DOCUMENT RESUME

ED 156 487 SE 024 448

AUTHOR Grayson, Lawrence P., Ed.; Biedenbach, Joseph M., Ed.

TITLE 1978 College Industry Education Conference, Theme: Effective Management of Human Resources. Proceedings, January 24-27, 1978.

INSTITUTION American Society for Engineering Education, Washington, D.C.

PUB DATE 78

NOTE 308p.; Not available in hard copy due to copyright restrictions

AVAILABLE FROM American Society for Engineering Education, Suite 400, One Dupont Circle, Washington, D.C. 20036 ($12.00 ASEE members)

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.

DESCRIPTORS Conference Reports; *Engineering Education; Graduate Study; Higher Education; *Industrial Education; Industrial Technology; *Industry; Science Education; Symposia; *Technical Education; *Technology

ABSTRACT

Included in these proceedings are papers on such topics as developments and trends in two-year engineering technology programs, cooperative education programs, women in engineering, registration and certification of engineering technology graduates, management education, market analysis, continuing engineering education, industrial training programs, and many other areas of concern to engineering, technical, and industrial education. (BB)

ED156487

Proceedings

1978 College Industry Education Conference

January 24-27, 1978
San Diego, California

American Society for Engineering Education

edited by
Lawrence P. Grayson
Joseph M. Biedenbach

PROGRAM AT A GLANCE — COLLEGE INDUSTRY EDUCATION CONFERENCE

TUESDAY, JANUARY 24, 1978

TIME	
0700 - 0900	WELCOME TO THE 1978 COLLEGE INDUSTRY EDUCATION CONFERENCE
0900 - 1030	CED BOARD MEETING — El Camino; INTERNATIONAL DIVISION — Adobe
1030 - 1100	
1100 - 1230	
1230 - 1400	CES BOARD MEETING — Mesa; ENGINEERING TECHNOLOGY DIVISION BOARD MEETING — El Camino; RELATIONS WITH INDUSTRY DIVISION BOARD MEETING — Adobe
1400 - 1530	
1530 - 1600	
1600 - 1730	COMBINED DIVISION CHAIRMAN AND PROGRAM CHAIRMAN'S MEETING (DEL MAR ROOM)
1730 - 1900	
1900 - ?	ON THE TOWN

WEDNESDAY, JANUARY 25, 1978

SESSION	TOPIC	ROOM
A	ETD Newcomers Breakfast	Santa Fe
B	CES Newcomers Breakfast	Helix
1 1	Effective Development of Human Resources for Industry	Calif
	COFFEE BREAK - SOUTH FOYER	
2 1	Determining Corporate Training Needs & Trainee Selection	Friars
2 2	Developments & Trends In Two Year Engineering Technology Programs	Sierra
2 3	Employer Planning, Organization, and Management of a Cooperative Education Program	Padre
C	RWI Luncheon	Tiki Hut
3 1	Who Really Determines Whether An Engineer Is Required For a Particular Job	Sierra
3 2	Women in Engineering and Science	Del Mar
3 3	Registration & Certification of Engineering Technology Graduates	Padre
3 4	CES WORKSHOPS:	
	A Workshop Managing Vitality	Santa Fe
	B Workshop Market Analysis	De Anza
	C Workshop Personalized Continuing Engineering Education	Mesa
	D Workshop Training Measurement & Evaluation	Adobe
	E Workshop Media Selection	El Camino
	COFFEE BREAK - SOUTH FOYER	
4 1	Industrial Training Programs	Friars
4 2	The College and University Role in Cultivating New Cooperative Education Employers	Sierra
3 4 Cont	Continuation of Session 3 4 CES Workshops in Same Locations	
	ON THE TOWN	

THURSDAY, JANUARY 26, 1978

SESSION	TOPIC	ROOM
D	CED/ID Newcomers Breakfast	Santa Fe Helix
E	CES Special Interest Group Career Management	Adobe
F	CES Special Interest Group International Continuing Education	El Camino
G	CES Special Interest Group ITFS	Mesa
H	CES Special Interest Group Media Producers/Users	De Anza
5 1	Effective Management of Human Resources	Calif
	COFFEE BREAK - SOUTH FOYER	
6 1	MEET THE EXPERTS	Golden West
I	CES/ID Luncheon	San Diego
J	CED Business Luncheon	Padre
7 1	How Do Coop Experiences Complement Engineering Curriculum	Calif
7 2	Developments & Trends In Four Year Engineering Technology Programs	Sierra
7 3	CES WORKSHOPS:	
	A Workshop Managing Vitality	Santa Fe
	B Workshop- Market Analysis for CES Products	De Anza
	C Workshop Personalized Continuing Engineering Education	Mesa
	D Workshop Training Measurement and Evaluation	Adobe
	E Workshop Media Selection	El Camino
	COFFEE BREAK - SOUTH FOYER	
8 1	Open Universities - Challenges for Engineering	Del Mar
8 2	What Constitutes An Effective Cooperative Education Experience	Padre
8 3	The Walls Came Tumbling Down Distance Delivery Discourses	Sierra
8 4	Who On Campus Hears Industry's Voice	Friars
7 3 Cont	Continuation of Session 7 3 CES Workshops In Same locations	
	SANITY BREAK CASH BAR - SOUTH FOYER	
K	CONFERENCE BANQUET	Golden West Calif

FRIDAY, JANUARY 27, 1978

SESSION	TOPIC	ROOM	TIME
L	Conference Committee Breakfast	Del Mar	0700 - 0900
M	CES Special Interest Group Registration & Certification	Adobe	
N	CES Special Interest Group Personalized Continuing Education	El Camino	
O	CES Special Interest Group Professional Societies	Mesa	
P	CES Special Interest Group University Continuing Education Directors	De Anza	
9 1	Industry Involvement - The Effect of Management of Human Resources	Calif	0900 - 1030
	COFFEE BREAK - SOUTH FOYER		1030 - 1100
10 1	Career Development - Program for Engineering Technology Graduates	Calif	1100 - 1230
10 2	International Division Business Meeting	Del Mar	
10 3	Is Engineering All It's Cracked Up To Be	Helix	
Q	Conference Luncheon	Friars Padre Sierra	1230 - 1400
	CES DIVISION BOARD MEETING - SENATE ROOM; CONFERENCE STEERING COMMITTEE EVALUATION OF CONFERENCE COMMITTEE ROOM; ASEE Board of Directors Meeting (1 00 - 11 00 PM) El Camino; January 28, 1978 ASEE Board of Directors Meeting (8 00 AM - 12 Noon) El Camino		1400 - 1530
			1530 - 1600
	HAVE A SAFE TRIP HOME THANKS FOR COMING		1600 - 1730
			1730 - 1900
			1900 - ?

RWI

1978
COLLEGE INDUSTRY
EDUCATION
CONFERENCE

Theme
Effective Management of Human Resources

RWI

PROCEEDINGS

January 24-27, 1978

Edited By
Lawrence P. Grayson
NATIONAL INSTITUTE OF EDUCATION
WASHINGTON, D.C.

Joseph M. Biedenbach
UNIVERSITY OF SOUTH CAROLINA
COLUMBIA, SOUTH CAROLINA

AMERICAN SOCIETY FOR ENGINEERING EDUCATION

San Diego

AMERICAN SOCIETY FOR ENGINEERING EDUCATION

PRICE

$12.00 ASEE Members

CATALOG NUMBER

CIEC 3

TABLE OF CONTENTS

FOREWORD

Lawrence P. Grayson
Chief, Technological Applications Division
National Institute of Education
Washington, D.C.

Joseph M. Biedenbach
Director, Continuing Education For Engineering
University of South Carolina
Columbia, South Carolina

This third annual College Industry Education Conference is devoted to the theme "Effective Management of Human Resources". In today's society, with its changing needs and priorities and a renewed recognition of the importance of people as individuals, this is a particularly important topic. The growing concern and response to problems of the environment, energy resources, health care, housing, education and food have important implications for the number, type and quality of engineers and engineering technologists to be trained in the coming years. This is true both nationally and internationally, as countries and people become more concerned about our less privileged brethren.

This year's conference is sponsored by five divisions of the American Society for Engineering Education--the four original sponsors, Cooperative Education, Continuing Engineering Studies, Engineering Technology, and Relations with Industry division, have been joined by the International Division. Each of these groups has a different and important point of view to bring to bear on the theme, as reflected in the program.

In the past decade, a good deal of rethinking has been done about traditional concepts and approaches in education and career development, giving rise to experimentation and the development of new patterns of schooling and personnel management. This has been particularly true at the post-secondary level, giving engineers and engineering technologists expanded opportunities to continue or resume their education. New methods are being developed to deliver continuing education to those who need it. where and when they require it. Television, newspapers, audiovisual techniques and a variety of telecommunications applications combined with open systems of education are being employed to provide education at work sites, on-campuses and in homes. Industrial organizations continue to offer extensive programs of continuing education to meet the specialized needs of their companies, as well as engage in cooperative education programs with engineering schools to develop new practitioners. A system of recurrent education is evolving, primarily in Europe, which allows people to engage in alternate periods of work and study, permitting them to leave the educational system without sacrificing forever, because of lack of opportunity or financing, the right to return. France has taken this to the point of having employers contribute a fixed percentage of an employee's salary to a central fund which will support the employee during "Sabbatical" leaves for schooling. Industry is developing and utilizing more than ever before comprehensive and systematic methods for career planning to allow a fuller and more personally satisfying development of the employee, while at the same time making him or her more productive and valuable to the company. The result of these and other activities is that more flexible arrangements for education and career development are possible, which allow a continuous adjustment of careers to labor market opportunities, changing social conditions, ambitions and personal desires. This conference and the pages of these Proceedings will explore various, important aspects of these topics.

The editors are indebted to the chairmen of the sponsoring groups for their support, to the program and sessions chairmen for their willingness and cooperation in responding to the many requests made of them, and to Jim Todd for his confidence and support, allowing deadlines to be met and these proceedings to be published.

The editors are especially grateful to Mrs. Linda K. Maynard of the University of South Carolina and Miss Carol Foley of the National Institute of Education for their uncomplaining and ever cheerful secretarial assistance.

LAWRENCE P. GRAYSON is serving as chief of the Technological Applications Division and as program manager for telecommunications applications in the National Institute of Education, where he is responsible for activities in the educational use of communications satellites, computer-based management information systems for higher education, and the support of an open university at the University of Mid-America. He has served as director of the Division of Technology Development in the U. S. Office of Education, taught on the faculties of The Johns Hopkins University and Manhattan College, and worked for IBM, after receiving a Ph.D. in electrical engineering from the Polytechnic Institute of Brooklyn. He currently is chairman of ASEE's Society Publications Committee and, in ASEE, has served as Vice President, chairman of the Council for Teaching and Learning, and chairman of the Educational Research and Methods Division, among other offices.

Joseph M. Biedenbach received his Ph.D. from Michigan State University in Higher and Adult Education. He has served on the faculties of General Motors Institute, Purdue University, Florida Atlantic University. He served as Associate Dean of the Indianapolis Campus of Purdue University, Director of Education Resources for the Milton S. Hershey Medical Center and currently is the director of Continuing Education for Engineering and Health Sciences at the University of South Carolina. Industrial experience includes a research physicist for A.C. Spark Plug Division of General Motors Corporation, Director of Continuing Education on the corporate staff of RCA Corporation, and supervisor of construction for American Bridge Company.

CONFERENCE GENERAL CHAIRMAN

James P. Todd
Chairman, Engineering Technology Department
California State Polytechnic University
Pomona, California

The general chairmanship of a conference having the national scope of the ASEE's College-Industry Education Conference is an exciting challenge. Those who have attended these CIEC meetings over the past few years know of their value and look forward to each successive get-together. This particular conference emphasizes the industry/education interface and as such provides valuable input from professional engineers, technologists and technicians needed in the broad spectrum of engineering education today. My position has been 'routine' due to the effective job done by all the division officers and session chairpersons. It would be redundant to list all these persons by name here; however, several must be singled out for special recognition. These are Ann Decker, Registration; George Craig, Local Arrangements; Joe Biedenbach and Larry Grayson, Proceedings.

Each CIEC meeting seems to add a new dimension, and at the same time provide a certain continuity. The conference in San Antonio, Texas last year saw four participating divisions--Relations With Industry (RWI), Continuing Engineering Studies (CES), Cooperative Education (CED) and Engineering Technology (ETD)--along with the Technology/Engineering Coordinating Committee (TECC). The interaction of these four divisions of ASEE in joint session, in addition to individual sessions, enhanced the benefits from the program and provided a forum for the dual program symposium which had been held as a separate meeting. This interchange of program ideas within these four divisions was instrumental in the decision to a fifth division this year--the International Division (ID). With this added dimension the conference committee is looking forward to interesting and valuable sessions for the 1978 College-Industry Education Conference here in San Diego, California.

Your program committee has worked hard to develop the type of program that you the members have requested--built around the theme of this CIEC Conference, "Effective Management of Human Resources." We hope you will participate in the discussion which makes each session more dynamic and relevant to the participants.

Outstanding speakers and knowledgeable resource specialists have been scheduled throughout this conference. These printed proceedings, which you are reading, represent an effort which I believe pays many dividends. The speakers have been asked to supplement the printed remarks, while the audience is encouraged to be prepared to challenge the hypotheses or ask pertinent questions related to an update of the subject matter. Again our co-authors have done an outstanding job!

Opportunities for informal as well as formal exchanges of ideas has been incorporated again this year in the planning of this program. The convention facilities of the Town and Country Hotel are excellent. I am sure you will find a congenial atmosphere here in San Diego's Mission Valley where the conference is being held, and the surrounding area is equally friendly and casual.

The Conference program committee extends its welcome to you at this 1978 College-Industry Education Conference. The attitude and cooperation of all the divisions have made this conference the success it is. Your cooperation in being prompt and attentive of the various sessions will be appreciated by all concerned.

If you find this to be the best CIEC Conference to date, it is due to the many people who gave of their time and talents to make it so. I am proud to be part of this team.

James P. Todd

James P. Todd
General Chairman
1978 CIEC Conference

JAMES P. TODD

"Jim" is the Chairman of the Engineering Technology Department, and a Professor in the School of Engineering at the Calif. State Polytechnic University in Pomona. He was the Associate Dean of Engineering from 1970-72 while the B.S.E.T. and Masters of Engineering programs were being developed. [illegible] Todd received his B.S. and M.S. degrees in Mechanical Engineering from Stanford University. He is a registered professional engineer (mechanical) in California. Prof. Todd was the 1976-77 Chairman of the Technology and Engineering Coordinating Committee (TECC) of ASEE, having been the Secretary during 1975-76. He is currently Secretary of the Engineering Technology Division (ETD) of ASEE. His thirteen years of industrial and consulting experience includes such companies as Pratt & Whitney Aircraft, Aerojet-General, Lycoming Division of AVCO, Plasmadyne Corp. and JPL. Among his professional society affiliations are ASME, ASEE, AIAA and ASTM.

A MESSAGE FROM THE ASEE PRESIDENT

Otis E. Lancaster
Chief, Section of Mathematics and Statistics
Associate Dean and Westinghouse Professor Emeritus
The Pennsylvania State University
Interstate Commerce Commission
University Park, Pennsylvania
Washington, D. C.

"LIVE AND LEARN, DIE AND FORGET IT ALL", JOHN COBB 1929

Living and learning go hand in hand. In fact learning is an integral part of civilization. Learning has been essential to survival. Civilizations have given away to new civilizations which knew more about supplying protection, food, water, and shelter. Those cultures which became dormant or stagnated in their learning have literally died or have become second-class societies.

Where does this stagnation take place? Probably in the areas of science, technology, and engineering. Who must learn to prevent this? Each of us! all of the people!

When must we learn? I have heard students say upon graduating, "I am glad this grind is over. I never expect to open a book again". We all know there is far more to learning than book learning. So, I am sure, these same students will learn more in some way later. And, of course, such comments are made at the end of a curriculum by weary workers. Their views will change. However, there is a big temptation to rest on our laurels. When one gets a Ph.D., there is a feeling he has it made. He has a corner on knowledge and life.

