



Viewpoints

**Issues of
Accreditation
in Higher
Education
Vol. II**

**Continuing
Education**

Foreword

There is an increasing demand for continuing education, lifelong learning as it is often called, especially among technical workers. This demand is bolstered by both employers and employees themselves, each understanding the need to stay as up-to-date as possible in these rapidly changing technological times. Because ABET is responsible for providing quality assurance in technical higher education, it is not unreasonable to think that it may, too, have a hand in quality assurance of lifelong learning in the not-so-distant future.

In light of this possibility, this report has been filed by ABET's Industry Advisory Council, based on the outcomes of its August 2001 meeting to address the issue. This group of industry leaders, often called upon to advise or direct ABET's efforts in conjunction with educational leaders, examined the scope of continuing education in engineering, its quality and its quantity, in an effort to foresee the role ABET should eventually play in this arena.

**By the Members of the
Industry Advisory Council
of the Accreditation
Board for Engineering
and Technology, Inc.**

As the second in the ABET series *Viewpoints*, this report is provided to you, our stakeholders, for both your information and your response. ABET values your input, so please take time to provide us with your comments.

Our sincere appreciation goes to the members of ABET's Industry Advisory Council and, of course, to you for your continued support of ABET.

A handwritten signature in black ink that reads "Joe R. Fowler". The signature is written in a cursive style with a large, looping initial "J".

Joe R. Fowler
ABET President, 2000-2001

Continuing Education in Engineering



Background

“We recognize that workforce learning is already receiving widespread attention from business, organized labor, educators, and others.... Employers spend an estimated \$60 billion annually on education, training, and upgrading skills of their employees. Unions are working with employers to expand education benefits for workers and their families through collective bargaining. Public institutions and government programs invest billions. Individuals are investing in skills for lifelong employability. But as changes accelerate and require ever-higher skill levels, continuous workforce learning is becoming a more critical priority.”

- *Skills for a New Century: A Blueprint for Lifelong Learning*

Continuing education is growing by leaps and bounds in this country. In August 2000, the National Center for Education Statistics (NCES) reported that an estimated 90 million adults participated in some kind of formal lifelong learning in the previous year. This number is up from 58 million in 1991 and includes ESL and GED classes, as well as courses designed for professional and personal development.

The increasing demand for continuing education could be considered to begin with the adult worker. These individuals must work harder to stay abreast of the rapid changes in technology that have occurred over the past decade. The current workforce is working longer than in the past and consistently must upgrade its skills to keep current with the changing workplace. The booming economy of the '90s could not even halt the growth of continuing education; the participation in adult learning was higher in 1999 than in 1991. Participation in learning activities increased from 38 percent of those in the population age 18 or older in 1991 to 50 percent in 1999.

As we experience a downturn in the economy, there are financial repercussions to not having the needed education and skills for the knowledge-based economy. A result is even greater participation in post-secondary education, as adults seek to refresh their skills in order to better compete professionally.

As much as individuals recognize the need to keep their skills fresh, the same could be said of their employers as they try to compete in an ever-evolving and increasingly global market place. Current estimates from the Educational Resources Information Center (ERIC) of the Department of Education cite that employers “spend approximately \$30 billion to \$50 billion on formal employee education and \$180 billion on informal, on-the-job education. Employees in companies with 600 or more employees—4.4 million people—can expect to receive frequent instruction paid for and provided by their employers.”

Industry organizations today also realize “that they must prepare employees to compete in the global economy, to meet and exceed service expectations, to adjust to changing roles and new technologies, and to respond to current and future global pressures. Continuing education and training is no longer considered a cost to cut, but rather an investment to attract and retain the best work force.”

Survey results, published in the Heller Report, on continuing education and e-learning related to the sluggish economy reported that “54 percent of corporate training managers and executives feel it will have no affect on e-learning program budgets. Eight percent of them also said they expect their e-learning budgets to expand in the face of an economic slowdown.... As companies try to get by with less staff, handling more responsibility, learning becomes even more important for companies to remain competitive and grow their markets,” said Gary Lopez, president and CEO of NETg, an e-learning provider.”

