Despite the large numbers of students enrolled at Los Angeles Trade-Technical, the number of students choosing to enroll in STEM related educational programs and successfully completing them is a challenge. This challenge seems to mirror national trends. According to the Chairman, Committee on Rules, House of Representatives, United States Government Accountability Office (GAO) report (October, 2005) entitled “Higher Education Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends”, “the number of graduates with degrees in STEM fields increased by 8 percent from the 1994-1995 academic year to the 2002-2003 academic year. However, during this same period the number of graduates with degrees in non-STEM fields increased by 30 percent. From academic year 1994-1995 to academic year 2002-2003, the percentage of graduates with STEM degrees decreased from 32 percent to 28 percent of total graduates.”

As a result, Los Angeles Trade-Technical College (LATTC, Trade-Tech) has embarked on developing and implementing a plan to build multiple K20 STEM pathways and employ curriculum, pedagogies, and support services necessary to ensure student engagement, enrollment, and success. In particular this plan consists of five objectives and multiple activities outlined here and more fully described below:

1. **Increase student interest in STEM careers**
   a. LATTC Science and Technology Academies: Provide opportunities for students to begin or continue a sustained interest in STEM through in academies when they are out-of-school.
   b. Sustainability-Themed Courses, Activities, and Projects: Engage students in solving real world problems for which they demonstrate a strong interest or value in. In particular, the LATTC Green College Initiative engages students in sustainability or “green” themed courses and activities.

2. **Create dual pathways for students while still in high school that lead to specialized certifications in STEM fields**
   a. Expand the LATTC Success in Technical and Professional Pathways (ST&P³) Model to include STEM pathways

3. **Develop vertical, articulated K20 educational pathways in STEM programs and opportunities for K20 faculty to interact and share and improve on curriculum and pedagogical strategies**
   a. Develop and implement a LATTC STEM Pathways Initiative
   b. Develop and implement a LATTC STEM Teacher Alliance

4. **Implement a project-based learning model that engages students in STEM disciplines through hands-on application rather than traditional STEM instruction**

5. **Increase size and scope support network(s) for students and parents**
   a. Develop and implement a LATTC Student Leadership Development Program – Develop student chapters of The National Hispanic Environmental Council, American Chemical Society (ACS), Society of Hispanic Professional Engineers
   b. Utilize the LATTC/HENAAC Partnership: Partner with HENAAC to provide enrichment activities in and outside the classroom
   c. Develop and implement a LATTC STEM Student Support Services Network
      i. Peer Tutoring and Support Programs
      ii. Supplemental Instruction
Overview of the LATTC Building K20 STEM Pathways Plan

Increase student interest in STEM careers by providing dedicated STEM education enrichment inside and outside the classroom. A dual-pronged approach at providing enrichment activities that engage students in STEM education is taken. First, we focus on creating awareness, spurring interest, and fostering a culture of high achievement in STEM education in K12 students. This is accomplished by providing Science and Technology Academies. **LATTC Science and Technology Academy** students participate in an eight-week series of project-based learning modules integrating science, technology, engineering and math from a variety of STEM specific disciplines during the summer and/or when students are “off-track”. Second, we develop theme-based courses, activities, and projects that engage students in solving real world problems for which they demonstrate a strong interest or value in. In particular, LATTC focuses students on the environment and sustainability initiatives through the courses and activities available in the **LATTC Green College Initiative**. This not only addresses a global need, but is also a documented area of interest among youth and young adult students, and therefore, creates a sustained interest of students in STEM.

