Harvard Medical School and the College Board. The BSP project began in September 2004 and is funded by a five-year, $12.5 million Math Science Partnership grant from the National Science Foundation."[199]

- Center for the Advancement of Hispanics in Science and Engineering (CAHSEE)
  - "The Center for the Advancement of Hispanics in Science and Engineering mission is to prepare talented Hispanic and other underrepresented minority science and engineering students achieve academic excellence and professional success through CAHSEE's pipeline of rigorous educational and leadership development programs."[200]
  - CAHSEE Stem Institute

[196] http://www.massachusetts.edu/stem/programs.html; see http://www.batec.org/index.php.
[197] http://www.batec.org/aboutus.php.
[198] http://www.massachusetts.edu/stem/programs.html.
[199] http://www.bostonscience.org/html/about.asp.
[200] http://www.massachusetts.edu/stem/programs.html.

- "This four-summer program is designed to prepare pre-college students fifth through eleventh grades to enter and succeed in science and engineering at the colleges of their choice. During the first summer, students concentrate in learning mathematical abstraction, logic and syntax, and geometrical conceptualization and visualization. The second year, students learn model building of physical phenomena and/or economic systems. The third summer, students focus in developing mathematical and engineering intuition. Finally, the fourth summer, students learn to simplify complexity by focusing in mathematical and scientific analysis and synthesis. These four areas of concentration: mathematical abstraction, logic and syntax visualization, conceptualization, model building, intuition analysis, and synthesis constitute the fundamental basis for outstanding success in science and engineering."[201]
- Housed at Merrimack College.

- Digital Sisters, Inc.
  - "Digital Sisters (DS), Inc. is a 501(C)3 non-profit organization created to promote and provide technology education and enrichment for women and children who are traditionally underserved. … Working through enhance partnerships with community based organizations, corporations, technology centers and local schools, Digital Sisters provides assistance in closing the gender gap in technology that is plaguing single mothers. … By providing support through in and out of school activities, community outreach and professional workshops, Digital Sisters empowers women and girls which further strengthens families."[202]
- Hampshire Educational Collaborative
  - "The Hampshire Educational Collaborative (HEC) links education, schools, families, and communities to opportunities and resources that advance student learning by helping teachers, schools, and communities address the fundamental issues of improving education. We help schools and school districts share critical resources through regional planning and offers a wide range of programs and services providing opportunities and professional advancement for educators and education."[203]
  - "Located in Western Massachusetts, the Hampshire Educational Collaborative is a nonprofit organization dedicated to fostering educational excellence, opportunity, and growth for all learners. For more than thirty years, HEC has provided access to quality educational programs for our most vulnerable, at-risk children and youth, and trained teachers and administrators to provide programs of excellence. Through collaboration and leadership, HEC enhances learning and supports

[201] http://www.cahsee.org/2programs/stem.asp.htm.
[202] http://www.digital-sistas.org/aboutus.shtml. Listed at http://www.massachusetts.edu/stem/programs.html, though Massachusetts connection unclear.
[203] http://www.massachusetts.edu/stem/programs.html;

member districts and others by providing exemplary programs, effective practices, and identifying and developing resources."[204]