Employers have looked to universities to provide the needed education and in some instances, over the past two decades, have found their needs not being met. This has caused “the number of corporate universities to balloon from 400 to more than 2,000.”

As corporations began establishing their own universities and training centers to meet continuing education needs, higher education began responding, perceiving the potential boon in income for the institution. Today, a growing number of universities and colleges are branching out into the continuing education arena to try to satisfy the growing demands of industry and the individual. A New Model for Education-Online Universities Empower Students states:

- New York University's School of Continuing and Professional Studies now brings in about \$92 million per year in revenue, up from about \$3 million in the early 1970s. The school has 107 certificate programs, which range in length from four to eight courses, and allow students to learn skills in specialized areas such as financial planning or computer programming.
- Harvard takes in about \$150 million per year from continuing-education classes—roughly 10 percent of the university's \$1.5-billion annual budget. A study conducted a few years ago found that 60,000 students per year were taking part-time continuing-education classes at Harvard—more than three times the number then in full-time undergraduate, graduate, and professional programs.
- More than half of the 16,000 students at Johns Hopkins, which has four continuing education centers in the Baltimore-Washington region, are in part-time post-baccalaureate programs. Two-thirds of all the master's degrees awarded by Johns Hopkins are earned by part-time students.
- At the University of California at San Diego, continuing education classes generate about \$25 million in annual revenue, and programs that certify a specific set of skills are proving far more popular than traditional graduate degrees. For example, some 7,000 students are studying for a certificate of some sort in engineering.
- Berkeley Worldwide, a continuing-education program for foreign students run by the University of California at Berkeley accounted for about 40 percent of the \$45 million in revenue generated during 1997 by Berkeley Extension, the university's continuing education unit.

The growth in continuing education is expected to continue. Numerous adults are pursuing educational activities in one form or another to increase their knowledge, information, or skills in an effort to either ensure greater success in the workplace, expand their basic skills, or receive credentials—but ultimately to enrich the quality of their lives.



Continuing Education in Engineering

For the purposes of this report, “continuing education in engineering” refers to activities beyond the first degree obtained by a graduate to include both degree and non-degree-granting educational opportunities. Types of activities include traditional classroom courses, distance learning courses, evening courses, weekend seminars and workshops, web-based courses, CD-ROM courses, video courses, and graduate degree programs, offered by professional societies, universities and colleges, or other types of providers.

Engineers are not exceptions to this growth trend in continuing education. Graduation with a degree in engineering is no longer considered the end of the education process. A B.S. degree in engineering has been estimated to have a life of about seven years. Engineers are continuously challenged to keep up with the rapid changes in technology and stay abreast of current global and societal issues. Engineers engage in lifelong learning—the process of acquiring the skills and knowledge necessary to remain current in a chosen field—for a variety of reasons, including career advancement, licensure requirement, and self-fulfillment.

In September 2000, The National Society of Professional Engineers (NSPE) posted the following question on the Forum Online portion of its website: “Many Professional Engineers find it critical to expand their range of non-technical skills for their continued

professional and business development. Do you agree? What would be the value of a non-technical skills certification program?” Provided below are some responses:

“Continuing education is a necessity! However, certification programs do nothing more than provide money-making opportunities for the businesses providing the courses/seminars, and do very little in increasing the non-technical and technical skills of Professional Engineers.”

“The plethora of certification programs that have started in the past 10 years have increased the cost of continuing ed. to astronomical prices (even for courses/seminars that used to be free)!!!”

“I agree that it is critical for Professional Engineers to continue their development of non-technical skills for career development and success in the business world.”

NSPE’s question respondents raise concerns over the value, both professionally and monetarily, of non-technical skills certification programs. Their responses could perhaps be considered a backlash against the proliferation of technical-skills-based continuing education programs and certifications that use “engineer” in the title. Such programs have had a significant impact on the traditional engineering workforce, resulting in concern over who is evaluating course content and whether some certification programs are enabling unqualified individuals to call themselves “engineers.”

Industry

To stay current in their field, many engineering graduates continue to pursue their education after college. For some, this focuses on technical aspects; for others, it may involve increasing their business acumen by pursuing an MBA. These same benefits are issues for industry as they too try to keep their companies, through their employees, abreast of changes in the field.