A distinguished professor at Harvard University made it clear to his students when they got their Ph.D.'s that he expected them to devote their lives to research. Live and learn, or learn and live. Although I quarrel with the idea that learning comes only through research, I applaud his basic idea. Whatever the learning endeavor, one should concentrate upon it. (In an engineering context, I prefer design and development to research.) The theme is to live, which means learn.

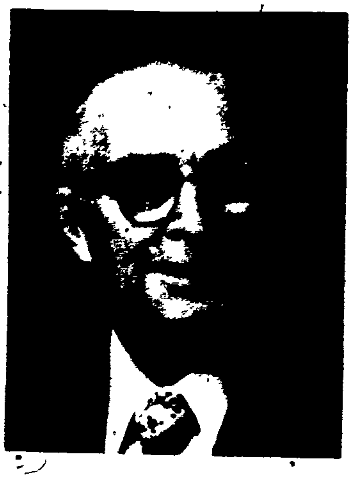
The statements on learning are not confined to the classroom. Lawrence Welk completed only the fourth grade. Yet, he has learned about and promoted a style of music which is living. My father did not complete grade school; yet, it was said, he could figure faster with a stick in the ashes than high school graduates. Once in my career I worked in an Aviation Design Research Division whose director had left Michigan State University after two years of engineering. Yet he formed his own company and was made a fellow of societies, both in the United States and Europe. These examples point to the fact that formal education is not the only kind of learning. We must learn in school and out of school. The first only gives a foundation for future learning.

The essential point is there must be <u>continual</u> learning, or as frequently expressed, life-long learning. One interpretation of Cobb's statement could be when one quits learning he is dead (intellectually dead).

Hence, the most important part of an engineer's education is the kindling of the desire and the development of the ability to learn throughout life.

There is a two-fold message in Cobb's statement. The first, learning is a requirement for living. The second, much is forgotten at death. This is true of civilizations as well as of individuals. Much was lost with the fall of the Incan Empire, the civilization on Easter Island, the unknown culture which constructed Stone Henge in England, the knowledge in Egypt which built pyramids. Much knowledge and many skills are lost when individuals die. An example of this is the irretrievable loss of the knowledge and skill needed to make the famed glass flowers in the Harvard Museum.

The message is that the important ideas, concepts, and techniques should in some manner be preserved for the future. Of course, there may be physical disasters in spite of such preservation such as the volcano at Pompeii. Yet every effort should be made to publish what is learned so that future learning will build up on past knowledge. It has often been said that in ASEE we rehash the same old subjects over and over again. For what truth there is in the statement, it probably results from a lack of sufficient effort to preserve the thoughts and skills of the past. I want to commend this conference for preserving the important ideas presented here by issuing the "Proceedings". By combining the "Proceedings" with continued learning; <u>engineering will not die</u>.



Otis E. Lancaster is President of ASEE; Associate Dean and Westinghouse Professor for Engineering Education Emeritus, College of Engineering, The Pennsylvania State University; and Chief of Mathematics and Statis Interstate Commerce Commission. He has a Ph.D. from Harvard University, an aeronautical engineering degree from California Institute of Technology, a MA from the University of Missouri, and a BS in Education from Central Missouri State University. Otis was on the faculty of Penn State for 18 years, at the University of Maryland for 5 years, and at Harvard University for 1 year. He directed the Penn State-ASEE Institutes on effective teaching. He is author of "Effective Learning and Teaching", co-author of "Gas Turbines for Aircraft", and has published about 40 papers on teaching gas turbines, and mathematics. He is a Professional Engineer and has directed a graduate program for the preparation of technology teachers. He has been consultant to NASA Administrators, FAA, Pennsylvania Railroad, Easters Railroads, Bendix Corporation, Rockwell, and several universities.

STEERING COMMITTEE

1978 College Industry Education Conference

San Diego, California

1978 COLLEGE INDUSTRY EDUCATION CONFERENCE

1978 GENERAL CHAIRMAN
Mr. James P. Todd
Chmn., Engr'g. Technology Dept.
Calif. State Polytechnic Univ.
Pomona, CA 91768
(714) 598-4322

1978 REGISTRAR & TREASURER
Mrs. Ann L. Decker
Secty., Engr'g. Technology Dept.
Calif. State Polytechnic Univ.
Pomona, CA 91768
(714) 598-4322

1978 LOCAL ARRANGEMENTS CHAIRMAN
Dr. George T. Craig
Assoc. Dean of Engineering
San Diego State University
San Diego, CA 92182
(714) 286-6061

1977 & 1978 CO-EDITOR PROCEEDINGS
Dr. Lawrence P. Grayson
Director, Tech. Appl. Division
National Institute of Education
Washington, DC 20208
(202) 254-6050

LONG RANGE PLANNING
Mr. Alvah K. Borman, Dean
Graduate Placement Services
Northeastern University
Boston, MA 02115
(617) 437-2430

1977 GENERAL CHAIRMAN
Dr. Carl P. Houston
Assoc. Dean, College of Technology
University of Houston
Houston, TX 77004
(713) 749-1341

1977 REGISTRAR & TREASURER
Dr. Irvin Bennett Miller
302-D Cullen College of Engr'g.
University of Houston
Houston, TX 77004
(713) 749-4406

1977 LOCAL ARRANGEMENTS CHAIRMAN
Dr. Carl W. Morgan
Director, Engr'g. Career Asst.
Center
University of Texas
Austin, TX 78712
(512) 471-1915

INTERNATIONAL DIVISION CHAIRMAN
Dr. Vladimir Yackovlev
Central University
Apartado 51566
Caracas 105, Venezuela

RWI 1977-78 CHAIRMAN
Mr. B. J. Whitworth
Mgr., Product Reliability
Hughes Tool Co.
P. O. Box 2935
Houston, TX 77001
(713) 924-2600

RWI 1976-77 CHAIRMAN
Dr. Walter R. Turkes
Assoc. Dean of Engineering
323 Benedum Hall
Pittsburgh, PA 15261
(412) 624-5262

RWI PROGRAM CHAIRMAN
Mr. Karl W. Doerr
Mgr., University Relations
Westinghouse Electric Co.
Ardmore Blvd.
Pittsburgh, PA 15221
(412) 256-5673

CES DIVISION CHAIRMAN
Dr. Raymond J. Page
Director Cont. Engr'g. Education
General Motors Institute
1700 W. 3rd Avenue
Flint, MI 48502
(313) 766-9442

CES PROGRAM CHAIRMAN
Mr. Charles J. Sener
Director, Ed. & Training
Bell System Center for
Technical Education
6200 Route 53
Lisle, IL 60532

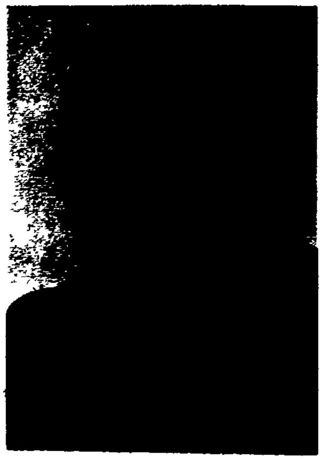
ETD DIVISION
Mr. Ralph E. Davey
Dept. Head Aeronautical
Technology
Wentworth Institute
550 Huntington Avenue
Boston, MA 02115
(617) 442-9010

ETD PROGRAM CHAIRMAN
Prof. Frank V. Cannon
Dean of Engineering
Milwaukee School of Engr'g.
P. O. Box 644
Milwaukee, WI 53201
(414) 272-8720

CED DIVISION CHAIRMAN
Dr. Robert L. Heyborne
Dean of Engineering
University of Pacific
3601 Pacific
Stockton, CA 95211
(209) 946-2575

CED PROGRAM CHAIRMAN
Dr. Anthony L. Rigas
School of Engineering
University of Idaho
Moscow, ID 83843
(208) 885-6373

DIVISION PROGRAM CHAIRMAN
1978 CIEC PROGRAM



Anthony L. Rigas
Director, Cooperative Education
University of Idaho
Moscow, Idaho

Charles J. Saner
Director - Education and Training
Bell System Center for Technical Education
Lisle, Illinois

Francis V. Cannon, Jr.
Dean of Engineering
Milwaukee School of Engineering
Milwaukee, Wisconsin

Vladimir Yackeviev
Chairman, International Division
Central University
Caracas, Venezuela

RWI

PICTURE NOT AVAILABLE AT TIME OF PRINTING

Karl W. Doerr
Manager, University Relations
Westinghouse Electric Company
Pittsburgh, Pennsylvania

CIEC
BEST PAPER AWARD

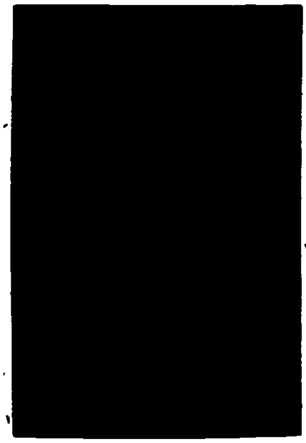
1977
College Industry
Education Conference

J. Peter Graves
Assistant Professor of
Business Administration
California State College
San Bernardino, California

"NOW EVEN OBSOLESCENCE MAY BE OBSOLETE: A LOOK AT CAREERS AND THEIR DEVELOPMENT"

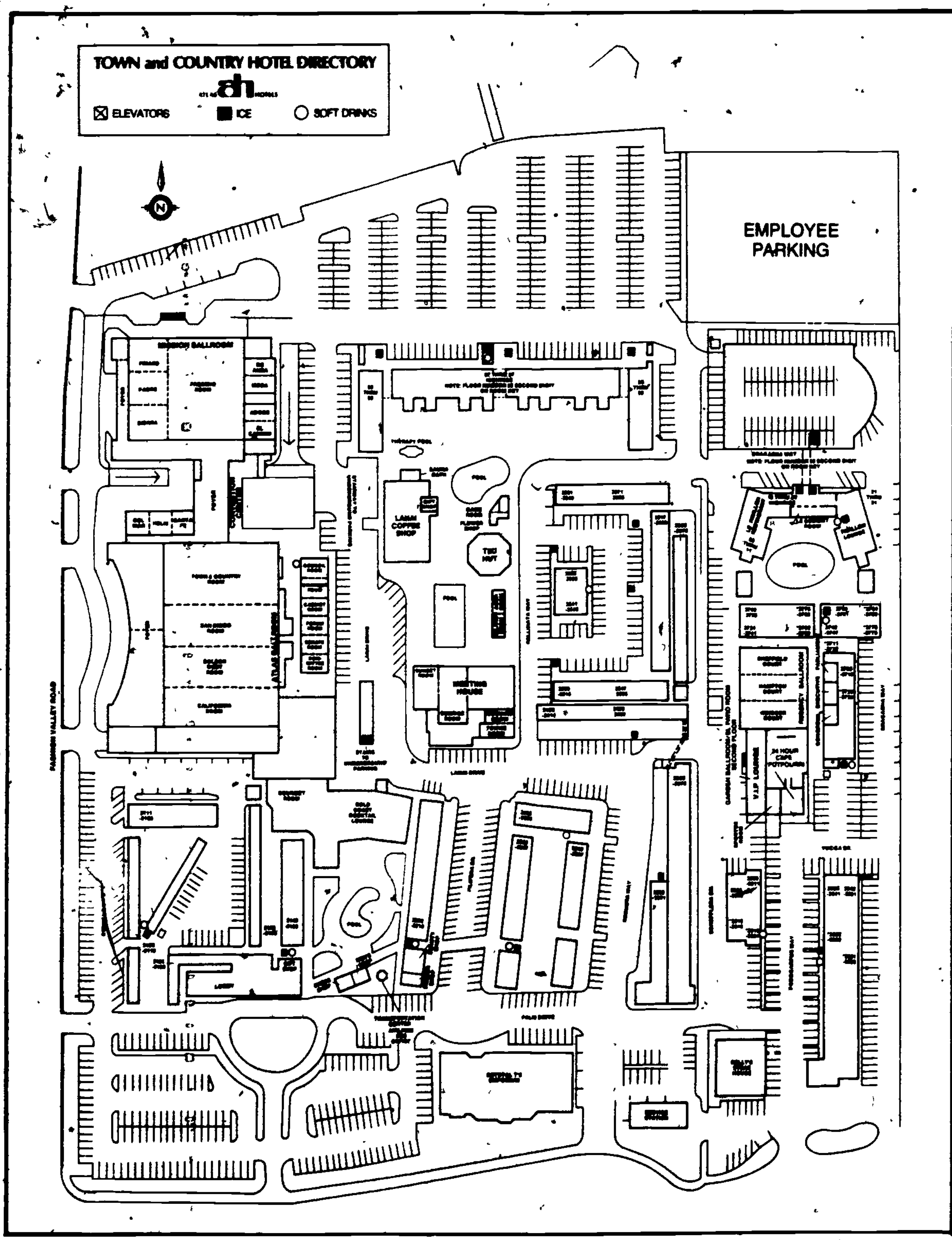
The supposed peak and decline in engineers' productivity with increasing age has often been explained with the model of "technological obsolescence." The picture portrayed by this metaphor is that of an older engineer out of school 15 or 20 years, increasingly less conversant in the language of state-of-the-art engineering. The prescribed solution to the problem emerges, not surprisingly, as a return to education. Studies of Continuing Education, however, have not shown meaningful relationships between CE and continued career vitality.

This paper describes a model of career stages for the engineering professional: Stage I, an apprentice; Stage II, an independent contributor; Stage III, a mentor or manager; and Stage IV, an organizational leader or national expert. The author rejects the obsolescence model as an explanation for engineering career problems. Rather, he suggests that if the engineer, either by design or through ignorance, fails to move into the next stage when others around him expect him to, his perceived value to the organization is likely to decline. He gives some practical suggestions for both the individual engineer and the engineering organization to enhance engineering career vitality.



J. Peter Graves is currently Assistant Professor of Business Administration at California State College, San Bernardino. He has conducted research for and served as a consultant to many organizations, including Battelle-Northwest Laboratories, Lawrence Livermore Laboratory, Syntex Corporation, US Naval Weapons Center and Southern California Edison. He is a frequent speaker before both engineering and management audiences. His current area of interest involves the design and implementation of performance appraisal systems for engineers and the evaluation of training and development programs. He holds a Ph.D. in Social and Organizational Psychology from Brigham Young University.

FINDING YOUR WAY AROUND HOTEL COMPLEX



AUTHOR SESSION CHAIRMAN INDEX

SESSION INDEX

1979 COLLEGE INDUSTRY EDUCATION CONFERENCE MOBILE, ALABAMA

RWI

The 1979 College/Industry Conference to be held in Mobile, Alabama is the fourth joint meeting between the Relations with Industry Division, COOP Division, Engineering Technology Division, Continuing Engineering Studies Division, and the International Division of the American Society for Engineering Education. Outstanding speakers on a national and regional level have been solicited to present papers concerning the role and teaching of engineers in the decade ahead.

The format of the meeting will be such that all the participants will have an opportunity to exchange ideas with their colleagues and return to their institutions with a better understanding of where the engineering profession is going in the next decade. You will be encouraged to attend meetings designed by all five groups involved in this conference and the location of the meeting has been selected to encourage members of the family to attend.

The proceedings for the conference will be pre-published so that participants can make choices on what meetings they wish to attend because concurrent sessions will be held after a plenary session is held starting each day. Other professional societies are being made aware of the program and are being encouraged to participate with the ASEE.

The program committee feels that this will be an outstanding conference which will be down to earth, pragmatic, and containing information that the participants can use when they return to their respective institutions. Industry will be well represented at this meeting. Their views on their needs as they preceive them will be brought forth.

We hope to see all of you in Mobile, Alabama and we know the time, effort, and finances expended to get there will be justified by the program presented. See you in Mobile, January 23-26, 1979 for the 1979 College Industry Education Conference.

