Project Lead The Way®

Synergy of Colleges and Universities with Secondary Education

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Abstract

Project Lead The Way® (PLTW), a nonprofit corporation, has developed a national program forming partnerships among public schools, higher education institutions and the private sector to increase the quantity and quality of engineers and engineering technologists graduating from our educational system. Thirteen affiliated universities have joined in a partnership to support this mission across the country. Plans to expand this network to include 2-year colleges and teacher education universities are described.

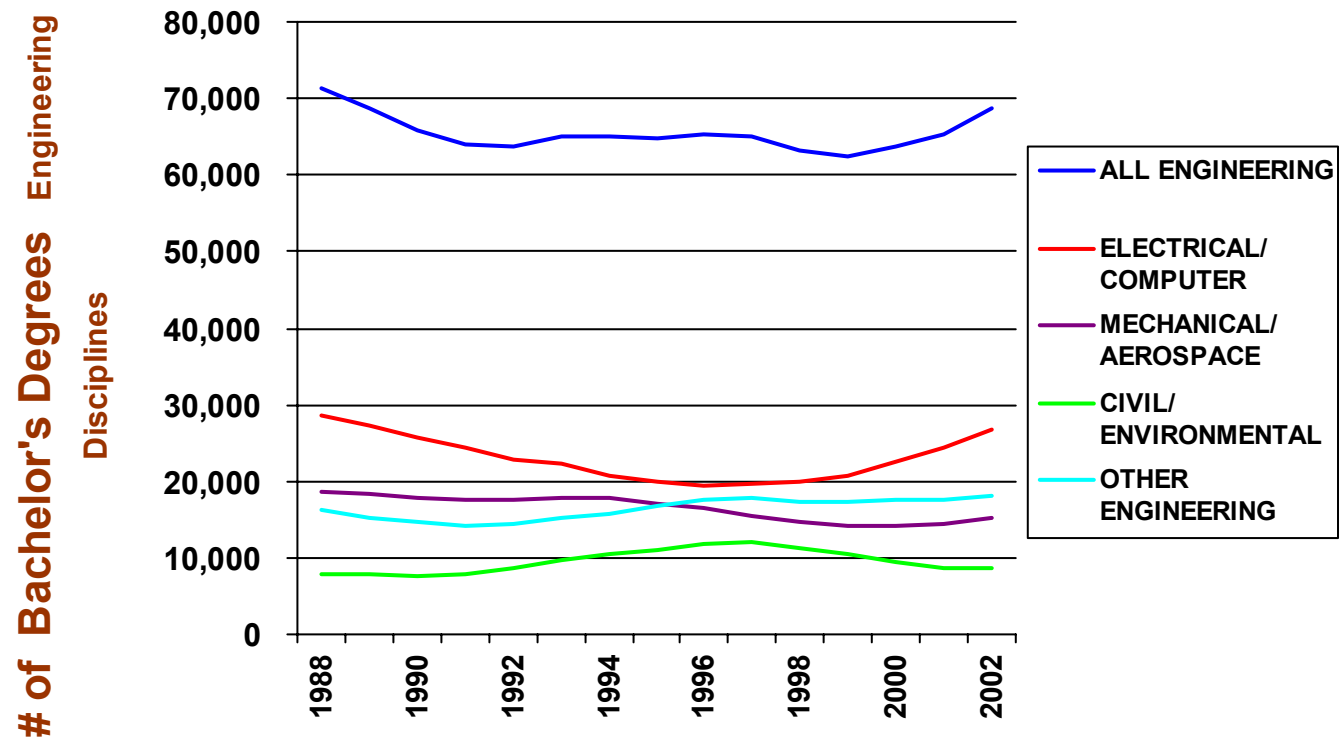
The Problem

There is a critical shortage of engineers and technologists entering the field at a time when technology is reinventing itself every few years. The accelerating pace of technological change in computer technology and communications has increased the demand for skilled workers in fields already suffering from declining interest. In a report published by the Educational Testing Service, Barton (2002), based on extensive job data from the Occupational Outlook Handbook, states that "employment in computer specialist occupations will grow by almost 2 million – almost 70 percent – from 2000-2010." Overall, employment opportunities in engineering are expected to increase by 9% with particular needs for Biomedical Engineers (+31%), Environmental Engineers (+26%), and Computer Hardware Engineers (+25%).