Offering tuition reimbursement is a great benefit to both the employee and the company, but the current plethora of continuing education opportunities can be confusing to both entities. Rapid technology changes have made it possible for education to be offered anytime, anywhere and to anyone. The rapid growth of Internet and other offerings, both at universities and other organizations, has left industry leaders struggling to evaluate the quality of lifelong learning opportunities for their employees.

Robert E. Spitzer, Vice President, Technical Affiliations at the Boeing Company, which offers all employees a tuition reimbursement benefit, estimates that 30,000 of their employees take advantage of this opportunity. Approximately half of this number are taking courses specifically designed to help them in their current job or on a specific project. Thirty percent of this group are specifically involved in engineering and engineering technology courses. The other half are pursuing higher degree opportunities.

Boeing has a department that reviews tuition reimbursement applications. Basic requirements are that degree-seeking courses be provided by an institution that is regionally accredited. Professional development courses are subject to an initial review by an employee's supervisor. Boeing's basic policy is that employees should be supported in the professional development opportunities they wish to pursue. Boeing also operates an internal training education center, which provides numerous training opportunities for its employees.

Isadore Davis, Manager, Engineering University Relations/Missile Systems-Raytheon Electronic Systems, cites that the company offers the Raytheon Advanced Study Program to professional staff. Called Raytheon Scholars, employees can pursue either a Master's or Doctorate in a technical field. Individuals can choose to go full-time to a university and receive financial support in the form of tuition, fees, and books, in an amount up to 50 percent of their salary. Under this program, a degree must be achieved in 24 months. Another option is to go part-time through a work-study program. The employee works approximately 20 hours per week and has 36 months to complete a degree. The efforts by Raytheon are to provide a system that is flexible and fits the employee.

All engineers at Raytheon must complete a minimum of 32 hours of continuing education a year but the company will reimburse up to a maximum of 40 hours. The employee meets with his or her manager to discuss an Individual Training Plan. Courses can be taken outside the company or at the Raytheon Learning Institute. Current course offerings by the institute are approximately 3,200. Courses are taught by both Raytheon employees and outside instructors. Distance education opportunities are offered to employees through the National Technological Institute.

Additionally, Raytheon works with the University of Arizona to offer a Systems Engineering degree which can be achieved in two years. The university also offers employees a weekend MBA program. In two years, employees can achieve an MBA by attending classes on Fridays and Saturdays.

Licensure

State Boards increasingly recognize the need for continuing education as more states implement Continuing Professional Competency (CPC) requirements as part of professional engineering licensure. While many professional engineers voluntarily pursue opportunities to improve their technical and professional knowledge, there has been a pressure growing, from both the engineering profession and consumer advocacy groups, for these activities to be pursued and recorded in a more formal manner,

requiring Professional Engineers (P.E.s) to meet CPC requirements. CPC requirements, also referred to as “continuing professional development” or “continuing education requirements,” mandate that professional licensees demonstrate to the licensing authority the satisfactory completion of specified activities as a condition for renewal of the individual’s professional license.

The National Society of Professional Engineer’s (NSPE) website maintains the following information regarding Continuing Professional Competency Status in the states: as of January 31, 2001, 19 states had CPC rules in effect, two states have them under development, and five states have voluntary CPC programs. National licensing requirements do not exist for the P.E.; P.E.s must submit their application to each state in which they are licensed.

Many engineers, though, are not required and, therefore, do not pursue professional licensure. NSPE states that of the approximately 400,000 licenses in the U.S., only about 250,000 to 300,000 of those are individual licensees. This is due to a duality of licenses, as individual engineers seek licensure in multiple states. With the current approximation from the Engineering Workforce Commission being that there are 2 million engineers in the United States, it can be estimated that less than 20 percent of practicing engineers choose to become licensed.

Societies

Societies, along with accredited institutions, have long recognized and responded to the need for engineering graduates “to engage in lifelong learning.” Many of the engineering professional societies offer their members and others numerous opportunities to pursue continuing education with technical and professional offerings. The professional societies American Society of Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), and the Institute of Electrical and Electronics Engineers (IEEE) offer approximately 80-90 percent technical programs and 10-20 percent professional programs.