For Further Information Contact the 1979 General Chairman:

Frank T. Carroll, Jr.
Executive Dean, East Campus
Delgado College
4200 Michoud Blvd.
New Orleans, Louisiana 70129
(505) 254-9094 or 95

SESSION A

ENGINEERING TECHNOLOGY DIVISION NEWCOMERS BREAKFAST

Kenneth C. Briegel
Research Supervisor
Honeywell Incorporated
Minneapolis, Minnesota

The Engineering Technology Division sponsors a newcomers breakfast at each of their annual meetings. You are cordially invited to attend if this is your first meeting at the College Industry Education Conference. Even if it is not your first meeting, please feel free to come and have breakfast with other people like yourself who are interested in the engineering technology curriculum. Tables will be arranged so that there will be easy information transfer with each other so that an interchange of ideas on technology programs is available.

The officers of the divisions will be there to discuss with you any of your ideas on how the engineering technology division can better fit your personal needs.

Members of the other divisions are also encouraged to attend and are most welcome.

Kenneth C. Briegel, Past Chairman of the Board of the American Society of Certified Engineering Technicians. (ASCET) Served as National President for ASCET for 2 years and North Central Region Vice President for 1 year. Graduate of University of Minnesota. Honeywell Supervisor, Research Technicians Laboratory. One of the first 4 Senior Engineering Technicians to serve on the Institute for the Certification of Engineering Technicians Board of Trustees. He holds ICET Certificate #2. Served 2 terms as Chairman of the ICET Board. U.S. Navy technical advisor in WW-II and Korean War. Chairman of Region II for the Engineers' Council for Professional Development (ECPD). He is a past member of the Minnesota Community College Advisory Board, member of the Curriculum Committee, Anoka Ramsey Community College, Normandale Community College and the Minnesota Southwest State College in Marshall, Minnesota. A member of the Board of Trustees at Northwestern Electronics Institute, Vice Chairman of the Engineering Technology Committee of the American Society of Engineering Education.

ASEE DIVISIONS TO SERVE YOU

CONTINUING ENGINEERING STUDIES—The major purpose of this Division is to assist the practicing engineer in maintaining a high level of engineering competence. An annual national two-day conference, attended by engineering educators and employers of engineers for discussion of problems and programs relating to continuing education, highlights the year. An increasing number of members participate in the many programs now underway and receive the Division's newsletters.

COOPERATIVE EDUCATION—This Division works to promote the philosophy of cooperative education throughout the educational and industrial worlds. It has established a research center for cooperative education, developed guidelines for cooperative accreditation, and also sponsors many active committees to bring together interested members. In addition to activities at the ASEE Annual Conference, this group holds a mid-year meeting.

EDUCATIONAL RESEARCH & METHODS—The prime objectives of the ERM Division are the dissemination of knowledge of teaching and learning, and the encouragement of the development of procedures and materials for improved instruction. Accomplishments include the Plenary Session at the 1971 ASEE Annual Conference, a large annual exhibit of academic demonstrations (ACADEMOS) and sponsorship of regional effective teaching institutes involving over a thousand engineering teachers. The Division also generates a quarterly journal, *ERM*.

ELECTRICAL ENGINEERING—Association with others interested in electrical engineering education is an important benefit of membership in this Division. Each year, an outstanding young electrical engineering educator is selected by this group to receive the Frederick Emmons Terman Award. The Division works closely with the IEEE Education Group in co-sponsorship of workshops, conferences and symposia and in co-publication of a newsletter.

ENERGY CONVERSION—This dynamic new group provides a special opportunity for engineers and educators involved in energy conversion to exchange information, share views and respond to pertinent issues. Annual meetings and recognition of individual accomplishments are an integral part of this group's work.

ENGINEERING ACOUSTICS—Membership in this group permits active participation in the planning and coordinating of acoustics programs, many in cooperation with other technical groups. Its goal is to promote and improve education in engineering acoustics.

ENGINEERING DESIGN—This constituent group provides for communication of knowledge about the philosophy, theory and techniques of engineering design—from products satisfying styling, safety, recycling and other goals to complex systems meeting societal needs, such as transportation. These multidisciplinary interests necessarily cross-link with many ASEE groups and the activities promote a great deal of interaction This committee has sponsored a series of National Design Conferences for several years.

ENGINEERING DESIGN GRAPHICS—This Division has sponsored a number of summer school programs for educators, as well as awarding each year the Distinguished Service Award to an outstanding educator, and the Oppenheimer Award to the best paper presented at the Division's annual meeting. The *Engineering Design Graphics Journal* is published by this active group

ENGINEERING ECONOMY—Economy is an important parameter of engineering social system design. This Division holds as its prime objective the effective communication of engineering economy concepts, and the demonstration of their relevance to all branches of engineering The group has offered many programs for teachers, as well as annotated bibliographies and the *Engineering Economist*, a quarterly journal.

ENGINEERING LIBRARIES—This Division works to promote and strengthen the role of the library as an integral part of the educational process in engineering education The members have compiled a number of valuable Guides to Engineering Literature and a directory of engineering libraries

ENGINEERING MANAGEMENT—This committee has been established to promote educational programs in engineering management, to encourage inclusion of courses in engineering management in traditional engineering curricula, and to provide a forum for discussion of the role of management in engineering.

ENGINEERING TECHNOLOGY—The Engineering Technology Division is considered to be THE professional society of the engineering technology educator It sponsors national studies, workshops, an annual national awards banquet, publishes newsletters, and is engaged in active committee work with national issues.

ENVIRONMENTAL ENGINEERING—This rapidly growing Division holds as its objectives the advancement of both graduate and undergraduate education in environmental engineering. The opportunity to participate in sessions at the ASEE Annual Conference, as well as the year-round opportunity to exchange ideas with their colleagues are important facets of this Division

ETHICS AND LEGAL PHASES—This special group is engaged in the study and identification of needs and problems related to the ethical and legal aspects of the education of engineers and engineering technicians, and in implementing programs to meet them. The group co-sponsored publication of *Ethical Problems in Engineering*, an important text on the subject, and is currently involved in committee work with other engineering societies

GOVERNMENT RELATIONS—The primary function of this group is to maintain effective relations between government agencies and the ASEE membership Its activities encompass the full range of relationships created by government legislation as given effect by the policies, procedures and programs of executive agencies A major endeavor of this group is the Annual College-Government Conference.

GRADUATE STUDIES—This Division has played an important role in revising the Advanced Engineering Test of the Graduate Record Examinations, and in helping engineering colleges develop standards and operational methods for off-campus graduate programs.

INDUSTRIAL ENGINEERING—An effective dialogue between industrial engineers in education with those in industry is provided by this Division A newsletter and tri-annual summer school add depth to the group's work

INFORMATION SYSTEMS—With an ever-increasing volume of information from which portions needed must be selected, information procurement is becoming a major portion of the engineer's work This committee is concerned with meeting the information crisis, both through efficient use of available information tools and through development of better systems

INSTRUMENTATION—The objectives of this Division are to serve interests in instrumentation, measurements, control, dynamic systems, laboratory instruction and computer simulation It offers an excellent opportunity to keep abreast of continuing change in the field, and to effect a strong line of communication among colleagues with similar interests.

INTERNATIONAL—In its work toward promoting research into the technical development process, this Division publishes a newsletter and quarterly journal (*Technos*) and maintains liaison with other international groups of similar interest. It also participates in the NAS-NAE Panel on Engineering Schools and Technical Assistance and holds an annual mid-year meeting

LABORATORY-ORIENTED STUDIES AND EXPERIMENTATION—Laboratory-oriented studies are a basic part of engineering education. This constituent committee provides a forum for the exchange of information related to laboratory-oriented courses· instructional materials—both software and hardware designs, instructional objectives, course formats, and educational research reports.

LIBERAL STUDIES—How the humanities and social sciences can be applied contextually to the professional needs of the engineering student is one important question to which this Division addresses itself A quarterly newsletter reviews pertinent books, and lists activities and programs for members

MATERIALS—This Division offers an opportunity for exchange among the various engineering disciplines interested in engineering materials, and furnishes a basis for discussion of the relationship of materials courses to various engineering curricula This group has sponsored highly successful workshops for teachers

MATHEMATICS—Association with others interested in engineering mathematics, and the opportunity to contribute to the improvement of the mathematical background for engineering education are but a few of the facets of this group, working to enhance the teaching of mathematics and to stimulate research in applied mathematics

MECHANICAL ENGINEERING—The advancement of education in all of its functions which pertain to mechanical engineering, including the processes of teaching and learning, research, extension services, and public relations these are the goals of this Division It also generates a quarterly journal, *Mechanical Engineering News*.

MECHANICS—This group strives to disseminate developments and trends in mechanics to engineering educators, and to foster interest in mechanics as a discipline In this direction, major studies and surveys have been conducted by this busy Division

MINERAL ENGINEERING—Mineral engineering has reached a position of greater strength due to the fine efforts of this group to promote education, research, training, and other important programs The information obtained through meetings, publications, and other activities can be applied readily to one's professional activities

NUCLEAR ENGINEERING—The goal of the Nuclear Engineering Division is to promote for educators, as well as for concerned engineers in industry, a program for the exchange of ideas It also works toward the publication of these ideas, as they relate to the rapidly changing technology of the conversion of nuclear energy to a useful form

OCEAN ENGINEERING—To keep abreast of educational developments in this new field, membership in this group is vital Panel discussions, newsletters, studies and other important work are now in progress, to study and assess the needs and problems of education in the field of ocean engineering and technology

PHYSICS—As a liaison among engineering educators, physics instructors, and the physics community, this group plays a part in determining the special requirements of engineering students in physics The Division sponsors activities in cooperation with AAPT and AIP, and also publishes the Physics Division Newsletter

RELATIONS WITH INDUSTRY—The continued improvement of relationships between the educational and business communities has long been the goal of this Division It sponsors the annual College-Industry Conference as well as participating extensively in the ASEE Annual Conference

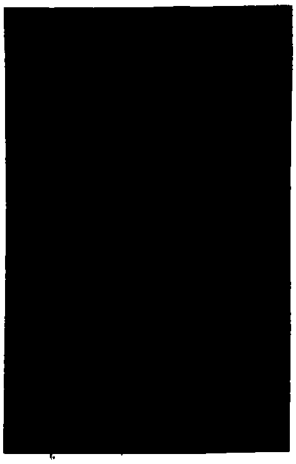
CONTINUING ENGINEERING STUDIES DIVISION NEWCOMERS BREAKFAST

Raymond J. Page
Director, Continuing Engineering Education,
General Motors Institute
Flint, Michigan

If you are a new member or just a "new thinking" old timer of the CES Division, you are cordially invited to attend the CES Newcomers Breakfast at this conference.

The breakfast meeting will be an informal session with round tables so that we can all interchange ideas and thoughts on how we can improve our operations whether we are with a college or university or working in industry.

Even if you are not a member of the CES Division and are attending the conference and would like to sit in and learn more about continuing engineering studies activities, please feel free to sign up and come to the meeting. Everyone is welcome.



Raymond J. Page received his BSME and MSIE degrees from Purdue University. His industrial employment has been with Sylvania Electric Company, National Cash Register Company, and National Gypsum Company. He has taught at SUNY at Buffalo, Cornell University and General Motors Institute where he is currently Director of Continuing Engineering Education. In this position, he is responsible for providing technical programs to General Motors Units.

He has been active in professional society activities for several years. He was a member of the ASME Policy Board Education and served as the National Chairman of it's Continuing Education Committee. His ASME offices also include several at the section and regional level and a term as Vice President. He has been active in the CES Division of ASEE since it's formation and is currently Chairman.

SESSION 1

EFFECTIVE DEVELOPMENT OF HUMAN RESOURCES FOR INDUSTRY

Arthur F. Hartford
Manager, University/Industry Relations
E. I. DuPont
Wilmington, Delaware

1. In this fast moving technological society of the United States the effective development of human resources for an industrial concern is taking on more importance. Research has shown that the development of human resources for business and industry improves the productivity and quality of the product developed by a company. The need for the effective development and utilization of human resources in any business is rapidly being recognized as a primary concern to the corporation. This session deals with an approach to the effective development of human resources for industry. It is an approach that has proven successful by a corporation and will give the participants insight into how one organization is developing their people.

Mr. Hartford was graduated in 1941 from Northeastern University, Boston, Massachusetts with a BS degree in Industrial Engineering. After serving 4 years in the United States Navy, he was employed by the Du Pont Company in 1945. His initial employment was in the Engineering Department where he had several assignments before transferring to the Company's Personnel Division in 1950. He is currently Manager of University and Industry Relations in the Du Pont Company's Employee Relations Department.

His professional activities include past member Board of Directors of Eastern College Personnel Officers (ECPO), a past member of the Board of Governors of the College Placement Council, Past-Chairman of the Engineering Manpower Commission, current Chairman of the Middle Atlantic Section of ASEE, and a past member of the Board of Directors of ASEE.

EFFECTIVE DEVELOPMENT OF HUMAN RESOURCES FOR INDUSTRY

Hershner Cross
Senior Vice President
General electric Company
Fairfield, Connecticutt

Hershner Cross
Senior Vice President
General Electric Company

"DEVELOPING HUMAN RESOURCES FOR INDUSTRY"

Today's engineering graduates are better prepared to enter industry than ever before. In a recent study conducted by The Conference Board, executives in industry judged, by nearly 10 to 1, that four year colleges of Engineering & Science were doing particularly well in fulfilling their work-preparation role.

Your graduates come to us in industry with exemplary skills and attitudes. Of course, today's entry-level engineers are more comfortable writing computer programs than English compositions, but they are also more familiar with engineering systems, tools and techniques than my engineering friends in their own youth dreamed possible.

They're eager to enter industry, to meet its challenges, and are "turned on" by work they can become involved in; the grads themselves place a high value on their first job, as an important index of their preparation for the future.

But despite the skills you've given them, and their positive attitudes, these entry-level engineers must undergo an "adjustment process" if they are to fulfill their job and career potential. This process is more difficult than it used to be for several reasons.

1) The value systems of young people are changing fast, and are likely to be different from those of older employees and managers;

2) As the business environment becomes more complex, and our technology more sophisticated, the "experiential gap" is widening. Adjustment to work is becoming a more critical process;

3) Finding and training first-line supervisors and managers to help these young people bridge this gap is becoming increasingly critical, in view of the great influence on the total career potential of the new engineer they can and do have.

What is it we at GE are trying to do to help solve this adjustment problem?

1) A comprehensive program of communications to all levels of management highlighting this adjustment problem;

2) Since 80% of the adjustment process occurs on-the-job, careful attention is given to early work assignments and their impact on future careers;

3) Formal programs of education and training, both for the fledgling employee, and for our first-line supervisors and managers are provided at every major plant site, at regional centers and at our Crotonville Management Development Center.

4) Special Career Development Programs for the young person, with close guidance, have been established.

5) A system of Accountability to measure the effectiveness of our training, education and career development efforts and to provide feedback is being refined.

******

Hersh Cross, a graduate of Johns Hopkins and Harvard Business School, was general partner and director of an import-export company until he entered the Army in 1941.

Upon his discharge as a Lt.Colonel in 1946, he joined GE as a Methods Division Analyst. After a career in several of its industrial businesses, he became General Manager of the Radio & TV Division in 1959 and was elected a Vice President in 1962.

Mr. Cross became Group Executive of the Industrial Group in 1963 and was appointed a Senior Vice President in 1970 when he became Corporate Administrative Staff head. He is a member of GE's Corporate Policy Committee, as well as Chairman of both its Benefit Plans Investment Committee and the GE Foundation.

A resident of Stratford, Conn., Mr. Cross is married and the father of three daughters.

CALL FOR PAPERS

ANNALS OF ASEE ENGINEERING EDUCATION JOURNAL

The December issue of the Engineering Education Journal is called the ANNALS. This publication has one primary purpose, which is to attract, publish and stimulate the writing of high quality articles that are of long-lasting interest to engineering educators. Through the existence of the Annals, ASEE hopes to increase the incentive to do research in engineering education, to publish the results, and to provide a means by which the quality of the research can be judged. A more complete statement of purpose appears in Engineering Education, December, 1975, p. 227.