Create dual, concurrent enrollment pathways for students while still in high school that lead to specialized certifications in STEM fields while also meeting California pre-college admission requirements. **LATTC’s Success in Technical & Professional Pathways Program (ST&P³) Model** is a comprehensive program—in partnership with K12 schools, universities, and Los Angeles Trade-Technical College—of sequenced courses, activities, and support services that prepare students for college and careers in multiple technical and professional pathways in high-growth, high-demand, and emerging industry sectors is provided. Educational pathways are mapped and programmed with courses that meet high school graduation and a-g requirements, university general education entrance requirements, and STEM career-technical and professional certification and degree requirements. Pathways are designed so courses offered each term/semester in each pathway are aligned by a common purpose, theme and comprehensive, real-world project(s) utilizing technology-mediated tools and applications. Further, the aim is to enhance pathways with concurrent enrollment coursework—particularly STEM, career-technical coursework and mathematics and English coursework that keeps students proficient at or above their grade level—which will increase student high school outcomes and encourage college-going through the **LATTC Bridges to Success** (for middle school students) and the **Bridge to College** (for high school students) Programs. Research has demonstrated there is a positive relationship between concurrent enrollment and short- and long-term outcomes for students including likelihood to earn a high school diploma, enrollment in college, persistence in college, and grade point averages in college. This same research demonstrates these outcomes are higher for students who concurrently enrolled in career-technical coursework.¹

Develop vertical, articulated K20 educational pathways in STEM programs. There is a need for curriculum alignment and instructor interaction to insure smooth transitions from high school to community college to four-year colleges and universities. To address this issue we are developing and implementing a **LATTC STEM Pathways**

**Initiative.** Current and new STEM degree programs at LATTC will all be aligned and articulated with universities LATTC students most commonly transfer to...beginning with CSULA. These pathways will be developed via articulation agreements, which indicate the transferable units for credit, as well as “maps” of the multiple pathways for degree attainment. Also, the **LATTC Vertical STEM Teacher Alliance** provides an arena to support opportunities for shared curriculum, vision and pathway expectations between high school, community college and four-year college instructors. Teacher training is provided jointly and collaboratively at all three levels to insure that the content, student learning, pedagogical methods, and expectations are closely aligned. It is also an arena where the teachers can get valuable information on the “green aspects” of their curriculum.

**Implement a project-based learning model that engages students in STEM disciplines through hands-on application rather than traditional STEM instruction.** The successful implementation of "learning by doing" requires high school, community college, and university faculty to work collaboratively to reconstruct their understanding of how students learn and to develop new teaching techniques. A growing body of research supports the use of project-based learning (PBL) to improve students’ attitudes toward STEM education, promote critical thinking, and enhance faculty collaboration². High school and college faculty are engaged as a community of learners in developing long-term projects (from one semester to one year in length) that involve students in complex, real-world projects through which they must draw upon skills and knowledge acquired in a-g (e.g., general education) and STEM disciplines using technology-mediated tools and applications. Technology-mediated tools will also be used to facilitate faculty professional development and collaboration on PBL such as ePortfolios, eCoaching, and GoogleApps. PBL materials, activities, resource documents are stored in an electronic repository that can be accessed by faculty at all levels. LATTC currently utilizes these resources to facilitate collaborative faculty work, most significantly it is one of the first community colleges in the nation to use GoogleApps for collaborative student and faculty work.

**Increase size and scope support network(s) for students and parents through student organizations, professional organizations, parent networks, and industry support.** Student organizations provide not only an opportunity for student involvement and increased peer support, but also opportunities for professional mentoring, scholarships, conferences and other enrichment opportunities that enhance and enrich a students’ interest in the field. Several organizations have been selected to develop **LATTC STEM student chapters** including: The National Hispanic Environmental Council, the American Chemical Society (ACS), and the Society of Hispanic Professional Engineers. In addition to the student chapters that we will start at LATTC, we also partner with and work closely with HENAAC (Hispanic Engineer National Achievement Awards Conference), a Los Angeles-based non-profit, which has an unmatched 20 year record of accomplishment in recognizing the professional achievement of Hispanic scientists and engineers. In collaboration with federal mission agencies including NASA, the Department of Energy, and the Department of Defense – as well as more than a dozen Fortune 100 multinationals – HENAAC has also developed the nation’s first bilingual STEM awareness program. Students enrolled at LATTC (including concurrent enrolled middle and high school students) are encouraged and assisted in taking advantage of the partnership opportunities HENAAC has to offer--