- Metro South/West Regional Employment Board
  - Technology Initiative
    - "The Technology Initiative is uniquely positioned to provide a multi-dimensional, systems approach to increasing K-12 student academic preparation, awareness, interest, and motivation for pursuing postsecondary majors and careers in Science, Technology, Engineering, and Math (STEM)."[205]
  - LIFT^2 (Leadership Initiatives for Teaching and Technology)
    - "Leadership Initiatives for Teaching and Technology (LIFT^2) offers middle school and high school math, science, and technology teachers a research-based professional learning program that integrates **graduate coursework** with authentic and relevant **externships** in 'innovative' industries in Massachusetts. Teachers enrolled in LIFT^2 improve their classroom instructional practice and school leadership abilities in four areas: Experiential and inquiry-based teaching and learning; Application of 21st Century technologies to STEM curriculum and instruction; Integration of 21st Century workplace skills; Integration of STEM careers awareness into classroom culture. This is a proven formula to impact student preparation for and interest in STEM careers. Public, Private, and Education Sector Partnership: LIFT^2 has been sponsored through three pilot cycles by the Massachusetts Department of Education (DOES) and funded through the No Child Left Behind Act, representing a total commitment of $650,000, an unprecedented vote of confidence. More than thirty-five corporate sponsors, to date, have provided equipment grants and sponsored teacher externships for more than eighty teachers. LIFT^2 teachers have completed externships in biotechnology, nanotechnology, information technology, process manufacturing, environmental services, financial services, and more."[206]
  - **High School STEM Internship Collaborative**
    - *"(Serves senior high school students)* Internship experiences help to overcome negative stereotypes and lack of awareness of STEM careers by exposing high school students to top-flight innovation, technology, and research companies. Teachers and Career Specialists in the high schools identify students for internships based on their academic performance or personal interest in STEM. Students are carefully screened, evaluated, and then placed with a STEM company on a part-time basis during the school year or full-time during the summer. Student interns spend at least 50% of their time working on STEM-related tasks, and are paid a reasonable wage

[204] http://www.collaborative.org/images/pdf/hec-annrept08.pdf.
[205] http://www.lift2.org/.
[206] http://www.lift2.org/.

for their work. During the 2004-05 academic-year, 992 students from 62 high schools in seven regions of Massachusetts were placed in STEM career-related internships in 282 businesses. (57% Female/26% African American/16% Hispanic)"[207]

- **The Center for Women and Minorities in STEM (WM/STEM)**
  - *"(Serves grades 5–9 grade female and minority students)* WM/STEM uses a systems approach involving middle school students, teachers, parents, school leaders, company employees/retirees in a range of compelling programs. Programs are designed to increase the math and science skills of students in grades 5-9, and raise their awareness, interest, and motivation for pursuing STEM post- secondary fields of study and careers."[208]
  - "Program offerings feature: Out-of-School-Time Activities for Students; Professional Development for Teachers and Administrators. Over 500 students in four communities have participated in our **Future Scientists and Engineers of America** clubs since 2001 (34% girls/32% minorities). In 2004-05, over 50 students from four communities participated in **Lego Robotics** clubs. An additional 24 girls currently participate in a 5th grade Lego Robotics club with female-only mentors in Framingham."[209]

- Mass Insight Education and Research Institute
  - "Mass Insight Education & Research Institute, a 501c3 non-profit organization based in Boston, MA, was founded in 1997. Its launch reflected the high priority that business, government, and education leaders placed at that time on the success of Massachusetts' nascent standards-based reform drive, set in motion by the passage of the Education Reform Act of 1993. It is the sister organization of Mass Insight Corporation, which has worked since 1989 to keep Massachusetts and its businesses and institutions globally competitive. Since its inception, Mass Insight Education & Research Institute has become a statewide leader in the Commonwealth's education reform drive and, more recently, a provider of research and strategic consulting services nationally. For more information about our current initiatives, see our mission statement and the description of our core strategies, below."[210]
  - "**Massachusetts Math and Science Initiative:** Following a highly competitive application process, the Commonwealth of Massachusetts, in partnership with Mass Insight Education and Research Institute, succeeded in securing one of the first-ever awarded grants from the National Math and Science Initiative, Inc (NMSI) for the *Massachusetts Math & Science Initiative* (MMSI), an Advanced Placement® training and incentive program. NMSI is an innovative non-profit organization created to facilitate the national scale-up of programs that have a demonstrated impact on math and science education in the United States. Initial funding for NMSI comes from ExxonMobil. Massachusetts was one of six states

[207] http://www.lift2.org/.
[208] http://www.lift2.org/.
[209] http://www.lift2.org/.
[210] http://www.massinsight.org/about/index.aspx.