Articles may pertain to any aspect of engineering education, including educational research, learning, theory, teaching methods, review of ongoing projects, administration, organization, guidance, finance and technical research as it applies to education. All articles will be reviewed by experts in engineering, engineering education and appropriate allied disciplines, such as psychology, education or sociology. The criteria for selection are based on the significance of the subject to engineering education, the quality of the treatment, including the author's knowledge of past work in the area, and long-lasting value.

Articles may be of any length appropriate to the subject, but on the average are expected to be about 4,000 to 5,000 words. If a paper is accepted, the author must be prepared to submit originals of all illustrations, and submit five copies by June 15 of each year.

Editor, Annals
American Society for Engineering Education
One Dupont Circle, Suite 400
Washington, D. C. 20036

SESSION 2.1

DETERMINING CORPORATE TRAINING NEEDS AND TRAINEE SELECTION

Vladimir Yackovlev
Chairman, International Division
Central University
Caracas, Venezuela

Determining the corporate training needs and participants in a particular training program is becoming for many business and industries throughout the world. This session will take a look at several approaches that various corporations use to determine their corporate training needs and how they select their people to participate in programs.

The concept of just offering any training program to improve people no longer is sufficient in a well run organization. It is important that the needs, goals, and objectives of the corporation are clearly spelled out and those people who can have some impact on the corporation are selected to participate in various training programs. Training perse is not necessarily good, if it does not meet the specific goals and objectives of a corporation. This session will attempt to show how various organizations do this and will allow interaction with the audience to give the participants an insight on how they may improve their own training selection process.

Vladimir Yackovlev, who is the Chairman of the International Division of ASEE, is a Civil Engineer, educated in Venezuela and the United States. After graduating from the Central University of Venezuela, he came to the United States where he got his M.Sc. degree from the University of Illinois. He returned to his country and began working at his university as an instructor. After getting some experience there, he came once more to the U.S., where he obtained his Ph.D. degree at the same university. Very early in his career Dr. Yackovlev became interested in engineering education and it is in this field where he has become known internationally. After some 40 publications in this field and participating in numerous meetings on engineering education both in his personel capacity as an expert in this field, as well as a representative of his country, he is an active spokesman for engineering education in Latin America. Aside from his duties as Chairman of the International Division of ASEE, Dr. Yackovlev is a Member of the UPADI Committee on Engineering Education on the Panamerican level; a member of the Committee on Education and Training of Engineers of the World Federation of Engineering Organizations and a member of the International Working Group on Engineering Curriculum Design of UNESCO. In his own country - Venezuela - he is the Director for International Affairs of the Venezuelan Society for Engineering Education. He has held various academic positions at his university, being at the present time the Executive Secretary of the Venezuelan Fund for Research and Personel Development for the Petroleum and Petrochemical Industries.

MANAGEMENT TEAM APPROACHES TO DESIGN OF ENGINEERING COURSES

John Van Horn, Assistant Director
Corporate Technical Education Program
Corporate Engineering Services
Westinghouse Electric Corporation
Pittsburgh, Pennsylvania

John J. Herald
Manager, Engineering Training Program
Education Department
Westinghouse Electric Corporation
Pittsburgh, Pennsylvania

Identification of organization training needs, how to best meet these needs, selection of students and evaluation of results are tasks that become manageable for the training activity when there is meaningful dialogue with potential users of the training. The dialogue between corporate training staff and potential training users which is vital to meeting training needs can be significantly strengthened by involving both parties as an integral part of the course design process through the use of ad hoc course design teams.

Ad hoc course design teams guide the development of all corporate-wide in-house engineering courses at Westinghouse Electric Corporation. These courses, usually of three to five-day duration, are managed by a Corporate training activity, which is financially self-sustaining through charge back of course tuitions to operating units. This training activity is responsible for satisfying unique training needs not otherwise served and for providing relevant and practical engineering skills to make engineers more effective on their jobs. Determination of the specific course objectives, the audience for whom the course is to be designed and the course content are established by the course design team which consists of key managers from operating units of the Corporation and the Corporate training activity.

The design team concept has evolved from our successful experience of working through Ad Hoc Advisory Committees in the joint development of continuing engineering studies with universities and other industrial firms in five metropolitan areas. Over the past fourteen years, Westinghouse and other companies in the technical community have used the ad hoc committee approach to developing continuing engineering studies through which the university producer and the potential consumer of courses participate in joint course designs.[1] The academic (and financial) successes of university courses designed by the joint process has led to our design team approach for developing in-house training courses.

Development of In-House Courses

Interested operating units of the Corporation work with the corporate staff as a design team to jointly focus on the need, develop a functional specification, guide the course design and market the program. The result has been better selection of students for training courses, which are more responsive to Corporate needs and are self-supporting.

Identification of Needs

The need for training courses is identified in several ways, all involving some mode of corporate staff/operating unit interface. For example, Corporate functional staff may hypothesize a need based upon contacts with operating units. Individual operating units or a Corporate-wide technical committee representing several operating units may also identify needs. In any event, the need is verified (or rejected) by contacting a number of operating units and requesting ad hoc committee members from their management to guide the design of the proposed course. If the response is favorable, the course development proceeds; if not, the development is dropped and resources can be redirected to developing other offerings.

Course Objectives

In-house courses place emphasis on development of skills, techniques, and understanding of theory and formulation of methods that enable engineers to make better use of engineering techniques. Topics treated are of practical importance to Westinghouse. Course objectives range from providing an understanding and insight for the theoretical aspects of an advanced technology to providing tools for managing engineering assignments. Exhibit I lists titles and objectives of courses that have recently been developed by Westinghouse design teams.

Team Selection

A steering committee is formed from interested staff and operating personnel to scope the proposed course and to recommend candidates for the course design team.

The success of the design team concept stems from the commitment to success of the team members. This commitment includes the investment of time to guide development of the course (typically 2-4 meetings) and communication within their own organization to identify candidates; thereby, ensuring a viable course offering. Team members are selected from corporate operating units who have potential need for the proposed course based upon the following considerations:

(1) Understanding of the mission and technical needs of the operating unit they represent.
(2) Knowledge of proposed subject in sufficient depth to determine and communicate its relationship to needs of individuals in their organization.
(3) Ability to make or influence the decision of their organization to send students to the course if it meets their perceived needs.

Technical Coordinator

One cannot design a course to be all things to all people and the design team cannot effectively do the detailed course design. We have found it useful, therefore, to have a technical coordinator, who is a member of the design team and has sufficient knowledge of the subject to do the detailed course design. Team members guide the course design by specifying course objectives, characterizing the intended course audience and suggesting topics and candidate lecturers. The technical coordinator takes their inputs and works up a course that meets the agreed upon objectives and as many stated interests as possible. The technical coordinator packages the program, maintains consistency and continuity at the lecture interfaces and guides lecturers to reinforce the overall course objectives. This task can be performed by a qualified in-house person or by an expert from outside the Corporation. We have used both approaches, depending upon the nature of the objectives, content of course and availability of qualified personnel. Exhibit II identifies the titles of persons who have participated as technical coordinators in the development of recent courses.

Course Design Procedure

Prior to the first team meeting, team members are provided with a draft course prospectus developed by a steering committee. This is a "first-cut" of course objectives, outline, and candidate selection profile which serves as a starting point for discussion at the first team meeting. Team members are requested to come prepared with their own list of course objectives, topics, central themes, etc., that would be of most interest and use to their organizations, and with a descriptive profile of prospective participants from their organizations.

The purpose of the first meeting is to provide team members an opportunity to present their input and to determine whether there is sufficient need and interest to warrant development of the proposed course. A decision to proceed with course development should lead to the following actions at this meeting:

(1) General agreement on course objectives, content and characterization of the participants for whom the course is designed.
(2) Suggestions for candidate lecturers.
(3) Determination of potential market for the course.
(4) Establishment of a time table for course development.

The success of the first team meeting depends upon the team's ability to focus on and obtain general agreement for the course objectives and participant profile. Our experience indicates that control may be required by the moderator to prevent the discussion of how and what we will teach before general agreement has been reached on who is the audience and what we want the learner to "take away from the course."

Subsequent to this meeting, the course technical coordinator is responsible for promptly preparing a course prospectus from the inputs obtained at the meeting. This prospectus, which contains a statement of course objectives, expanded outline of course content with potential lecturers and guidelines for candidate selection, is provided to the team members for review and comment. Ample time should be afforded for this review to allow the team members an opportunity to consult with their colleagues in the organization.

Feedback from the team members establishes the agenda for subsequent team meetings. The process is iterative and continues until general agreement is obtained on the final course prospectus. It is imperative that this prospectus provide sharp objectives and detailed definition of what the course is designed to accomplish (1) to help managers select students who will benefit from the course, (2) to guide lecturers who will participate in the program and (3) to provide a sound basis for evaluating the effectiveness of the course. We have found Mager's book[2] helpful in formulating course objectives.

The technical coordinator contacts all course lecturers, briefs them on the objectives and content of their particular presentation and provides as much background information on the potential audience as possible.

Design Review

Prior to the pilot offering of the course, the design team and course lecturers critique the course at a design review which is a "dry run". While the "dry run" is conducted on a compressed time schedule (typically 10 minutes design review time for each hour of real course time) it is not a mere compression of real-time course presentations. Rather, course leaders provide statements of their session objectives, expanded outlines of their sessions' content and their approach to the subject. The purpose of the design review is to:

(1) test the objectives and content of each session for consistency with and support of, overall course objectives and content;
(2) ensure that the course sessions maintain continuity and "fit together";
(3) provide the opportunity for course leaders and design team members to discuss presentation and arrive at a course design and content which meets the needs of the intended audience.

Development Timetable

A typical timetable for the development of a new five day course would be:

January	Steering committee nominates candidates for design team.
February-March	Meetings of ad hoc design team (typically two to four meetings); course preliminary design (including course prospectus) completed.
April	Initiate course publicity and recruitment.
May	Conduct design review.
July	Conduct five day program.

Course Monitoring

The design team is not only a valuable asset to course development but also affords an opportunity for direct user feedback during the life of the course. Subsequent to the first course offering, evaluation data is transmitted to the design team for review. If these results identify problems and/or opportunities, a meeting of the team is convened to consider course changes.

Normally on a three year cycle, all courses are reviewed by their respective design teams to make adjustments that may be necessary to keep the course objectives and content matched to the training need.

Benefits

Four new in-house engineering training courses have been developed by design teams over the past two years. Course presentations to 200 students have satisfied the designed learning objectives as well as participants' own personal course objectives. Management feedback also confirms that these courses met stated objectives and that the objectives did, in fact, reflect the needs of their operating units.

Application of the design team concept for new course development can be summarized as follows:

(1) Courses designed by users are more responsive to their needs.
(2) Operating units through involvement in the design process, become committed to course success.
(3) Design teams open new meaningful channels of communication between operating units, thereby affording cross fertilization of ideas.
(4) Engineering managers obtain a vehicle to carefully examine training needs of their people related to their organizational objectives.
(5) Management's increased knowledge of the courses provides for better selection of participants.

[1] Van Horn, J.R., Joint Development of Continuing Engineering Studies Programs: An Example of Industry Education Dialogue Using Ad Hoc Advisory Committees. Volume E-19, Number 1, February 1976, pages 22-25, IEEE Transactions in Education.

[2] Mager, Robert F., Preparing Instructional Objectives, Fearon Publishers, 1962.

EXHIBIT I: TITLES AND OBJECTIVES OF COURSES
DEVELOPED BY WESTINGHOUSE DESIGN TEAMS

1. Advanced Finite Element Structural Analysis

Following the course, participants will have:

- the current status of capabilities and limitations of advanced methods in Finite Element Analysis
- greater depth of understanding of theory and formulation of advanced methods to solve complex structural analysis problems
- insight into practical considerations in the application of advanced Finite Element methods
- enhanced ability to select or recommend appropriate methods to solve specific problems

2. Computer Aided Design and Drafting

At the conclusion of this course, participants will:

- learn how the design and drafting function is changing to the extent required to select and use new concepts and trends to improve their operations
- be sufficiently familiar with computer aided design and drafting systems to be able to evaluate them for their own use; this includes:
  (a) familiarization with the direct interaction with the system via actual hands-on experience.
  (b) ability to select a project from his division, benchmark the project, and evaluate the results.
- be able to manage the selection of computer-aided design and drafting systems hardware and software for their operations, including being able to:
  (a) state his functional requirements for a computer graphics system for inclusion in a specification,
  (b) evaluate vendor's systems specification against his needs,
  (c) evaluate cost/benefits, and
  (d) justify the project.
- be able to develop a plan to manage procurement, installation, start-up, personnel training and operations management for computer graphics systems.

3. Assuring Reliability/Availability/Maintainability

Following this course, the participant will have:

- sufficient background and understanding of the theory and techniques of availability assurance management for planning, managing and performing availability/reliability/maintainability engineering tasks associated with product development/design/production. This course is not designed to develop in depth skills in the application of techniques presented
- acquired adequate amount of insight as to what techniques and corporate resources are available, when they should be used, their advantages and limitations, and how to judge their effectiveness
- identified areas where further self-development is needed
- acquired adequate amount of insight as to the practical implementation of the Westinghouse Corporate Product Reliability Guideline, MB-3451.

EXHIBIT II:
COURSE TECHNICAL COORDINATORS

Course and Coordinator's Title

1. Advanced Finite Element Structural Analysis
   - Professor & Chairman
     Structural Engineering at a leading university
2. Computer Aided Design and Drafting Course
   - Assistant Director
     Corporate Information Systems
     Westinghouse Electric Corporation
3. Assuring Reliability/Availability/Maintainability
   - Assistant Director
     Corporate Product Integrity
     Westinghouse Electric Corporation

Jack Herald is Manager, Engineering Training, Education Department, Westinghouse Electric Corporation. He is responsible for the implementation of in-house corporate training courses that are developed in concert with the Corporate Technical Education Planning Activity.

Prior to joining the Education Department in 1975, he spent nineteen years in five operating units of the corporation with assignments in engineering design and development, marketing/system engineering and project management. He graduated with a BS degree in Electrical Engineering in 1956 from the University of Pittsburgh. He is a member of IEEE and a registered professional engineer in Pennsylvania.

JOHN R. VAN HORN

Assistant Director for Corporate Technical Education Planning, Westinghouse Electric Corporation. His responsibilities include the design and implementation of education and development programs, working closely with engineering colleges and operating units of the Corporation in the design of programs for practicing engineers.

Before joining the Corporate Headquarters organization, Mr. Van Horn held various management positions at the Bettis Atomic Power Laboratory where he was responsible for the Laboratory's technical education and training programs. He conceived and produced the "Design of Experiments Course," a continuing engineering studies instructional package consisting of 32 films and seven-volume self-study guide which has been used widely within and outside of Westinghouse.

Active in ASEE, he served as the 1974-75 Chairman of the CES Division. He was a leader in organizing the 1976 College Industry Education Conference, the first ASEE joint Midwinter Meeting.

DIRECT APPROACHES BY THE VENEZUELAN OIL AND PETROCHEMICAL INDUSTRIES FOR TRAINING REQUIRED PERSONNEL

San Diego

RWI

Efrain E. Barberii
Manager, Western Region
INAPET (Training Institute Venezuelan Oil Industry)
Caracas, Venezuela

The Instituto de Adiestramiento Petrolero y Petroquímico, INEPET, extends to all of you sincere thanks for the opportunity of presenting to this important assembly our experience and challenges yet to be met in the training of the required personnel for the Venezuelan oil and petro chemical industries. Certainly, to a great number of the participants here, the name of Venezuela is associated with oil. The country produces some 2.200.000 b/d of crude oils and exports almost 2.000.000 b/d of crude oils and products. Total proven reserves are at present 18 billion barrels and possibilities for new additional reserves are very great.