Additionally, the American Society for Engineering Education (ASEE) felt there was a “critical need for a widely accessible, national repository of continuing education courses.” ASEE established *learnon.org*, a website initiative that they operate as an online resource for continuing engineering education and distance learning, offering engineering professionals a searchable database of thousands of courses across all engineering disciplines. Learnon.org is not an evaluation agency, but providers do go through an application process before they can register their continuing education opportunities on the website.

Nina Weber, Director of Educational Services, American Institute of Chemical Engineers (AIChE), is directing the society's continuing education program into a very customer-focused and revenue-generating enterprise. Before, the program operated more as a service to members. The new direction is to increase the quality of the offerings and rid the program "of the bottom 10 percent that's not performing and bring in new courses in the top 10 percent, the performers." The society currently has 62 course titles and is slowly growing. Based on past course evaluations by attendees, success depends on keeping the information offered in the courses current, state-of-the-art, and more industry-focused, including increasing the number of instructors who are from industry rather than academia.

John Casazza, Senior Director of Continuing Education, ASCE, states that his society currently offers approximately 250 seminars per year throughout the U.S. He estimates that three to four years ago this number was only 120 to 130 course offerings per year. He projects the expected growth in the next fiscal year will raise the number to 300 courses per year. Online course offerings have increased from none two years ago to a current offering of 15. The number is expected to grow to 20 to 25 courses online in the next fiscal year.

Tom Perry, Director of Engineering Education, ASME, comments that over the last three years, the number of "live" short courses offered by his society has been reduced from 131 to 101. The demand for more courses is there, but the society decided to focus on a greater yield in revenue in its continuing education offerings. Class size has increased to 22 people per course, a 31 percent increase, which has resulted in a 20 percent increase in revenue over the last three years. Currently, the total number of continuing education activities ASME offers, including short courses, web/video-delivered courses, and in-house contract courses for companies, is approximately 180 per year. These activities account for \$4.6 million in revenue for the society per year. He expects this number to grow in the upcoming year with the society's recent establishment of a continuing education institute.

The IEEE offers over 800 courses developed or brokered by IEEE Education Activities. The emphasis is on providing its members easy access to professional development materials a flexible format—any time, anywhere. In line with this, self-study courses and videos are migrating to CD-ROM and online formats. The IEEE Professional Development Institute (PDI) provides an online searchable index of IEEE products, as well as a wide variety of educational experiences. This includes IEEE Technical Society tutorial overviews. In addition, The IEEE Technical Societies, Sections, and Chapters offer on-site seminars and tutorials for their own audiences at numerous conferences and meetings.



Universities

A growth in universities offering continuing education opportunities, beyond the graduate degree level, should be duly noted. As of June 26, 2001, 75 of the 330 schools with ABET-accredited engineering programs were listed on the ASEE *learnon.org* website as registered providers of continuing education opportunities for engineers. A sampling of these registered providers offers some information about the growth of continuing education of engineers at the university level.

- University of Colorado at Denver College of Engineering and Applied Science Continuing Education has grown from offering 10 classes in 1994 to approximately 30 classes being offered in fall 2001.
- The Center for Advanced Training in Engineering and Computer Science (CATECS) at the University of Colorado at Boulder has experienced substantial growth since its establishment in 1983. Course enrollments were at 201 (note: an individual could have multiple enrollments) in 1983-84, where current enrollments for 2000-01 are 1,506. In 1983-84, the number of course offerings was 18, this number has increased to 150 in 2000-01.
- Penn State's office of Engineering Continuing and Distance Education (C&DE) reports that its greatest growth has been in non-credit programs, specifically those that focus on training individuals. Six years ago, approximately 30-40 programs per year were offered. Current offerings are 50-100 programs per year.
- In the early 1980s, The Professional Development Department in the School of Engineering at University of Alabama at Birmingham offered approximately 20-50 courses per year with upwards of 400 students. In 1996, the department began operating as a for-profit cost center of the engineering school and has enjoyed steady growth. The department currently offers 150 courses with upwards of 1,400 students.