to receive the grant, which will provide $13.2 million through 2014 (to be matched by local funding) to help fund a state wide Advanced Placement® training and incentive program. The goal of the initiative is to increase student enrollment in mathematics, science and English AP courses, and to improve student performance as reflected by a substantial increase in the number of qualifying scores (3, 4 or 5 on a 1 to 5 scale). The program will provide extensive training for AP and Pre-AP teachers, establish AP lead teachers, demand additional student preparation, and provide performance-based financial incentives for students and teachers. Under the leadership of Morton Orlov II, who is the President of the AP Training and Incentive Program in Massachusetts, cohorts of high schools are being selected annually to join the program, with the goal of implementing the initiative in 100 high schools by 2013 through the integration of Regional Development Centers."[211]

- **"School Turnaround Strategies:** *The Turnaround Challenge*, Mass Insight's 2007 Gates-funded report, reveals the urgent need in the education reform community for new strategies to turn around the nation's poorest-performing schools. The report was downloaded more than 100,000 times in the year after its publication. *The Turnaround Challenge* has clearly struck a chord. Our continued work will produce organizational strategies, work plans, and manuals for states, large urban districts, and outside funding partners to turn around low-performing schools through a new system of turnaround zones with improved operating conditions, lead turnaround partners, and other supports. The new system, an operationalization of the recommendations from *The Turnaround Challenge* report, will create models that use clusters of turnaround schools as an entry point for reinventing the way districts, states, and external partners organize their work. The initiative, which has received startup funding from the Carnegie Corporation with matching support from the Bill & Melinda Gates Foundation, will establish "partnership zones" in three states in 2009-2013 to serve as proof-points for these school turnaround and district redesign strategies. There is some urgency in this work – not only on behalf of struggling students in struggling schools, but because of the two-year window of opportunity in front of us to develop effective turnaround policies, implementation strategies, and new capacity before a reauthorized NCLB starts channeling significant federal funding into school intervention. The lessons from the experience of NCLB's expansion of support for failing students (through Supplemental Educational Services) are clear. In the absence of good policy models, promising exemplars, and informed partners, federally-driven scale-up of support for failing schools will result in largely ineffective, marginal-impact reform."[212]

- **Museum of Science Boston**
  - "As partners in science, technology and engineering education, we provide ongoing programs for educators as adult learners and as teaching professionals. Our work includes: Workshops and events on using Museum resources in the classroom and at the Museum; Professional development programs to develop

[211] http://www.massinsight.org/about/index.aspx.
[212] http://www.massinsight.org/about/index.aspx.

content knowledge and improve teaching; Collaborations with educators involving constructing new understandings and approaches to the teaching of science, technology and engineering."[213]

- Engineering is Elementary (EiE)
  - See above under K-12 section.
- National Center for Technological Literacy
  - "NCTL's goal is to integrate engineering as a new discipline in schools nationwide and to inspire the next generation of engineers and innovators. NCTL fosters learning about how technologies are created and used. It offers educational products and programs for pre-K-12 students and teachers, creates curricula, supports an online resource center, and engages in partnership and outreach with other institutions. NCTL works with state departments of education and teacher organizations to facilitate the re-engineering of curricula and learning standards."[214]
- Classroom Resources
  - The Museum also provides classroom resources for teachers.[215]
- Collaborations
  - BioTeach
    - "BioTeach is a state-wide initiative of MassBioEd that enables high schools to include biotechnology in their curriculum through equipment grants and teacher professional development. As one of four regional BioTeach centers, the Museum of Science helped to develop the BioTeach curriculum, the associated materials kits, and the professional development workshops. In addition to providing summer workshop experiences for teachers from multiple districts, the Museum of Science has initiated a planning process with Boston Public Schools' science department to look more closely at how the resources of BioTeach, the Museum, and other institutions can be appropriately integrated into the BPS high school science curriculum."[216]
  - Exploring Life's Origins
    - "This project uses molecular illustration and animation to help describe research and theories on the origins of life on Earth. It includes live presentations on the *Gordon Current Science & Technology Center* stage, an interactive Exhibit Halls kiosk, and the Exploring Life's Origins website."[217]

[213] http://www.mos.org/educators/professional_development_and_events/.
[214] http://www.mos.org/nctl/.
[215] http://www.mos.org/educators/classroom_resources/.
[216] http://www.mos.org/educators/professional_development_and_events/collaborations&d=1716.
[217] http://www.mos.org/educators/professional_development_and_events/collaborations&d=2701.