In fact, several areas of the country are awaiting the explorer. The whole offshore area of the country, covering, approximately, 1.750 miles of coastline has not yet been touched and oil discoveries made in the Gulf of La Vela indicate that the possibilities are very promising. Another big area is the petroliferous belt of the Orinoco, which measures some 380 miles in length and an average of 32 miles in width. Moreover, the traditional oil provinces still require a tremendous amount of studies and reevaluation work to fully appreciate whatever possibilities still exist to recover additional oil and possibly to find new reservoirs. These figures and outlook are large enough to convey the challenges faced by the 25.000 men and women who work for the Venezuelan oil and petrochemical industries. It is estimated that during the next eight to ten years, approximately, 7.500 men and women now serving the oil industry will retire. In fact, this number of people leaving the ranks at all levels represent a great challenge in that appropriate substitutes with adequate background and the will to learn by doing the technological changes and innovations now occurring in all phases of the oil and petrochemical industries demand that a daily effort be sustained in the continuous education of the personnel running these industries. And for us that is a must. The importance of the challenges can be summarized by saying that oil is the backbone of the Venezuelan economy. It represent, moneywise, 85 % of the country's international trade.

To keep the Venezuelan oil and petrochemical industries efficient is a must. And the first answer to that challenge is by maintaining a high standard of working performance by the people in charge of all the aspects of the oil business : exploration, drilling, production, transport, refining/manufacturing, marketing and management of all these branches.

WHAT IS INAPET

INAPET was created in January 1976, right after the nationalization of the oil industry. The Institute is supported, directed and managed by the INCE (National Institute of Cooperative Education), FONINVES (The Fund for Research and Personnel Training in the Area of Hydrocarbons); I.V.P. (the Venezuelan Petrochemical Institute); the C.T.V. (Confederation of Venezuelan Workers) and the 14 operating oil companies, subsidiaries of Petróleos de Venezuela, S.A. (P. de V. SA).

INAPET offers training to all the employees of the oil and petrochemical industries in the following classifications : skilled workers/technicians, engineering and graduates in other technical professions; supervision and management. The training offered covers the following levels of instruction : basic, intermediate, advanced and specialized.

The following table shows figures obtained during the first year of operation and what has been accomplished during the first semester of 1977 and the target for the year (Table 1).

To carry out the annual program of courses INAPET has divided its activities according to the needs of the oil and petrochemical industries, taking into consideration the geography and the importance of the activities in the different areas of the country. To accomplish the required program in every area, INAPET has built an educational center in Eastern Venezuela, located in Anaco, State of Anzoátegui; one for the Metropolitan Area, Caracas; one in Morón, State of Carabobo, to serve also the needs of the oil personnel in the States of Guárico and Barinas; one in Paraguaná, State of Falcón to serve the two largest oil refineries in the country; and three centers in the State of Zulia, which represents 80% of the oil producing capacity of the nation and has the largest petrochemical complex in the country. These centers are located at Ciudad Ojeda/Tamare, Maracaibo, ane El Tablazo, respectively.

The way in which the instructional program is presented varies. And the effort is a combination of resources displayed by INAPET; by the operating companies; by the service companies; by the universities and educational companies or by independent instructors, local as well as foreign. All the programs are coordinated by INAPET in a very close association with the operating oil companies and their respective Departments of Industrial Relations and/or Human Resources.

To carry out all the managerial, instructional and operational functions, INAPET has a Board of Directors, a Director General, and Executive Committee, and Operations Department and a Technical Department. These main functions are assisted and supported by the Departments of Personnel, Administrations, Public Relations, Auditing and Services. The centers in the different geographical areas depend directly of the Operations Department and receive functional support from the Technical Department and the other units of the organization.

AN OUTLOOK TO THE FUTURE

The challenges to be met now and in the near future are most important. Training and personnel development for a specific industry is a specialized undertaking. However, it is felt that the experiences gained and resources applied in the United States in the pursuit of identical accomplishments have given outstanding results. And there is no reason why we cannot benefit from these experiences and at the same time make ourselves an outline of the possibilities of cooperation open to all interested in these endeavours through INAPET.

Certainly the American Society of Engineering Education, the National Institute of Education, the College Industry Education Conference such as this and the many outstanding colleges and universities represented here have a great deal to offer to our programs. On the other hand, the many industries of this country and your teachers, scholars and professional men and women can offer the experience and knowledge needed to bridge the gap in our needs for the training and developement of our own human resources. We feel that there is a great challenge in all this and that there is no better way to improve our understanding of each other than through the sharing in the advances of the technical education you have developed.

The transfer of technology is a wonderful means of getting people to know each other better. When knowing each other better through studying, working and accomplishing many tasks together, the chances for closer relationships between our nations are better and more attractive.

Our presence here is to stimulate that better understanding and to obtain your cooperation in what we are doing for our people in the oil and petrochemical industries through INAPET.

Table 1

Year	Number of Courses	Hours of Classes	Number of Participants	Hours-Participants
1976	305	-	4.159	189.400
1977 (1st semester)	525	18.868	7.677	267.540
1977 (target)	750	-	10.432	713.758

EFRAIN E. BARBERII

Mr. Efrain Barberii is one of the leading and most respected Consulting Engineers in the Venezuelan Oil Industry. With a varied background, B.Sc. Petroleum Eng. from U. of Oklahoma and an M.Sc. in the same field from Tulsa, Mr. Barberii also holds the degree of Pet. Engineer from the University of Zulia; he has had a long and distinguished career in industry, the academic world and on the international level. He has been a faculty member at Tulsa, Zulia and Dean of Engineering at the new Urdaneta University in Maracaibo. At the present time in charge of the Western Region of INAPET.

DETERMINING CORPORATE TRAINING NEEDS AND TRAINEE SELECTION

Frank Demaree
Assistant Vice President for Engineering
Illinois Bell Telephone Company
Chicago, Illinois

A paradox is emerging in the engineering profession.

The paradox has to do with time.

Today, many engineers have a gnawing fear that time is running out. They look at technological change, and see that it is not in fact going to slow down for anyone. If anything, it will only happen faster. They look at their equipment and inventions, and see that the moment of glory for any new technical idea can be relatively short.

And most important, they are looking at themselves. They see that the usefulness of their technical degree can also be short lived, unless they work very hard to keep their knowledge current. From the day they earn their diploma, they are running a race against time, to keep from becoming technical dinosaurs 20 or even 10 years later.

But here's where the paradox comes in. In the midst of that harried race...a race not just to succeed but a race for professional survival... engineers may also have more time than ever to develop themselves and work on personal goals.

It's a simple mathematical assumption that improved technology will result in fewer hours required to do the world's work. And it seems almost inevitable that the end result will be a shorter work week with more leisure time to spend on ourselves.

That means there will be time for personal development and growth.

Time to accomplish our goals.

Time to stay current in our field.

But what does that mean for us, the members of ASEE?

As engineers and educators, it means we are going to have to revise our concept of college education. We are going to have to rid ourselves and our associates of the notion that going to school is something we do when we are young.

It also means that we are going to have to re-evaluate our situation. Emerging needs in continuing education...coupled with the additional time people will have to continue their schooling...can open new opportunities to us as educators and managers. But before we can take advantage of them, we have to take some concrete steps to find and meet the needs of our potential training clients.

First, we have to look at our own industries or, if we are in universities, look at the industries around us. We have to study present training needs. Then we have to project what those needs may be in ten or twenty years. We have to look at the changes happening around us, then determine how we are going to cope with them. If we are going to be successful, we have to have a strategy. We have to get everyone involved. That means a commitment from top management to help us set priorities. Then, we have to see to it that management commits the resources needed to do the job. We have to build communications with managers at our own companies---or with industries which could be served by a university. We have to let them have a strong say in what we do. We must have good two-way communication channels for passing and receiving information. Above all, we must be flexible. Our programs must be able to grow with their needs.

When the Bell System Center for Technical Education started in Lisle, Illinois, in 1968, these principles essentially were our guidelines.

Plans for the Bell System Center for Technical Education began in the mid-1960's. A group of us at Illinois Bell started a small scale training program at a local hotel. It turned out that our technical management training needs were not unique. Other Bell System operating companies were doing the same thing. And so, during the next two years, we began work with AT&T and all the Bell System companies to establish a firm corporate commitment to the inevitable changes we saw coming in the Bell System's technical future. The end result was the training center at Lisle.

The concept of Lisle worked in a way that no other Bell System training program had ever worked before at the technical management level.

One reason was good leadership from its director, C. J. Sener. Another was the inspiration and guidance offered from his supervisor, C. H. Elmendorf (AVP - transmission) at AT&T. Without support from headquarters, the training center might still be a gleam in the eyes of Illinois Bell engineers.

Under Sener's direction, a site was selected which would be geographically accessible to every training candidate.

And early in the planning stages, a system was set up to get all Bell operating companies involved in identifying needs, setting priorities and managing the budget. The key factor was the Board of Advisors which oversees budgets, policy and long-range plans. Eventually, a network of boards, councils and committees was also formed to meet each specific training need and make certain no company and no level of management would be left out of the planning process.

The largest of these advisory boards is the one for engineering education. This board includes the Center's director and a group of engineering managers at the assistant vice-president level. It uses input from Lisle staff, operating companies and AT&T to make recommendations to the Board of Advisors on budget, course needs and course development. Each member of the Engineering Education Advisory Board represents several Bell System operating companies. The work of the Board requires continual interface with other Bell System councils, boards, committees and individuals to ensure a System-wide viewpoint in decision making.

Other boards and councils represent technical disciplines such as network operations, operator services, business services, forecaster training and technical planning. Councils feed information to boards and recommend revisions in existing training. Smaller ad hoc committees bring field people into the act and advise developers at the Center on what is really needed.

The process described here provides a continuous interchange between the operating companies, AT&T headquarters and the Lisle staff.

In order to translate all this activity into terms the field supervisor can understand and appreciate, one Lisle Coordinator has been named at each operating company.

This Coordinator is the point of interface between each company and the Bell System Center at Lisle.

It is up to the Coordinator to answer student questions, see that students get to Lisle, help supervisors line up courses for subordinates, help fill empty seats, iron out budget difficulties and keep training priorities in the minds and hearts of top management.

The Lisle Coordinator also plays an important role in staffing and recruiting for Lisle. Under a fair share plan, each Bell company has agreed to contribute rotational employees to the training center for two to three year assignments. The arrangement has a mutual benefit for both the company and the training center, since experts recruited by Lisle return to their companies with a System-wide perspective on their jobs.

For Lisle, it is added assurance that the people doing the training...the instructors and course developers...include people who have been in the front lines of the telephone company. They are subject matter experts... people who have been up to their elbows in problems before they try to teach others.

The organization of the training center itself is also arranged to meet needs of training customers. The director (C. J. Sener) has five deans and a general administrator reporting to him.

One entire deanship is devoted just to planning, developing training methods, training trainers, and measuring the success of training within the classroom and back on the job. The planning team spends much of its time in the field or working at Lisle with visiting operating company managers. Connections are constantly made with operating company boards, councils and committees to determine if and where training needs exist. People in this division are also skilled in ferreting out other possible solutions to performance problems, when it is determined that training is not required.

The staff at Lisle includes about 80 course developers, 80 people on the instructional team and 120 some people in support functions such as instructional media, clerical services and preparation of student materials.

The curriculum at Lisle takes in nearly all technical disciplines and all levels of management. Full courses are usually geared to the first line people, or the doers. But special seminars and briefing sessions are designed for middle and upper management to keep them abreast of changes in their field.

Somewhere during the development process, Lisle has to get an early commitment on classroom seats from operating companies. Since the development process can take as long as a year, it is important that operating companies give careful consideration beforehand to their training needs, and priorities.

This early commitment also requires managers to dedicate time well in advance to development of human resources.

But the Lisle system, like any system, is not foolproof.

Despite the best-laid plans, there are still occasional problems getting the right people into courses. Engineers, for example, may not always see an advantage in acquiring more technical knowledge. Even when they do, not all supervisors are completely supportive.

Special steps have to be taken to help the student know his or her own needs.

We are still looking for ways to make that engineer want to go back to school, and ways to make knowing more a rewarding thing. Complete corporate backing is needed to make technical training a way to get rewards on the job.

We're also looking for ways to educate and persuade supervisors to sacrifice staff, time and money to train their people.

I cannot overemphasize the importance of the boss in the training process. If we're going to be really good at training, we have to understand and communicate with bosses. We have to understand their budget constraints, their staffing difficulties and their perspective. It's a tall order to get support from supervisors, but it can be done if we put our minds to it.

A third problem, related somewhat to the first one, also merits our consideration.

That problem is training people who feel threatened by training. For men and women with masters' degrees in engineering, our job is to convince them that we have the credentials to challenge them. But for people coming in cold to new technology, perhaps undereducated for whatever reason, the challenge to us is a little different. You may be dealing with an employee who has spent a whole career working on a piece of equipment, and feels he is the best there is at that job. But when that equipment becomes obsolete, he may think he's obsolete, too. He may think he can't learn anything new.

The challenge to all of us is to create a training program which meets all needs. A program which sets priorities and gets management commitment. But a program geared to meeting the needs of both the subordinates and the supervisor. One which can create a non-threatening environment to provide basic skills, but one which also challenges high powered engineering graduates.

For us in the ASEE, continuing education is a prime opportunity. But it is not only an opportunity, it is a responsibility. As people from the academic world, people from the business world, and people whose sole job is to teach others how to teach, we will be letting our organizations down if we don't meet that responsibility.

If needs in continuing education are not met, people at all levels of the technical spectrum could be denied a chance to realize their own potential. The resulting gaps in technical competence could have a critical impact on the future of our businesses.

Like us, you have no doubt considered the implications of this responsibility at some time in your professional careers. But it is time now for all of us to stop considering and start taking action.

FRANK E. DEMAREE

Frank E. Demaree is AVP-Engineering-Technical Planning at Illinois Bell Telephone Co. He started there after receiving his BSEE at Iowa State in 1941. From 1946 to 1962 Demaree was responsible for the design and construction of a wide variety of facilities for Illinois Bell and Western Electric. This included engineering radio and detection systems for the Distant Early Warning Line and Balistic Missile Early Warning System in Alaska and Canada. Also, he was in charge of engineering for the Project Mercury Global 18-station ground instrumentation and tracking system which Western Electric built for NASA for the space flight program. He returned to Illinois Bell in an engineering management position and between 1962-65 was in charge of the Bell System Data Communications Training Center operated by AT&T in Cooperstown, N.Y. In 1965 Demaree returned as Assistant Vice President-Engineering. He is now responsible for technical long range planning, fundamental planning, PBX equipment engineering and maintenance, and overall staff engineering.

CALL FOR PAPERS

1978 Conference on

Frontiers in Education

Dutch Inn, Lake Buena Vista, Florida
October 23 - 25, 1978

Hosted By Colleges of Engineering of
University of Florida
Florida Institute of Technology
Florida Technological University
University of South Florida

The Education Group of the IEEE and the Educational Research and Methods Division of the ASEE, with the participation of the Colleges of Engineering of central Florida, are pleased to announce the 1978 Conference on Frontiers in Education, to be held October 23-25, 1978, at the Dutch Inn, Lake Buena Vista, Florida. The name of the Conference is the theme of the Conference, Frontiers in Education. The purpose is to bring together persons concerned with education in schools, in colleges and universities, and in industry and government to discuss new developments and new directions in engineering and other post-secondary technical education.

Papers are invited from a wide range of areas including, but not necessarily limited to, those listed below:

Engineering for Non-Engineers
Engineering and Society
Pre-Engineering Studies
Guidance and Counseling
Continuing Education for Engineers
Off-Campus Instruction
The Role of the Teacher
Graduate Education
Graduate Research
Design of Learning Experience
Technology in Education
Computers in Education
New Methods in Education
Evaluation of Education
Student Self-Appraisal
Grades and Grading
Cost Effectiveness in Education
Management Science/Techniques in Education

One of the basic purposes of this Conference is to provide maximum opportunity for personal involvement and interaction, as opposed to passive listening to lectures. Proposals for workshops, panel discussions, and other types of interactive sessions are invited.