The article *Engineers Gain Option in Continuing Education* discusses the establishment of a joint effort between Stevens Institute of Technology and the Institute of Electrical and Electronics Engineers (IEEE) to offer online degree programs to engineers in telecommunications management and wireless communications. “The quick pace of technological change has prompted trade organizations like the institute to look beyond traditional educational resources like journals and meetings for continuing education for their members.... Many societies are now trying to upgrade the skills of their members.... Stevens has received approximately 100 inquiries about the programs from members of the institute, and has 30 students enrolled in the first three courses.... Member response to the course offerings has exceeded expectations.”

Evaluation

“The regulated professions are moving increasingly toward requirement of continuing professional development as a means of assuring professional competency. Already, there is a commercial and competitive zoo of courses that purport to satisfy this need.”

- Lee Saperstein, *ABET's 68th Annual Report 2000*

Statistical and anecdotal evidence supports that the growth of continuing education is on the rise and a veritable “zoo of courses” exists. As this growth continues, concerns exist over the quality of some continuing education opportunities. Earlier in this report, individual concerns over the proliferation of courses were cited in quotes from the NSPE website. Approximately 20 percent of the information inquiries to ABET’s Accreditation Department from individuals regard continuing education. ABET headquarters has received multiple inquiries from both state chapters and national headquarters of professional engineering societies relating to its plans for quality assurance of continuing education in the U.S. Discussion at last year’s Board meeting and the resulting establishment of a sub-team of the IAC to review the issue is evidence that industry members have concerns regarding quality assurance in continuing education.

In a June 2001 brief, the National Governors Association, Commission on Technology and Adult Learning, presented the following commentary on continuing education in the U.S.:

“Create the highest-quality e-learning experiences possible. Rapid growth in such areas as distance learning, technology-enabled assessment, and the increasingly diversified and expanded public-private adult learning marketplace requires us to develop new strategies for assuring quality and protecting consumers. Important priorities for the public and private sectors include providing reliable and universally accessible quality information for consumers; developing quality assurance mechanisms; ensuring that learners have the support they need to make the right decisions about their e-learning options; and developing policies and practices to ensure privacy.”

Currently, the International Association for Continuing Education and Training (IACET) exists as the main national organization that evaluates providers of continuing education courses in professions and is not limited to engineering. IACET-registered providers can offer Continuing Education Units (CEUs) to their participants, which are the units of measure most accepted by State Licensing Boards. Approximately seven of the 32 ABET Member Societies have registered with IACET as Authorized Providers of CEUs.

The American Council on Education (ACE) offers a service for continuing education providers in which courses are reviewed by college-level faculty teams to determine college-level equivalency. ACE also reviews an array of course providers and is not limited to engineering. As stated on their website, “ACE has reviewed thousands of training courses for Fortune 500 corporations, associations, labor unions, government agencies, schools, and training suppliers.”

The Professional Development Registry of Engineers and Surveyors (PDRES), operated by the National Society of Professional Engineers (NSPE), offered a registry record-keeping service and reviewed provider course submittals using criteria created by IACET. PDRES did not guarantee acceptance of registered courses by State Licensing Boards but did offer some measure of recognized quality control. NSPE suspended PDRES activities on June 30, 2000.

A number of Internet websites offer themselves as online resources for continuing education. These sites do not offer specific course review or quality control but simply serve as a “clearinghouse” of courses for professionals seeking continuing education.

ABET

ABET is a recognized leader in the accreditation process. Since 1932 it has carved the path of the accreditation process in the United States and in the last 10 years has gained national leadership in assessing the quality of engineering, technology, computing, and applied science education through its accreditation practices. Through its accreditation activities, ABET has helped to assure industry of the technical qualifications of engineering graduates.

As engineering graduates move into careers and pursue continuing education, an important discussion is developing regarding quality assurance of these opportunities. One result of that discussion is an objective of ABET's Strategic Plan: "determine ABET's role in continuous professional development."

In addition to its mention in ABET's Strategic Plan, the importance of continuing education for engineering graduates is part of EC2000. Criterion 3 (i) states, "Engineering programs must demonstrate that their graduates have...a recognition of the need for, and an ability to engage in, lifelong learning." The need for pursuit of lifelong learning opportunities is echoed in the recently established outcomes-based criteria for technology (TC2K) and applied sciences (AC2001). Lifelong learning covers a broad spectrum of continuing education options, including short courses, professional society meetings, and graduate degree programs.