- Genzyme Teacher Sabbaticals
    - "Since 1997, with continued generous support from the Cambridge-based biotechnology firm Genzyme Corporation, over 250 elementary and middle school teachers from Boston, Cambridge, Framingham, Westborough, and Waltham have had the opportunity to spend a week during the school year immersed as learners in unique educational experiences at the Museum. While substitutes cover their classrooms, a team of five teachers from these five communities spend their "sabbatical" week with Museum educators, attending programs, learning the science behind our exhibits, and seeing how real objects from our collections can deepen both content and inquiry learning for them and their students. In addition, teachers have reported that the opportunity to spend time in adult discussion with other teachers is an essential element of this program. Although the Museum has exhibits and programs from many disciplines, the learning experiences are designed to explore the relationship between biotechnology and life science topics throughout all grades. Furthermore, teachers are encouraged to pursue their interests in any area that they feel will strengthen their understanding of science, technology or engineering. To apply what they have learned, teachers can take advantage of the follow-up benefits, which include a return field trip to the Museum with their class and bus transportation at no cost. This program is fully funded by Genzyme Corporation. There is no cost to these five communities selected by Genzyme."[218]
- Innovations in Biotechnology: An International Exchange Program
    - "The Museum of Science, with the generous support from Novartis Institutes for BioMedical Research, currently has four Massachusetts high school teachers and five gymnasium teachers from the Basel region of Switzerland involved in a teacher exchange focused on biotechnology education. In order to develop new ideas about biotechnology education, engage in collegial discussion, and gain new perspectives on educational systems, the Massachusetts teachers traveled to the Basel region in October 2006. Visits to schools in Switzerland, Germany, and France were complimented by an opportunity to see the Novartis and participate in the BioValley Life Science Week College Day. While there, teachers from each area were paired and began a teaching project as a way to stay engaged between meetings and inquire into the teaching and learning of biotechnology concepts. The teachers from the Basel region visited Massachusetts in March. During that time they participated in the Museum's Biotech Symposium and visited their partner's schools as well as some local educational

[218] http://www.mos.org/educators/professional_development_and_events/collaborations&d=1712.

outreach programs. A seminar was held at the end of this visit during which each pair presented their project."[219]

- Project ASTRO
  - "Project ASTRO is an Astronomer-Teacher Partnership program that combines the expertise of educators and scientists to collaboratively teach space science in the classroom. Astronomer and educator partners train together in workshops at the Museum of Science with hands-on, inquiry-based astronomy activities. The program is open to private and public school teachers for grades 2-10 in the Greater Boston area. To participate, you must attend a two-day summer workshop."[220]
- The Gateway Project
  - "Although Massachusetts has strong state standards for technology and education, it is a long way from standards to effective programs for every student. The Gateway Project aims to help Massachusetts school districts align their curriculum, teacher education, and assessment systems with the state technology/engineering curriculum standards. The Institute of Museum and Library Services has provided a half-million dollar grant for us to support 50 school district leadership teams over three years. Participant district leadership teams collaborate during summer institutes, call-back days and online forums with other Gateway teams."[221]

- National Inventors Hall of Fame
  - Club Invention
    - "After-school program for 2-6 grade students is an exciting after-school program where children learn through fun, hands-on experiences and discovery. Activity-oriented adventures enhance the understanding of science, mathematics, history, and the arts."[222]
- Project Lead the Way
  - "Project Lead the Way - four year sequence of courses which, when combined with college preparatory mathematics and science courses in high school, introduces students to the scope, rigor and discipline of engineering and engineering technology prior to entering college."[223]
  - A large number of school districts in the Commonwealth are involved in the program.