Authors wishing to present papers should send a synopsis (typically 200 to 500 words) describing the scope of the paper to:

Program Chairman
Professor Andrew Revay
Program Chairman, FIE '78
Department of Electrical Engineering
Florida Institute of Technology
Melbourne, Florida 32901

General Chairman
Gene Chenette
Professor, General Chairman
Department of Electrical Chairman
University of Florida
Gainesville, Florida 32611

Deadline for submission of synopses is January 15, 1978. Speakers will be notified of acceptance by March 15, 1978. Final drafts will be due June 15, 1978, and will be published in the Conference Proceedings. Persons wishing to propose workshops, panel discussions, or other special sessions should also contact Professor Revay no later than January 15, 1978.

San Diego

SESSION 2.2

DEVELOPMENTS AND TRENDS IN TWO-YEAR ENGINEERING TECHNOLOGY PROGRAMS

Howard J. Lawrence
Dean of Instruction
State Technical Institute
Memphis, Tennessee

Two-year engineering technology educators have always prided themselves on their ability to react quickly to changes in the profession and in society. The needs of industry change continuously. Society modifies its goals for education, and students constantly pressure for a more relevant, realistic, and reliable educational program. In this session three outstanding persons in two-year engineering technology education programs will discuss these and describe some of the programs which have been developed to meet this need. During this session you will be provided some insights into how engineering technology educators are assessing the needs of industry through industrial experiences of the faculty, advisory committees, cooperative programs, and contacts with alumni and recruiters. You will see what leading schools are doing to attract non-traditional students into the two-year engineering technology program and will have an opportunity to view examples of such promotional material as "Blacks in Technology" slide program; "You'll Work Too," a slide presentation for high school girls; a Women in Technology Day plan; and a speaker's bureau of women or minorities. You will also hear described a part-time work/study program for two-year engineering technology students wherein a university and industry employer jointly select students and allow them to attend school half time and work half time during each of the four regular academic quarters and full time during all intersession periods. In summary, this session on two-year engineering technology programs should provide information as to how others are meeting their various needs and how such programs may be initiated in your own institution.

HOWARD LAWRENCE

Howard is presently serving as Dean of Instruction at the State Technical Institute at Memphis, Memphis, Tennessee. He received his Ph.D. from the University of Mississippi in 1972, his M.B.A. from Memphis State University, and his B.S. in Mechanical Engineering from Christian Brothers College. He has served as a design engineer for Bemis Brother Bag Company in St. Louis, Missouri and plant engineer for Chromium Mining and Smelting Corporation in Woodstock, Tennessee. Howard has been active in many professional organizations and within ASEE he served as chairman of the Engineering Division Guidance Committee, a member of the RWI Board of Directors, and a member of the Editorial Committee of Engineering Technology. He is both a Registered Professional Engineer and a Certified Public Accountant.

AN INTEGRATED PART-TIME WORK/STUDY PROGRAM FOR THE DEVELOPMENT OF ENGINEERING TECHNICIANS

Dashamir M. Petrela
Chairman, Engineering and Agricultural Technologies Division
State University Agricultural & Technical College
Farmingdale, New York

John M. Lester
Department Chairman
Electrical Technology Department
State University of New York
Farmingdale, New York

SUMMARY

This paper describes a part-time work/study program for two-year Engineering Technology students as offered by the Electrical Technology Department of the State University of New York Agricultural and Technical College at Farmingdale in conjunction with AIL, Division of Cutler-Hammer, Inc. Incoming students are selected jointly by the College and AIL. This company hires them initially as Technician Trainees and later as Test Technicians to work half-time during each of the four regular academic semesters, and full-time during all inter-session periods. The students' work experience is carefully programmed and evaluated by the Department and Adjunct Faculty who hold supervisory positions at AIL. The company upgrades the student (in both position and salary) on the basis of both satisfactory work performance and academic progress. Special scheduling and the granting of academic credit for appropriate work experience allow the student to still complete the requirements for his A.A.S. degree in two calendar years. The program has significant benefits for the company, the College, and especially the student.

Introduction

The State University of New York Agricultural and Technical College at Farmingdale is a two-year College emphasizing A.A.S. Degree programs in the Agricultural, Business, Health, and Engineering Technologies. It also offers A.S. Degree transfer programs in Liberal Arts and Engineering Science. Located in the centre of Long Island, the College serves a suburban population of over two million people, and close to 90% of its 6000 full-time students, as well as approximately 7000 part-time (evening) students, commute to and from the College by automobile. Though often considered the "bedroom" of New York City, Long Island does have a considerable industrial base of its own. Over 150,000 of its residents are employed by manufacturing industries on the Island, and the College's Engineering Technology Departments have traditionally provided the skilled technicians for these companies. Each of the Technology Departments has an Advisory Committee made up of local industry representatives, and these committees are formally involved in the program and course development activities of the departments. It was at meetings with its Advisory Committee that the Electrical Technology Department first began exploring the concept of a part-time work-study program for its students.

The Electrical Technology Department at Farmingdale offers an ECPD approved A.A.S. Degree program designed to develop electronic technicians. The program is listed below - *note that the numbers in brackets indicate the "weekly lecture hours - weekly laboratory hours - and semester credit hours" for each course.*

ELECTRICAL TECHNOLOGY - ELECTRONICS

First Semester:

ET 100	*Survey of Electronics*	*(1-2-2)*
ET 101	*Electrical Circuits I*	*(4-2-5)*
ET 116	*Electronic Drafting*	*(0-2-1)*
MA 129	*Mathematics*	*(4-0-4)*
EN 100	*English Composition*	*(3-0-3)*
PE -	*Physical Education*	*(0-2-1)*
		(12-8-16)

Second Semester:

ET 103	*Electrical Circuits II*	*(4-3-5)*
ET 106	*Basic Semiconductor Circuits*	*(3-3-4)*
MA 130	*Mathematics*	*(4-0-4)*
EN 101	*Introduction to Literature*	*(3-0-3)*
		(14-6-16)

Third Semester:

ET 232	*Amplifiers*	*(4-3-5)*
ET 233	*Digital Electronics*	*(4-3-5)*
PH 131	*Physics*	*(3-2-4)*
SO -	*Social Science*	*(3-0-3)*
		(14-8-17)

Fourth Semester:

ET 234	*Applications of Linear Integrated Networks*	*(4-3-5)*
ET 235	*Communication Electronics*	*(4-3-5)*
ET 236	*System Construction and Analysis*	*(0-3-1)*
PH 132	*Physics*	*(3-2-4)*
SO -	*Social Science*	*(3-0-3)*
		(24-11-18)

Total Credits Required; 67

As might be expected, the program does have a very high rate of attrition. Only 30% or so of its entering freshmen graduate two years later. Interviews with incoming freshmen have shown that very few really know what the program and the careers it leads to are really like. The first semester *"Survey of Electronics"* course was introduced primarily to meet this need, and to motivate the student towards the study of the other early courses. It was during the discussions on this course that the concept of a part-time work-study program was raised with the Advisory Committee. Surveys had shown that almost 50% of the freshmen students felt they had to work part-time (primarily to meet the cost of operating a car). It seemed logical to try to make their work experience more directly related to their educational program. Both the Departmental Faculty and its Advisory Committee supported the concept. In particular, Mr. Horace Corigliano, who was at the time Director of Product Support of AIL (a Division of Cutler-Hammer), strongly supported the plan. AIL was ideal for the program. A large employer of electronic technicians, it was located within a 15 minute drive of the College, did not have a union (which made for much greater flexibility), and had just received several large contracts which required it to expand its technical staff over the next few years. As a result, Mr. Carmen DeNovio (of AIL's Product Support Division) and Professor Norman Lurch (then Chairman of the Electrical Department) were able to initiate a pilot work-study program between the College and AIL in September of 1973.

The Program

This program, first set up in 1973, now incorporates the following features:

1. The joint selection of students by both the Department and AIL prior to their first semester and the continuation of students in the program only if both their work performance and academic performance are satisfactory.

2. Special scheduling of these students for a reduced academic load so they can work 20 hours/week at AIL during the academic year.

3. A commitment by AIL to provide these students with full-time employment during the six week Christmas recess and the three month summer recess with periodic salary increases and accrued paid vacation time.

4. The joint structuring (using clearly stated performance objectives) of the students' work experience by both the Department faculty and their AIL supervisors.

5. The appointment of Adjunct Faculty at AIL to formally evaluate student performance in light of stated performance objectives. These reports are filed with the Department Chairman, who may then recommend the granting of appropriate academic credit for this experience.

6. The use of the Summer (Evening College) Session to permit students to graduate within two years.

In practice, all accepted freshmen are invited to apply to this program. Those applicants willing to make the commitment are then recommended to AIL which interviews and hires them effective in September. In the meantime, the department plans special schedules for these students. Their academic weekly contact hours are reduced to 17 hours per semester blocked in from 12:30 to 5:00 P.M. Monday through Friday and their work at AIL from 7:30 to 11:30 the same five days. In order to do this, the following courses are left off their schedules:

First Semester:

ET 100	*Survey of Electronics*	*(1-1-2)*

Second Semester:

ET 103	*Electrical Circuits II Laboratory only*	*(0-3-1)*

Third Semester:

PH 131	*Physics (taken in Summer Session)*	*(3-2-4)*

Fourth Semester:

ET 236	*System Construction and Analysis*	*(0-3-1)*
PH 132	*Physics (taken in Summer Session)*	*(3-2-4)*

The students are generally programmed to take their second year Physics courses sequentially during the Evening College summer sessions. Occasionally, an exceptional student is permitted to take one of these Physics courses on an extra course basis in the evening during one of his regular academic semesters. Students who perform well both at work and in their academic courses, may be given academic credit for *ET 100 (2 credits)* and *ET 103 Laboratory (1 credit)* at the end of their first academic year. Similarly, at the end of their second year, successful students may be given academic credit for *ET 236 (1 credit)*. To receive such academic credit for a particular course, the student must have achieved specific objectives in his work experience. For example, to receive credit for *the ET 103 Laboratory*, he must have demonstrated his competency in:

1. Using test equipment, particularly the oscilloscope, to measure such signal parameters as time constant and rise time for exponential waves, and period, amplitude and p-p and rms values, and phase angles for sine waves.

2. Making voltage, current and power measurements and calculations for RC, RL, and RLC networks.

3. Making basic transformer measurements, and impedance and power efficiency measurements and calculations.

4. Making frequency response measurements on sample filters and/or amplifiers.

In practice, the students' work experience more than covers the topics associated with these courses, and by thus earning the four (4) associated academic credits, the students still graduate within two years.

The students' work experience at AIL is supervised by both the adjunct faculty member at the plant and the Department's full-time faculty, who visit AIL at least once a semester. Students are hired as "Tech Trainees" at approximately $3.00/hour. Those who maintain good academic standing and satisfactory work performance are given a salary increase approximately every four months. At the end of their first year, they are promoted to Test Tech "C" and upon graduation - if they stay with the company - they are promoted to Test Tech "B" at a salary of $190.00 per week. The salary figures given above are 1975 figures and can be compared to the $150.00/week average starting salary offered by AIL to non-participating E.T. graduates that year.

Student Performance

During its first three years of operations, a total of eighteen students entered this program. Of these eighteen students, fourteen have graduated (with an overall grade point average of 3.12), two transferred to our Engineering Science program, and two withdrew for non-academic reasons. Last year, an additional 9 freshmen entered this program. One of these was the first student dropped from the program for academic reasons. The other eight, however, successfully completed their freshman year (with an overall grade point average of 3.14).

The academic performance of the students who elected to participate in this program has been truly excellent, yet their high school averages and pre-college test scores are not significantly different from those of their classmates (only 30% of which graduate in two years). The general feeling in the Department is that this high level of performance is largely due to the increased motivation and maturity that these students acquire, at least partly, from their work experience. AIL has recognized that these students' first six months of employment is critical in developing their initiative and motivation, and has taken pains to provide close supervision and training for them during these first few months. There is no question but that the students find the split eight hour day of both school and work highly motivating and that their work experience helps them to mature more rapidly.

Conclusions

The management of AIL is more than satisfied with the program, after their initial training, these students have shown themselves to be quite productive. The Manufacturing Division of AIL using these work-study students has transferred some full-time technicians to other Divisions and has actually lowered its overall salary costs for technicians. The College is extremely satisfied with the academic success of this work-study program. The participating students are highly motivated and demonstrate exceptional initiative. This has a positive influence on other students in their classes, and most of the faculty find working with these students both more challenging and more rewarding. The concensus among all parties - the Students, the Company, and the College - is that the program is well worth the administrative effort required to ensure proper scheduling, supervision, and evaluation. As a result, the College is making every effort to expand this program and this year another company, Bertan Associates has begun participating in it.

Acknowledgment

The authors wish to acknowledge the contribution of the late Dr. Charles W. Laffin, Jr., President of the College, without whose support this program would not have been possible.

John Lester is presently the Chairman of the Electrical Technology Department. Prior to joining the College in 1969, he held numerous engineering positions - from Research Engineer to Engineering Manager at Sperry of Lake Success, New York. Professor Lester holds both the Bachelor's and Master's degrees in Electrical Engineering as well as numerous patents in his field.

"Dash" Petrela is Chairman of the Division of Engineering & Agricultural Technologies at the State University of New York at Farmingdale. Prior to assuming this position, he was a Professor in the Electrical Technology Department - one of the eight Engineering Technology Departments in the Division. Dr. Petrela is the holder of several degrees in Engineering (Ph.D. - Colorado State) as well as a Professional Engineer's License in the Province of Ontario, Canada, where he worked as an Engineer ere entering academia in 1962.

ATTRACTING NON-TRADITIONAL STUDENTS INTO TWO-YEAR ENGINEERING TECHNOLOGY PROGRAMS

Martha Henegar, APR
Director of Public Relations
Nashville State Technical Institute
Nashville, Tennessee

Before we plunge into the materials and methods of <u>how</u> to attract non-traditional students into engineering technology programs, let us consider an even more basic question: Why should we attract the non-traditional student?

Why should we upset the status quo? Are we not doing just fine the way we are?

At least one colleague of mine, a professor of engineering technology, believes that if we start recruiting more "women and Blacks, we'll have to lower our standards." My colleague, need I add, is a white male.

But teacher attitude is another matter. Let us defer for the time being the question of how to allay years of ingrained racist and sexist opinions. Of how to convince teachers in two-year technology programs that they are no longer in graduate school. That our students may well be academically and culturally disadvantaged and that <u>that</u> may well mean a special approach to teaching.

So, back to the basic question of 'why.' Why should we make a special effort to attract these non-traditional students?

Consider, if you will, three progressive facts: (1) For the next decade, there is going to be an increasing demand for our product: the engineering technician. The 1977 <u>Occupational Outlook Handbook</u> says that for engineering and science technicians "employment is expected to grow faster than average for all occupations as (a) result of industrial expansion and the increasingly important role of technicians in research and development. Favorable employment opportunities, particularly for graduates of post-secondary school technician training programs." Specifically, the estimated employment of these technicians in 1974 was 560,000, with an average opening between now and 1985 of 32,000 a year.

To meet this demand from industry, we have got to continue active recruitment efforts.

But whom do we recruit? Traditionally, our primary target group has been the young person aged 18 to 25, the recent high school graduate or the veteran who is ready to continue his education. But here comes hard, cold fact number two.

(2) That prime target is levelling off. The 18-year old student entering our two-year programs this Fall of 1977, was born in 1959... the last of the Baby Boom '50s. What does that mean for two-year institutions?

Let's look at data from the Department of Health, Education and Welfare. In 1973, HEW noted that fall enrollment of first-time degree-students in two-year institutions was 680,714. This enrollment, the HEW data show, had increased every year since 1966. Furthermore, HEW projected a continuing yearly increase through last year, 1977. From now on, now that the "Baby Boomers" are gone, it's all downhill:

1977 = 703,000	1981 = 666,000
1978 = 699,000	1982 = 643,000
1979 = 687,000	1983 = 612,000
1980 = 677,000	

And with the expiration of some VA benefits, the revision of others that require matching funds from the veteran himself, and the abolition of the military draft, the percentage of veteran enrollments is down all over the country.

Now, the high school grads are still there, alright, and so are the veterans; but their numbers are just not as great now and there are simply not as many to go around. In Nashville alone, there are sixteen colleges vying for their attention.