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particularly outside the classroom and after-school enrichment activities and support services provided by their committed private sector and government partners including the Boeing Company, Northrop Grumman, the Los Angeles District of the Army Corps of Engineers, the Department of Energy Laboratories, and others who provide mentorships, internships, conferences, and scholarships for students. Also, the LATTC STEM Student Support Services Network utilizes a number of evidenced-based tutoring models and Supplemental Instruction to increase support services for STEM students. More specifically, one-to-one, peer tutoring will be used as much as possible, but it will be supplemented by a form of computer-supported collaborative learning (CSCL), which is considered to be one of the most promising innovations to improve teaching and learning and capitalizes on youth’s and young adult’s natural propensity toward the use of computers for communication and supportive interaction. Furthermore, STEM courses identified as having less than an 80% success rate will be assigned Supplemental Instructors, advanced STEM students, who will sit in the course sessions, organize discussion sections, study groups and online tutoring groups. Finally, the College will develop the LATTC Science and Technology Parent Academy to expand the STEM student’s support network to include their parents. The Parent Academy consists of a series of presentations, conducted in English and Spanish, about STEM careers as well as college-going in general in a supportive and culturally relevant environment. In addition, STEM Parent Liaisons are employed to assist with recruitment, translation and grass root outreach to parents and students.

Funding to Support the LATTC Building K20 STEM Pathways Plan

Recently, two large grants and contracts have been secured to enable the College to implement its STEM pathways plan—a $1.35 million HSI, STEM grant and $7.4 million collaborative Department of Defense contract.

A brief synopsis of the grant and contract are provided below.

**LATTC HSI, STEM Grant (with an Emphasis on Sustainability).** Los Angeles Trade-Technical College has been awarded a two year, $1.35 million grant from the Department of Education to implement the STEM Success Program (SSP) a collaborative program with California State University Los Angeles College of Engineering, Computer Science and Technology. The overall purpose of the grant is to increase student success outcomes, particularly for Hispanic students as follows: Increased # of Hispanic students enrolled in STEM programs, Increased % of Hispanic students persisting in STEM programs, Increased # of Hispanic students earning STEM related degrees, Increased # of students transferring from LATTC to a 4-year STEM program, and Increased # of articulated degree programs in STEM disciplines. The funding will enable Trade-Tech and CSULA to create the following components that have previously been described: 1) Science and Technology Academy, 2) Additional LATTC Associate in Science Degree Programs in STEM fields, 3) STEM Pathways Initiative 4) Vertical STEM Teacher Alliance, 5) Student Leadership Development Component, and 6) STEM Student Support Services Network. In addition, all of the STEM Success Program (SSP) components will be integrated with our campus-wide “Green College Initiative”. The focus on the environment and sustainability initiatives in all activities in the SSP not only addresses a global need, but is also a documented area of interest among high school students and therefore, will create additional avenues for recruitment and sustained interest in STEM.

**The Value Chain Initiative.** Los Angeles Trade-Technical College is one of four collaborative partners in the Value Chain Initiative, a project funded by a five-year, $7.4 million contract from the Department of Defense and the US Army Corps of Engineers beginning fall, 2009. The Initiative is being led by HENACC and also includes these other
collaborative partners: the Roosevelt High School Complex (note: the complex includes Roosevelt High School and its 15 feeder middle and grade schools) and the College of Engineering, Computer Science, and Technology at California State University, Los Angeles (CSULA). This Initiative provides a pre-science program for high school students enrolled concurrently in high school, community college, and university courses. The Initiative also includes building the STEM pipeline in grade school and middle school by increasing student success in foundational math courses, exposing students to STEM careers, after school and Saturday STEM enrichment activities, learning experiences outside of the classroom, and career-technical courses at Trade-Tech that provide both “hands on—applied” and “contextualized” experiences. Parental and teacher/faculty involvement in the out-of-class activities is also included. The Initiative also includes a sustained mentorship/contact component with STEM industry role models, peers, teachers, and counselors through HENAAC. And, the Initiative includes HENAAC’s innovative Viva Technology Program which is designed to engage inner-city and rural K-12 students, teachers and parents in the applications of technology in order to stimulate interest and academic achievement in math, science and engineering, thereby laying the foundation for students to select and succeed in college and university degree programs leading to careers in science, engineering and technology. A total of 500 high school, 500 middle school, and 750 grade school students will participate in the Value Chain initiative each year.