Another objective of ABET's Strategic Plan is to "examine feasibility of multi-level accreditation." Institutions accredited by the Engineering Accreditation Commission (EAC) currently can only submit educational programs for accreditation at one degree level (i.e. undergraduate or graduate, associate or baccalaureate). Institutions that offer multiple degree levels in engineering currently cannot pursue accreditation of more than one degree program.

As the current industrial climate encourages, if not demands, the number of engineering graduates pursuing this next level of the lifelong learning process is on the rise. The feasibility of multi-level accreditation by the EAC could be considered a related part of any further discussion by ABET on continuing education for engineers.

References

National Center for Education Statistics (NCES).

Leadership Group on 21st Century Skills, *Skills for a New Century: A Blueprint for Lifelong Learning*, <http://novel.nifl.gov/nifl/skills.htm>, 2000.

Kwang Kim and Sean Creighton, *Participation in Adult Education in the United States: 1998-99*, <http://nces.ed.gov/pubs2000/qrtlyspring/6life/6-esq21-toc.html>, 2000.

Nancy S. Nash and Elizabeth M. Hawthorne, *Corporate Education. ERIC.Digest*, http://www.ed.gov/databases/ERIC_Digests/, 1988.

Elsa Schelin, A New Model for Education - Online Universities Empower Students, <http://www.elearningmag.com/may01/onlineuniversity.asp>, May 2001.

Jeanne C. Meister, *The Brave New World of Corporate Education*, The Chronicle of Higher Education, <http://chronicle.com/chronicle/>, February 2001.

Ben Gose, *Surge in Continuing Education Brings Profits for Universities*, The Chronicle of Higher Education, <http://chronicle.com/chronicle/>, February 1999.

Penn State Engineering Continuing and Distance Education Office, <http://www.engr.psu.edu/cde/>.

National Society of Professional Engineer (NSPE), <http://www.nspe.org/>.

Engineering Workforce Commission (EWC) of the American Association of Engineering Societies (AAES), www.aaes.org/ewc.

American Society for Engineering Education (ASEE), <http://www.asee.com/>.

Sarah Carr, *Engineers Gain Option in Continuing Education*, The Chronicle of Higher Education, <http://chronicle.com/chronicle/>, March 2000.

NGA Center for Best Practices, *A Vision of E-Learning for America's Workforce*, http://www.nga.org/center/divisions/1,1188,C_ISSUE_BRIEF^D_2128,00.html, June 6, 2001.

International Association of Continuing Education and Training (IACET), <http://www.iacet.org/>.

American Council on Education (ACE), <http://www.acenet.edu/>.

ABET Strategic Plan, Accreditation Board for Engineering and Technology, Inc., (ABET), November 1, 1997.

Engineering Criteria 2000, Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Inc., 2001.

2001 ABET Industry Advisory Council

Casimir S. Skrzypczak
*Global Communications
Partners II*

Sid Banwart
Caterpillar Inc.

Terry Brewer
Brewer Science, Inc.

Ronald L. Carle
*Law Engineering &
Environmental Services*

Ben S. Markham
*ExxonMobil Research
and Engineering Co.*

John M. Samuels
*Norfolk Southern
Corporation*

Robert E. Spitzer
The Boeing Company

Peter Staudhammer
TRW, Inc.

Mary Jane Hagenson
*Chevron Phillips
Chemical Company*

Stephen J. Andriole
Safeguard Scientifics, Inc.

Joe R. Fowler
*ABET President
Stress Engineering
Services, Inc.*

Lonnie Williams
*Scientific and Commercial
Systems Corp.*

Lee W. Saperstein
*ABET Past President
University of Missouri-Rolla*

Herbert Whitney
*CITGO Petroleum
Corporation*

Isadore T. Davis
*Raytheon Electronic
Systems*

Randy Hinrichs
Microsoft Research

Win Phillips
*ABET Academic Liaison
University of Florida*

Jerry R. Yeargan
*ABET President-Elect
University of Arkansas*

ABET Staff

George D. Peterson, Ph.D., P.E.
Executive Director

Kathryn B. Aberle, CAE
Associate Executive Director