Did I say our primary targets are high school graduates and veterans? I should amend that: Our targets are <u>white, male</u> high school graduates, and the <u>white, male</u> veterans.

That amendment suggests fact number three. Actually, a three-part fact:

(3a) By recruiting primarily from the male population, we are limiting our efforts to only half of our source of people. Over fifty-two percent of the population is female; and yet, only about two percent of all engineers are women. With the demand for engineers and engineering aides growing ever greater, it is simply unrealistic not to make a concerted effort to tap this source of girls and women.

(3b) In 1970, only 2.8 percent of engineers in this country were Black, Chicano, Puerto Rican or American Indian. At the same time, these groups constituted 14.4 percent of the population. Clearly, these minorities are underrepresented in the engineering field and provide, therefore, another relatively untapped source of new students.

I should add here that another persuasive reason for recruiting women and minorities is a plan known as Affirmative Action. The law charges us to make a special effort to increase our student enrollments of females and minorities.

(3c) Even if we do make special efforts to recruit high school girls and minorities, that fact about the birthrate persists. The Baby Boom of the '50s has just produced its last high school graduates. The market pool of 18 to 25 year olds is drying up.

Meanwhile, however, while the young crop is diminishing, the number of older people returning to school is increasing.

.Advancing technology is causing workers to return to school for additional training.

.Increased leisure time is allowing those who are dissatisfied with their work to learn new job skills.

.Mature women are returning to the work force in increasing numbers due to economic necessity, divorce, widowhood, or the simple desire to work outside the home.

So there they are. Women, minorities, older people: the non-traditional students in engineering technology.

We don't have time here to go into industry's responsibilities to hire and encourage these "non-traditionals," nor what we as educators might do to help employers meet their responsibility. Let's talk about that another time.

For now, we are concerned with getting the "non-traditionals" trained and that means first getting them into our schools.

So on to the "how." How do we go about recruiting them?

First, let's clean up our act. Let's take a good look at our publications, our audio-visuals, our advertising. Are we fair in representing girls and women? Minorities? The older student? Notice I don't say "equitable," but "fair." If you say, "Well, only five percent of our students are Mexican-Americans, so we'll include Mexican-Americans in five percent of the pictures in the college catalog," you may be equitable. But it will do little to increase your Mexican-American enrollment.

We have got to make a special effort, to reach further, to meet the non-traditional prospective student more than half-way. We can:

.review all our promotional materials and make sure the non-traditionals are included in pictures and stories.

.review the copy in these materials to rid them of sexist or other biased language. A good guide here is Without Bias: A Guidebook for Non-discriminatory Communication, a booklet that covers racial, ethnic and sexual bias, as well as communication sensitive about handicapped persons. The booklet is available from the International Association of Business Communicators. Also helpful are McGraw-Hill's Guidelines for Equal Treatment of the Sexes in McGraw-Hill Book Company Publications and Scott Foresman's Guidelines for Improving the Image of Women in Textbooks. A condensed version of these last two booklets is available from the National Council of Teachers of English in a pamphlet called Guidelines for Non-Sexist Use of Language.

Next, let's be creative. Let's think of new recruiting efforts we can make in this "reaching out" process. Consider, for example:

.special publications aimed at specific non-traditional groups. Last March, we devoted our Nashville Tech magazine PRINT-OUT to stories on women in their 30s, 40s, and 50s who had returned to school to prepare to go back to work. Last month, we ran a special issue on Blacks in Technology.

.an on-campus seminar aimed at a specific group. To a "Women in Technology" Day, we invited local high school girls to hear five women in engineering and other technologies talk about their experiences and advise on what courses to take in high school to prepare them for technical studies.

.slide programs to show to groups of prospective students. Feature your own minority students in these programs. They'll serve as role models; as real people with whom other minorities may identify. Nashville Tech has two such programs in its files; "You'll Work, Too" about our women students and graduates, and another about our Black students and graduates.

.a speakers' bureau of women or minorities who are willing to talk about their jobs at high school career days. Nashville Tech's "Women Who Work" program utilizes the services of sixty women in both traditional and non-traditional career areas.

The list goes on. We are limited only by our imaginations, only by our depth of caring in developing the materials and the methods of attracting the non-traditional student who may, in an engineering technology career, find just the life work to make that life more rewarding.

And that's the bottom line: The best reason of all to help all people in making wise career choices.

This paper presented January 25, 1978
1978 College Industry Education Conference
San Diego, California

DATA SOURCES

Minorities in Engineering: A Blueprint for Action. Summary and Principal Recommendations. The Planning Commission for Expanding Minority Opportunities in Engineering. The Alfred P. Sloan Foundation, 1974.

Occupational Outlook Handbook in Brief. 1976-1977 Edition. U. S. Department of Labor, Bureau of Labor Statistics.

Projections of Educational Statistics to 1983-84, 1974 Edition. National Center for Educational Statistics, U. S. Department of Health, Education, and Welfare.

BIBLIOGRAPHY

Guidelines for Equal Treatment of the Sexes in McGraw-Hill Book Company Publications. 1972. 16 pages.
McGraw-Hill Book Company
1221 Avenue of the Americas
New York, New York 10020

Guidelines for Improving the Image of Women in Textbooks. 1972. 11 pages.
Scott, Foresman and Company
1900 East Lake Avenue
Glenview, Illinois 60025

Guidelines for Nonsexist Use of Language in NCTE Publications. 1975. 7 pages.
National Council of Teachers of English
1111 Kenyon Road
Urbana, Illinois 61801

Without Bias: A Guidebook for Nondiscriminatory Communication. 1977. 78 pages.
International Association of Business Communicators
870 Market Street, Suite 928
San Francisco, California 94102

For Nashville Tech publications (PRINT-OUT, Women Who Work):
Public Relations Division
Nashville State Technical Institute
120 White Bridge Road
Nashville, Tennessee 37209

MARTHA HENEGAR

Ms. Henegar is Director of Public Relations at Nashville State Technical Institute. She is Accredited by the Public Relations Society of America and has served as that organization's Middle Tennessee liaison for its Task Force on the Status of Women in Public Relations. A member of American Women in Radio and Television, she is past president of the AWRT Nashville Chapter and served as the chapter's Affirmative Action chair. Ms. Henegar is also a member of International Association of Business Communicators and the American Vocational Association, and is past president of the Middle Tennessee Business Press Club. A graduate of Peabody College, with an M.A. degree in English, Ms. Henegar taught in the Nashville public schools for nine years, then joined WMCV-TV, a commercial television station, as promotion director and on-the-air personality. In 1970, she began her association with Nashville Tech, five months prior to that institute's opening, where she developed and heads the Public Relations Division, which is responsible for publications, press relations, advertising, and special events.

WHAT TWO-YEAR ENGINEERING TECHNOLOGY PROGRAMS ARE DOING TO MEET THE NEEDS of INDUSTRY

Robert L. Grigsby, Jr.
President
Midlands Technical College
Columbia, South Carolina

Abstract

This paper provides some insights into how engineering technology educators are assessing the needs of industry through industrial experiences of the faculty, advisory committees, cooperative programs, and contacts with alumni and recruiters. The needs of industry are viewed as being in two general areas, (1) a continuing supply of good engineering technicians and (2) technician training for employees and prospective employees. The responses of two-year engineering technology programs to these two areas are presented in some detail, considering benefits which are often overlooked, especially in the area of employment as related to more systematic staffing processes required today. Lastly, the author shares what he sees as trends in two-year engineering technology programs and developments that will affect these programs.

Introduction

Midlands Technical College located in Columbia, South Carolina, is a multi-campus institution with a current enrollment in excess of 6000 students. It was formed in July, 1974 by the merger of Midlands Technical Education Center, Palmer College, and Columbia Technical Education Center. The largest of the three merged institutions was Midlands Technical Education Center of which I have been Executive Director since it opened its doors in 1963.

Two-year engineering technology programs were the major course offerings in the early years of Midlands TEC. However, as time passed, the institution changed from a school offering programs in the fields of business, health, industry, public service, office occupations, craft and Associate of Arts. Nevertheless, I believe that our seven programs in engineering technology, five of which are ECPD accredited, have been and will continue to be an essential portion of our course offerings.

South Carolina's system of 16 technical education centers and technical colleges was established to help further industrialize South Carolina and improve the educational and economic well-being of many of its citizens who typically had not been drawn to or did not have the means to attend other state colleges and universities. In accord with this, our primary goal in engineering technology has been to develop well-trained technicians who are prepared to meet the needs of industry. For this reason it has always been imperative for us to maintain communication and close alliance with the industries we serve.

A. Assessment of Industry's Needs

One of industry's needs is simply to have its needs assessed by educational institutions and organizations. We assess the needs of industry in a variety of ways. Let me identify some of them.

a. Through Industrial Experiences of Faculty-- Almost all the faculty in our engineering technology programs have a number of years of engineering and industrial experience. The engineering technology faculty at Midlands, for example, have an average of 12 years of industrial work experience pertinent to their disciplines of instruction. Much of this experience is recent, as it should be. Nevertheless, all of these industrial experiences bring into the programs an intrinsic knowledge and understanding of many of the actual needs of industry, particularly what engineering technology graduates will be required to do. Summers and periods of leave provide time for faculty to update their work experiences and knowledge of industrial needs. On-going part-time consulting work, in which some of the ET faculty engage, provide additional occasions to become aware of industry's needs.

b. Advisory Committees--It is my firm conviction that good educational programs should have advisory committees, especially programs in engineering technology which are geared toward meeting the practical, day-to-day technical needs of industry. Advisory Committees provide a valuable channel through which engineering technology educators are continually receiving information from industrial representatives regarding their technician training needs and what to expect in the future. At Midlands we have made it common practice to have the faculty, and department head of each program to meet with their advisory committee at least twice each year, once in the fall and again in the spring.

c. Contacts with Recruiters--Company recruiters visiting the campuses to recruit engineering technology graduates occasionally present their various needs in terms of specific skills and capabilities that they desire in technicians. This type dialog between our faculty or placement offices occurs more frequently and is more beneficial when the recruiter comes from the engineering or operations department instead of the company's personnel office.

d. Contacts with Alumni--Engineering technology graduates who have been working in industry for several years often return to visit their old professors and see how the school has changed. Such alumni often take great pleasure in describing the latest development in their company and the types of work in which they are engaged. Occasionally, they offer specific suggestions concerning skills that should be taught or deleted.

e. Through Cooperative Education Programs--Our Mechanical ET program provides cooperative education. Two avenues of assessing industrial needs and trends are possible here, one from the students and the other from the students' immediate supervisor. Valuable feedback can be acquired through these channels.

f. Other Means of Assessing Needs--Other means of assessing industry's needs are through industrial manpower surveys, institutional personnel assigned to maintain continual contact with the local industry, formal and informal exchanges between school and industrial personnel at meetings of various professional societies, including meetings like this.

B. <u>The Needs of Industry and the Response of Two-Year Engineering Technology Programs</u>

Industry has two general needs to which two-year engineering technology programs are responding. These two needs are: (1) a continuing supply of good engineering technicians; (2) Technical training for employees and prospective employees. Let's take a look at these two areas of need.

(1) <u>A Continuing Supply of Good Engineering Technicians.</u> Our two-year engineering technology programs are producing technicians which have been trained to satisfy the practical, day-to-day production level, technical needs of industry. To accomplish this it has been necessary that students in these programs be taught by faculty who are not a collection of Ph.D.'s having never gained any practical experience, who entered the classroom immediately after graduate school. Instead they are taught and trained by faculty who have accumulated years of experience in industry. At Midlands Technical College about 60% of the engineering technology faculty are registered professional engineers and as stated previously, they have an average of 12 years of practical experience in and related to their areas of instruction. At Midlands we have a couple Ph.D.'s in our ET faculty. This is fine, but the important thing is that they have industrial work experience, also.

I said that industry needs a continuing supply of good technicians. Well, just what are <u>good</u> technicians? The word "technician" has a <u>broad</u> application. Literally, it can be applied to anyone who purports some skill in the technical details of a trade or profession. Therefore, a technician's formal training and academic preparation can vary from an absence of a secondary education to a number of years of post-secondary education. However, many college level courses don't focus on any particular area of technical expertise. So the accumulation of credit in a number of such courses does not always relate to the skills and knowledge required of a technician.

Some employees become valuable senior technicians over a period of years simply through job experience, training and rising through the ranks. I will not deny that some of these aren't good technicians and that industry doesn't value them and make good use of them. However, though such technicians may be competent and highly skilled in a rather specialized area, just how readily they can shift and adapt to a different and related area of technical service is often questionable. I believe good technicians are not only competent but able to make such adjustments. They offer their industrial employers this desired flexibility. Generally, this type flexibility is an intrinsic quality of graduates of two-year engineering technology programs.

Furthermore, good technicians are capable of more than following "cookbook" type performances. They have sufficient understanding of basic scientific principles and assumptions underlying methods, processes, and equipment being used so as to make reasonable judgements about the limits and ranges within which they are applicable and can properly function. A technician who has had no more than narrow, direct technical training to perform a complicated job is much more likely to make a serious and perhaps costly mistake than one whose technical training has been supported and reinforced by studies in technical and basic sciences and other non-technical areas. Thus, it follows that good engineering technicians will, in general, be those whose academic preparations are comparable to those which can be found in our two-year engineering technology programs, particularly those which have adopted ECPD's curriculum guidelines. These programs go beyond the typical industrial training programs by producing technicians whose training include courses in communications, humanities/social studies, mathematics, physical sciences and technical sciences as well as more comprehensive technical specialty courses. From these programs industry receives technicians that have a broader and more rounded educational background. They are more mobile in assignments and able to better cope with out-of-the-ordinary type situations.

In the past, staffing practices, which were inconsistent with specific job requirements, plus a te[illegible] "window dress" the credentials of technic[illegible]ffs contributed to an under utilization of the services of engineering technicians. Also, the lack of systematic, comprehensive programs to train engineering technicians on a nationwide basis, as our engineering technology schools of today, was responsible for little employer awareness and respect for the technician.

Today, however, an increasing number of employers of technical personnel such as engineers and scientists are starting to recognize that they have need for more engineering technicians. One reason for this is that employers are finding it necessary to engage in more systematic staffing processes in order to comply with federal regulations and protect themselves from possible charges of discrimination. All tests employed in personnel selection processes must be proven to be job related, especially where a test exhibits an adverse impact in the employment of minorities. As a result more employers are engaging in functional job analyses in which each job is broken into component tasks and the tasks are scaled on data, people, things, basic verbal math and reasoning requirements. Such job analyses are calling for the employment of relatively less engineers and scientists and for more technicians because employers are increasingly recognizing that engineering technicians can perform many different, valuable functions.

Some of these functions, to name a few, are drafting; checking engineering calculations; routine design work to be checked by an engineer or technologist; operation of complex and delicate instruments; computer programming; assistance in preparation of computer input data and analysis and application of output data; technical surveys; cost estimating; testing materials and components; technical sales; inspection; special maintenance; and supervision.