Yet the number of engineering degrees granted has remained unchanged since 1988 according to figures published by the American Society of Engineering Societies. There has been a precipitous decline in degrees in Engineering Technology.

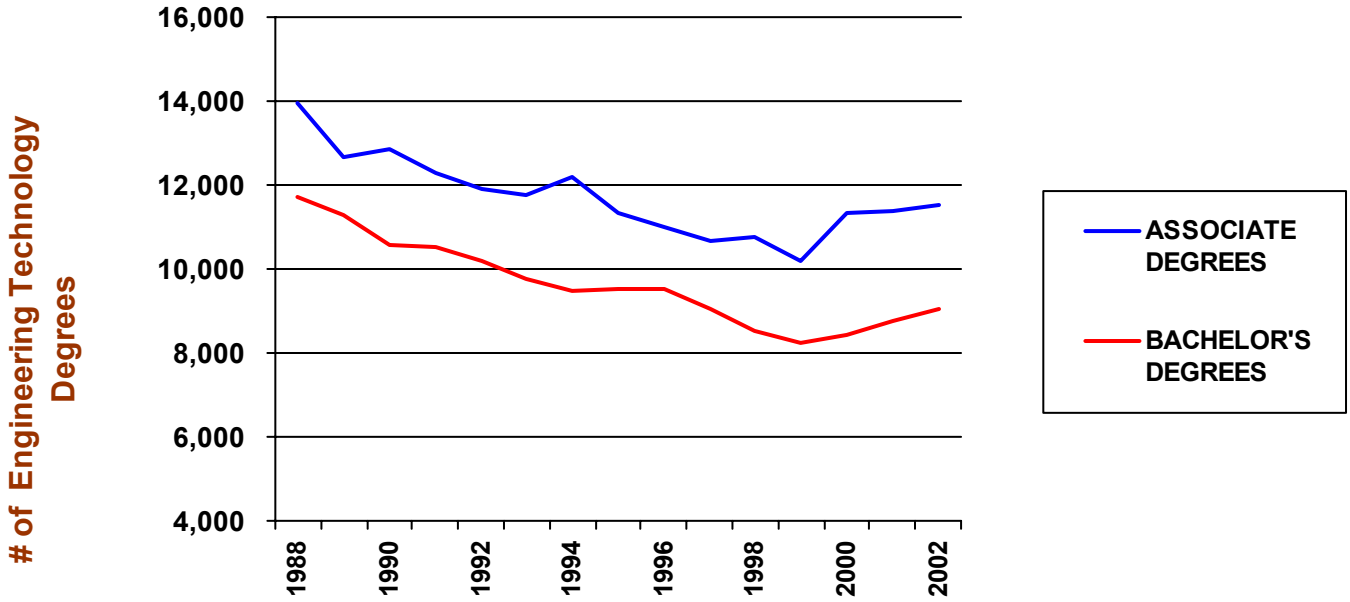
Engineering Degrees Awarded Nationally 1988-2002

SOURCE: American Association of Engineering Societies (2002)



Engineering Technology Degrees Awarded Nationally 1988-2002

SOURCE: American Association of Engineering Societies (2002)



The prospects for the future will not improve naturally since a large number of baby boomers are approaching their 60's in the next decade (Barton, 2002). The next generation of workers entering the labor force is smaller than those retiring. As they retire, where will we find skilled workers to take their place?

These statistics identify a major challenge for the United States. The country cannot remain economically competitive if the demand for people trained in engineering and engineering technology grows, while the pool of students entering and graduating from programs in these areas is static or declining.

A Solution - Pre-engineering Education in Secondary School Technology Programs

One way to address the challenge is to provide educational engineering experiences for students in secondary schools. A promising instructional model has been developed by Project Lead The Way® (PLTW) in upstate New York. For further details see Johnson, (2001) or visit the web site at http://www.pltw.org.

This nonprofit organization has developed a five-course curriculum that helps students explore engineering-related careers and develop engineering concepts that help them as they enter two- and four-year college engineering and engineering technology degree programs. PLTW aims at changing the focus of technology education at the high school level.

The strategic goal of PLTW is to forge a dynamic and on-going partnership among school districts, colleges and universities and industry that will establish and support a pre-engineering career cluster program in America's high schools. The PLTW program excites students about engineering careers and strengthens the link between traditional academic programs with hands-on learning experiences.