[219] http://www.mos.org/educators/professional_development_and_events/collaborations&d=1709.
[220] http://www.mos.org/educators/professional_development_and_events/collaborations&d=699.
[221] http://www.mos.org/educators/professional_development_and_events/collaborations&d=1442.
[222] http://www.massachusetts.edu/stem/programs.html; see http://www.invent.org/programs/2_4_0_club.asp.
[223] http://www.massachusetts.edu/stem/programs.html; http://www.pltw.org/index.cfm.

- Northeastern Girls Collaborative (Puget Sound Center)
    - "The Northeastern Girls Collaborative brings together organizations throughout New Hampshire, Vermont, Massachusetts and Rhode Island that are committed to informing and motivating girls to pursue careers in science, technology, engineering, and mathematics (STEM). Too often programs that serve girls in STEM are limited in service and impact due to size, location, funding, expertise and equipment. In other cases, projects compete with each other, duplicating services and seeking the same resources. The Northeastern Girls Collaborative provides the opportunity for programs to increase their ability to maintain interest and participation of girls in STEM within their regions through collaboration. The Northeastern Girls Collaborative is based upon a model developed by the National Girls Collaborative Project, and replicated through a grant from the National Science Foundation. The model is structured to bring organizations together to compare needs and resources, share information, and to plan strategically to expand STEM-related opportunities for girls."[224]
- TERC
    - "We imagine a future in which learners from diverse communities engage in creative, rigorous, and reflective inquiry as an integral part of their lives. We see teachers and students alike as members of vibrant communities where questioning, problem solving, and experimentation are commonplace. Such communities focus on actual problems for which there are no simple solutions. … TERC is committed to achieving this vision by improving mathematics and science teaching and learning through: sustained collaboration with members of the education community; innovation and creativity in the development of educational practices and products; cutting-edge research in classrooms and other learning environments; support for rich and engaging learning opportunities for all students, including underserved student populations; invention and application of technology to meet educational needs; implementation that responds to the complexities of real-world settings; approaches that draw on perspectives and methods from the natural sciences, mathematics, humanities, arts, and social sciences; continuous refinement of our practice and understanding."[225]
    - "Our work in mathematics and science education includes research, curriculum and technology development, and implementation support in the form of professional development and assistance to districts and schools. Our programs span pre-kindergarten through college, and include adult basic education and informal learning at museums, at home, and in after-school programs. Research drives the development of our activities and products. It also informs our efforts to create new knowledge about science and math teaching and learning."[226]
    - "Each year, TERC's programs and products reach more than 3.5 million students in the United States and abroad. We currently have long-term relationships with

[224] http://www.pugetsoundcenter.org/ngcp/northeastern/index.cfm.
[225] http://www.terc.edu/aboutus/.
[226] http://www.terc.edu/aboutus/.

249 schools and 47 districts; in one-third of them, the majority of students are eligible for free or reduced-cost lunches."[227]

- Machine Science Inc.
  - "Machine Science Inc. provides schools and community organizations with the resources and curricula they need to run hands-on, project-based STEM enrichment programs. Activities include digital electronics, robotics, and computer programming."[228]
  - "Machine Science is a 501(c)3 non-profit organization dedicated to supporting hands-on engineering programs for young people in schools, community centers, museums, and other educational institutions. Our high-quality project kits and on-line resources are being used in numerous Boston-area schools and community centers."[229]

II. STEM COORDINATING COUNCIL: WHERE ARE WE GOING?

[227] http://www.terc.edu/aboutus/.
[228] http://www.massachusetts.edu/stem/programs.html; see also http://www.machinescience.org/about/.
[229] http://www.machinescience.org/about/.