The graduation expectations of a secondary school student participating in the PLTW program include the capabilities of:

- Understanding the use of technology in problem solving
- Possessing knowledge of engineering and scientific methodologies.

- Being prepared for the rigors of science, engineering and technology education at the university level.
- Understanding the systems approach in engineering design and analysis.
- Developing skills in problem solving and problem analysis.
- Being skilled in the use of mathematics
- Being an effective communicator
- Demonstrating the skills necessary to work in teams effectively

Students in the PLTW program have the option to earn college credit through a certification program that enables students to take a college credit exam and earn transcripted credit. In addition, articulation agreements between secondary schools and area colleges offer seamless links between the two levels of education.

Building Project Lead The Way Post-Secondary Coalitions

A collaborative effort is necessary among post secondary institutions throughout the nation to address the shortage of engineers and individuals in engineering related occupations. This type of coalition will positively impact the number of students selecting and remaining in these fields of study. Listed below are the responsibilities for four levels of collaboration between Project Lead The Way, Inc. and post secondary institutions.

Project Lead The Way Affiliate:

Affiliate Colleges or Universities are recognized by their respective states as the main site for teacher training for Project Lead The Way schools. Current affiliate universities (one per state) include:

Rochester Institute of Technology – New York
New Hampshire Technical Institute – New Hampshire
University of New Haven - Connecticut
Pennsylvania State University - Pennsylvania
New Jersey Institute of Technology – New Jersey
University of South Carolina – South Carolina

University of South Florida - Florida
University of Houston - Texas
Purdue University - Indiana
University of Colorado at Colorado Springs - Colorado
Weber State University - Utah
San Diego State University - California
Ferris State University - Michigan

The Affiliate institutions work closely with the PLTW State Leader and State Department of Education to develop and implement a strategic state plan to:

- Build awareness regarding PLTW with state secondary schools and interested post secondary institutions;
- Develop a retention strategy for existing state PLTW schools;
- Lead the PLTW School Certification Process;
- Develop a business plan for sustainability of the program;
- Identify and support curriculum alignment strategies with secondary and post secondary institutions;
- Offer a Summer Training Institute (STI) for high school teachers when the state has a feasible number of PLTW schools;
- Identify and support Affiliate Professors to work with Master Teachers and others;
- Explore and offer graduate credit to STI participants;
- Offer recognition opportunities for secondary PLTW graduates.
- Grant and accept PLTW transcripted credit from other Affiliates and/or collaborating institutions;
- Offer a PLTW Counselor Conference for guidance counselors from PLTW schools;
- Host PLTW on-going training and other professional development for teachers who have completed the PLTW STI;
- Offer technical assistance to schools in the state PLTW network;
- Serve on advisory boards of other colleges and universities in the PLTW network.

- Have Affiliate Professors attend January and April professional development training along with the Master Teachers in preparation for the STI;
- Provide data to PLTW regarding student success and STI participant success;
- Consider offering scholarships to PLTW students;
- Develop an Affiliate link on the PLTW web page;
- Actively participate in the on-going PLTW evaluation process; and
- Assist with the review and development of state PLTW school database.

In an effort to expand the partnership role of post secondary institutions, PLTW has defined roles for other institutions starting in 2003.

Project Lead The Way Associate Institutions:

Associate institutions work together with the Affiliate institution within their state to offer more post secondary options to PLTW students in the field of engineering or other related fields of study. Associate institutions partner with the state affiliate in non-training ways to:

- Support selected faculty from the Associate institution to participate in the STI;
- Assist Affiliate with continuous professional development for trained PLTW teachers;
- Support Affiliate with technical assistance to PLTW schools and teachers;
- Grant and accept PLTW secondary student credit;
- Assist Affiliate with School Certification process;
- In partnership with Affiliate, support Counselor's Conference;
- Provide mentors for PLTW students;
- Partner with the Affiliate and State Leader to recruit and retain PLTW secondary schools in their state;
- Assist PLTW with the development of additional units of study and PLTW curriculum development and;
- Support data collection and evaluation regarding all facets of the PLTW program.
- Serve on advisory boards of other colleges and universities in the PLTW network.

Project Lead The Way Community Colleges:

Community Colleges work within their respective service area in an effort to offer more PLTW educational opportunities for students who may or may not be able to take advantage of the PLTW coursework during the regular school day and/or school year. The Community Colleges work closely with the state Affiliate institution, Associate institutions and PLTW State Leader to accomplish the goal of successfully educating more students in the field of engineering without duplicating efforts. The Community College responsibilities include:

- Offer college credit to students enrolled in the PLTW certified schools within their service area;
- Identify and support Community College Professors to attend a Summer Training Institute;
- Purchase the designated PLTW software and hardware to support the PLTW curriculum;
- Develop PLTW models to better serve potential students and life-long learners so they may take advantage of the PLTW courses. Thiswill include offering credit bearing PLTW courses on the community college campus;
- Assist with PLTW on-going training;
- Identify and/or solicit scholarships and co-op positions for PLTW students;
- In partnership with service area PLTW school, coordinate and facilitate mentors for PLTW students;
- Work with area PLTW to coordinate Pre-Engineering student organizations;
- Partner with the Affiliate and Associate Institution(s) with the PLTW School Certification Process facilitate seamless transfer to 4-year degree programs;
- Offer technical assistance to schools within their respective service area;
- In collaboration with Affiliate, Associate Institution(s) and State Leader, assist with the marketing and recruitment of the PLTW program and
- Collaborate under the leadership of the Affiliate and State Leader along with the Associate Institution(s), to develop a business plan with area business and industry to sustain the PLTW program.

- Serve on advisory boards of other colleges and universities in the PLTW network.

Project Lead The Way Technology Teacher Education Institution

Project Lead The Way partners with Post Secondary Teacher Education Institutions to offer PLTW secondary graduates and teacher candidates the opportunity to teach PLTW courses upon their successful completion of a bachelor's degree in education. Technology education teacher candidates would develop an understanding of the nature of technology within the context of the various Project Lead The Way curriculums.

- Identify and support selected professors to participate in their respective state's STI;
- Offer PLTW courses to teacher candidates as part of each candidate's post secondary degree;
- Purchase the designated PLTW software and hardware to support the PLTW curriculum;
- Participate in the data collection and evaluation of the PLTW program;
- Place teacher candidates in PLTW schools for their student teaching experience;
- Work in collaboration with the Affiliate, State Leader, Associate Institution(s) and respective Community College(s) to develop and recruit potential PLTW students; and
- Assist in the development of a state PLTW business plan with the leadership of the Affiliate and State Leader.
- Serve on advisory boards of other colleges and universities in the PLTW network.

Acknowledgements

Niel Tebbano, Director of Operations for PLTW, Inc. has been instrumental in providing material for this paper. In addition, significant recognition should be given to Richard Blais, Executive Director, for PLTW, Inc. for the development of many of the concepts that have made the PLTW program successful.

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Biography

Professor Guy Johnson is the Director of the National Technology Training Center at the Rochester Institute of Technology in Rochester, NY. The first Summer Training Institutes were held at RIT for all educators who teach Gateway to Technology (Middle School Program) or any of the five Pre-Engineering High School courses. He also oversees the RIT High School Certification and the Exemplary Student Recognition programs. Prior to this assignment he was the Department Chair for the Manufacturing and Mechanical Engineering Technology Department at RIT. He received his B.S. degree in Chemistry from the Pennsylvania State University in 1969 and M.S. degree in Systems and Information Science from Syracuse University in 1972. He has served as a faculty member at RIT since 1974 and taught in graduate and undergraduate programs in Computer Science, Information Technology and Computer Integrated Engineering Technology.

Dr. Dustin Swanger is the Associate Vice President for Workforce Development and Dean of Technical Education at Monroe Community College in Rochester, NY. He provides leadership for the non-credit training efforts of the College, as well as five academic departments including: Applied Technologies, Engineering Technologies, Hospitality, Office and Computer Programs, and the Public Safety Training Facility. Dr. Swanger has extensive experience at the higher education level in the development and administration of education and training programs for adults and growing customer bases for institutions. He is a Board Member of the Monroe County Workforce Investment Board, the High Technology Business Council and the Monroe County Manufacturing Partnership.

Dr. Swanger received his Ed.D. in Higher Education Administration from Nova Southeastern University. He holds and M.P.A. in Public Administration from the State University of New York at Brockport and a B. A. in Political Science from SUNY Fredonia.