As a result of employing technicians from two-year engineering technology programs, industry is reaping a number of benefits. What are some of these?

a. Economical benefits--Realized by employing the lower salaried technician to perform technician level work instead of an engineer.

b. Greater job satisfaction for engineers--Resulting from engineers being given more challenging and responsible assignments while paraprofessional tasks are handled by the technician. In practice, this helps to increase the self esteem of the engineer and contributes to his professional standing. Younger engineers, particularly those recently out of school, can be given assignments more commensurate with their training and, thus, not become so easily disillusioned with their work.

c. Less turnover of engineers--Improved satisfaction with job assignments contributes to increased periods of employment. This in turn provides for less confusion, delays and readjustments in meeting various project commitments.

d. Greater productivity--When technical personnel are engaged in work that is more compatible to their capabilities and expectations, resulting in greater job satisfaction and less turnover of personnel, productivity increases and further promotes the economy of operations.

e. Assistance in the process of staffing with technicians--There are several ways that industry is benefiting in the very process of employing engineering technicians. The staffing process involves recruiting, selection, placement, orientation, and consideration of affirmative action goals in some cases. Our training programs produce groups of technicians. The jobs of industrial recruiters are greatly facilitated by their being able to visit our campuses and quickly interview a number of qualified technicians. At this point the selection process is often reduced to the point of simply choosing those who seem to be the best matches for the individuals and the company. The practical nature of our training, especially our co-op programs, simplify and ease orientation of the graduate and placement within companies. We have not been negligent concerning industry's need for minorities. Many of you know that engineering and technology educators have sought and are continuing to seek and produce technicians from segments of our society in which people have been socially and economically deprived, and on whom past employment practices have not always been equitable. A number of special recruiting and special services programs are being used to attract and help keep minority students within our programs.

f. Managerial and supervisory personnel--Employers quickly recognize that our engineering technicians with their technical skills and knowledge combined with a good selection of general education courses, such as communications and human relations, are prime candidates to take on supervisory responsibilities. Management and supervisory development courses added to our basic engineering technology curricula, through course options or continuing education courses, help to further prepare our graduates to assume such responsibilities. Managers and supervisors with technical backgrounds seem to be highly valued in industry.

(2) <u>Technical Training for Employees and Prospective Employees</u>. Technical training for existing employees and in some cases for prospective employees is the second general area in which two-year engineering technology programs are responding to needs of industry. Some of the current training opportunities offered are:

a. For company developed technicians to enroll in evening engineering technology courses and programs to further develop and refine their capabilities, and to formalize their education through credit courses. Lack of a college degree can present a barrier to certain levels of promotion. Therefore, such educational opportunities are of much value to many employees.

b. Continuing education is important for degree holding engineers and technicians. Future job opportunities, such as a place in supervision, generally make continued education essential. Changes in technology, new processes and equipment or changes in assignment and responsibilities demand further education for the technician and other employees. The advent of the new international metric (SI) system of measure, for example, calls for a general education of the part of all; however, further education about standard practices to be adopted for each area of industry must be taught to millions of employees.

c. At the request of industry many of our courses of all types, credit and non-credit, are being taught off-campus in more convenient locations for employees, often within the plant. Registration and text materials are made available at the class site. This kind of service encourages more employees to increase their knowledge and skills in areas where company supervisors have identified educational needs.

d. Sometimes one or more specialized courses or perhaps entire curricula are developed to meet the specific educational needs of the employees or prospective employees of a company. In South Carolina we denote such educational services as "special schools". Often special schools are conducted for a new industry which our State Development Board has attracted to South Carolina. While a new plant is being set up and geared for production a special school may be provided to develop a pool of manpower which can respond to the technical needs of that company. One of the most extensive such programs which we experienced at Midlands Technical College was one which trained operators and health physic technicians for a multi-million dollar nuclear fuel reprocessing facility. This particular special school, offered over a period of three years, consisted of a 101 credit-hour, two-year curriculum which culminated in an associate degree in Nuclear Engineering Technology. The engineering technology divisions of three different TEC schools participated in this school. This special school became the forerunner of the regular Nuclear program we presently offer at Midlands. Special Schools have probably been one of the biggest benefits to our newer industries in South Carolina.

C. Trends Expected in Two-Year Engineering Technology Programs

In response to future needs of industry and society plus changes occurring in the field of higher education, certain trends may be expected in two-year engineering technology programs. Let's identify and look at some of these.

(1) Two-Year ET Programs will Become More Established. Two-year Engineering Technology programs will generally become more established, recognized, and appreciated by society and industry. In the technical manpower spectrum two-year engineering technology graduates are filling a real need in industry and there seems to be little or no "identification" problem nor charges of duplication.

Our society, our nation, and our world are continuously becoming more dependent on technology to develop, improve, and maintain our standards of living. Maintaining and improving these standards in an acceptable environment will be a tremendous challenge in view of the shortages we face and will encounter in food, resources, and energy. As a result the avoidance of major catastrophies and perhaps even the survival of man will become increasingly dependent on man's technological capabilities. Good technicians from our two-year engineer technology programs will be important members of our technological teams and, thus, will play prominent roles in helping to meet these challenges which confront man. This need for such technicians will help to confirm that two-year engineering technology programs be maintained and strengthened.

Another factor which will help to further establish two-year engineering technology programs is the need for American industries to economize by using technicians instead of engineers wherever possible. Other associated benefits mentioned previously will contribute to lowering costs. Competition that our industries are facing from foreign based industry in both domestic and foreign markets will continue to emphasize the need for cost savings in every possible way.

(2) High Cost/Low Benefit ET Programs Will Be Dropped. Being a part of post-secondary education two-year Engineering Technology programs will be caught in the economic squeeze that has already begun and will continue to confront higher education. As a result greater accountability for expenditures will be required. Technical education is expensive education compared to most other types of education and you can be assured that its programs will not escape the scrutiny of educational administrators, legislators, and tax payers. Cost/Benefit Analyses may be required of each program in the process of justifying the expenditures of tax payer's dollars. Programs which are found to have a relatively high cost/benefit rating will probably be dropped. New programs will continue to emerge in specialized areas but will endure only where really needed and supported by industry.

(3) Continued Recruiting of Minorities and Consideration of the Handicapped. In order to conform to current and future federal employment regulations, industry and schools of higher education will continue to call for minorities. Added attention and consideration is being given to the handicapped, also, in both education and employment.

The demand for minorities will continue to be especially acute among technical personnel. Although programs in engineering and technology have made efforts to attract, retain, and graduate more of the minorities, we still have a long way to go.

(4) Practicality and Hands-On Training To Remain the Basic Characteristic of Technician Education. This is the feature of engineering technology education that makes its graduates attractive to industry. Departure from this basic philosophy will create a gap which will be and must be filled by others because industry must have these kinds of technicians.

(5) Application of Educational Technology Will Increase. Non-traditional methods of instruction are being applied in engineering technology education--principally in the area of individualized and self-paced instruction. These methods and the technology which supports them offer needed flexibility and economy to both students and institutions, especially in areas where programs or classes with small enrollment must be accommodated. I believe such applications will increase in two-year engineering technology programs.

(6) Concerning Professional Registration. This is a big issue for technologists who graduate from four-year engineering technology programs. I believe there are problems ahead for those who would deny P. E. registration to individuals who can pass legitimate tests (see Article "The Perils Ahead for Professional Certification" by Donald E. Marlowe, ASEE Executive Director, Page 336, Engineering Education, February, 1977). However, for the engineering technician, I believe other certification such as that offered by ICET (Institute for Certification of Engineering Technicians) is more appropriate and will continue to be accepted. I don't know about the laws in other states, but in South Carolina graduates of our Civil Engineering Technology Surveying Program can become registered land surveyors after acquiring four years of acceptable experience in land surveying.

(7) More Emphasis In Off-Campus Courses. Declining enrollments and rising costs will spur on competition for greater shares of the educational, tax dollar. In an effort to maintain or increase FTE more courses will be taught in non-traditional locations in order to attract new students.

D. Conclusion

Two-year engineering technology programs are providing important services to industry. Their graduates provide a continuing supply of well-trained technicians which are very responsive to today's technical manpower needs, particularly with staffing processes becoming more systematic and requiring functional job analyses. Industry is benefiting, also, by the technical training that two-year engineering technology programs are providing for its employees. This includes continuing education, formal education geared to degree attainment, off-campus and in-plant courses, and special schools to help provide technical manpower needs for new plants and processes. Within the field of higher education the future for two-year engineering technology programs looks good, but only as long as practical, hands-on training remains the basic characteristics of these programs. These programs will have to compete vigorously for educational funds but the programs that are really responding to industry's needs will survive and should become more established.

ROBERT "BUCK" L. GRIGSBY, JR.

Born in Saluda, South Carolina. Graduated-Saluda High School; B.S.-Clemson College; M.S.-North Carolina State College. Attended Purdue University. Honors--Graduated with honors from Clemson and North Carolina State College. Phi Kappi Phi-Honor Fraternity. Kappa Phi Kappa-Honor Fraternity. Infantry Squad Leader in Europe. Recommended for a battlefield commission. Commendations-Battle Stars (2), Purple Heart, Combat Infantryman's Badge. Good Conduct Metal. Taught four years in Gilbert Schools Gilbert, S.C. Four years in Irmo Schools, Lexington, S.C. Six years with General Electric, manufacturing supervisor. Headed several task forces to analyze and suggest solutions to problems. Executive Director of Midlands Technical Education Center, 1962 to March, 1974. President of Midlands Technical College from March, 1974 to present. Served as president, secretary-treasurer, etc. in many civic groups. Served in many capacities in the local and the conference level of the S. C. Methodist Church. Member of various education associations.

EMPLOYER PLANNING, ORGANIZATION, AND MANAGEMENT OF A COOPERATIVE EDUCATION PROGRAM

Dr. Martha Johnson
Director, Cooperative Education
Virginia Polytechnic Institute and State University
Blacksburg, Virginia

This session, Employer Planning, Organization, and Management of a Cooperative Education Program, has been planned with the interests and concerns of the employers in mind. Co-op employers with different types of programs are discussing the various aspects of industry programs. The overall aim of this session is to provide a wide variety of information to generate group discussion and participation.

Goals: Short and Long Range Planning is being presented by an employer who recently completed a comprehensive planning for a co-op program to include 120 engineering students from 12 co-op engineering schools. Current participation is 60 students. The kind of decision making process is discussed with emphasis on corporate support. Central monitoring of all aspects of the program is a necessary component of this program. The university co-op programs considered and some guidelines for selection of co-op schools is a part of this presentation.

Managing Co-op Human Resources is being presented by an employer with over ten years of co-op experience. The budget for co-op salaries and description of tuition grants are featured topics with unique aspects. Co-op students are scheduled at different plants located in different states and the schedule and management aspects of this type of program are discussed.

The Role of the Supervisor is being discussed by an engineer who directly supervises several co-op students. Presented is the rationale for hiring co-op students, the goals set for their training and development, and the students' reactions to supervision. The time involved for supervision, and the process of integrating the students into the system is discussed. A part of this presentation is a discussion of the need for commitment to the program by both the employer and the university. This presentation emphasizes the importance of supervision.

The Labor and Management Relations Problems topic takes a look in some depth at the labor and management relations problems and practices in cooperative education in a large corporation. This company, one of Fortune's top thirty, has had a successful cooperative education program for over fifty years. Several of the company's participating divisions' salaried employees, including engineers and technical personnel, are represented by unions. During this presentation, the manager of this company's cooperative education program is discussing their program with its historical background and today's present status. However, the principal emphasis is placed on the actual labor and management relations practices and a discussion on the management of several key problems.

Martha J. Johnson is Director of Cooperative Education at Virginia Polytechnic Institute and State University where she received a doctorate degree in educational administration in 1973. Dr. Johnson has a B.S. degree in English and foreign languages from Western Kentucky State University, and a M.S. in English from Radford College. She has published short stories and poetry and authored an article, "Note of a Possible Source for 'Who's Afraid of Virginia Woolf?'"

Dr. Johnson has had five years teaching experience in high school and college, and has taught English, French, journalism, and English composition. She has spent the past four years in Cooperative Education at Tech and has served as a consultant for New River Community College, George Mason University, Western Kentucky State University, and the U. S. Office of Education. She has also served as Director for the Mid-Atlantic Center for Cooperative Education.

MANAGING CO-OP HUMAN RESOURCES

Thomas V. O'Reilly
Director Salary Administration and Recruiting
Abex Corporation
New York, New York

Although the subject of my talk today is managing Cooperative Human Resources, my remarks will be directed to the day to day operations of the Program without any consideration for the planning that's involved for long range goals previously discussed. To set the stage let me give you a little bit of background about Abex. We're a manufacturing Company with forty plants scattered around the country. We have additional operations outside the United States but these don't play any part in our current discussions on the Coop Program.

For purposes of the Coop Program, we're in three basic manufacturing lines. We're in machine shop operations, foundry and casting operations and processing operations.

Although we are a large manufacturing Company, our needs are not great and at the present time we have only about a dozen engineers in the Coop Program.

While we hire students for the Program, we generally do not look for the top of the line as far as grades are concerned. One of the problems in so doing is that we're in competition with many of the other larger companies that have much broader programs than we have and are willing to pay higher salaries then we are to get the calibre of person that they are looking for.

Our experience with the Coop Program and with our former recruiting program have shown us that a great bulk of the students are not in the top of the grade but somewhere down in the middle. Our reasoning is similar to that of the Internal Revenue Service in their method of taxing. Everyone wonders about those people who make a million dollars a year [illegible] pay no taxes but the IRS isn't really too conc[illegible]d with them because there's so few of them. They're more concerned about the middle class group because this is where the bulk of the tax money comes from. We feel it's the same with the Coop students, the bulk of the students are in a "middle class group".

We generally accept anyone into our program who qualifies to stay in the program sponsored by the school. In placing a Coop on an assignment, we have a philosphy of broad based training, that is, we will place a student in the machine shop environment for two terms, then two terms in a casting operation and two more terms in the processing operation. If there are anymore work terms available, he or she may even spend time in our Corporate Research facility which has a Metallurgical Research, Industrial Engineering Research and Mechanical Engineering Research.

As you may have noticed, we talk about students returning to work regularly. We don't want a student for one or two terms. We want to cultivate the student so that upon graduation he will want to work for us. We do not extract any commitment from the student to stay with us. Rather, we feel that it is incumbent upon us to provide the right kind of atmosphere and challenge so that the student is eager to return. In short, we have to impress him that Abex is a good Company in which to work for the foreseeable future. In this regard, the sequence of terms and assignments is flexible so as to meet the needs of the students.

The kind of work a student gets is not specifically formulated for him as a Coop. He is given the day to day assignments and projects which keep us in business. He's living and working in the real world with the advantage of getting work assignments which are slightly ahead of his apparent ability. We do this intentionally so as to stretch him and stimulate his interest.

Our aim obviously is to give the student an opportunity and exposure in several areas so that he will have better insight into what he wants to do if he is somewhat undecided. If a student feels that he wants to limit himself to a certain area such as machine shop, we'll try and satisfy his wishes. However, the student must have a bona fide reason for wanting to stay in the program at a particular location. If he feels for travel reasons he'd rather stay at one location, that to us is not sufficient reason and we will accommodate him at that location only if it's convenient to our schedule.

Upon completion of a work term, we ask each student to complete a report on his assignment. The report tells us what he did in the way of activities, what he got out of the assignment and does he have any suggestions for improving the Coop Program itself. Since these reports are confidential with the Personnel Department, we ask the students to be as candid as possible and we do find that they are objective and critical but in a constructive manner. This helps us track the plants that provide meaningful assignments and singles out those plants that are not providing the business background needed to enhance and stimulate the students education.

We have found the real heart of a successful Coop Program is in budgeting the students. When we first began the Program about ten years ago it was administered out of Headquarters but the budgetary operation was taken care of by the Divisions, that is, we went out and hired the Coops based on the needs supplied to us by our Divisions. They then had to put up the money to pay salaries and related expenses. During good times this worked well, however, when a Division ran into some production problems or economic downturn, they called off their Coop Program. In some instances this left students high and dry. They may have spent two or three terms with that Division and were planning to return to that Division but now did not have the opportunity. Because we had no finances in Headquarters, we did not have the opportunity to shift the student to another operation unless another operation was looking for a Coop student with that discipline at that time.

To alleviate this problem, we began to budget Coop students into the Headquarter's payroll based on the need as we saw them within a Division. It's also amazing to see how once this is accomplished a Division's needs change. A Division formerly that required perhaps only one student every other term all of a sudden needed a replacement for that student so that they had coverage all year round.

The Program runs much more smoothly when the dollars are controlled from a central source and the students allocated on a need basis as seen by Headquarters. We generally have very little difficulty placing students.

There are some things that you must watch for and avoid. When an operation has the opportunity to utilize a student at no cost to themselves sometimes they utilize the students in clerical functions rather than giving the student exposure in the field in which his major education lies. This has happened to us when the Program first got underway but we have successfully eliminated this in most instances simply by telling the plants that if they continue to do this they won't get anymore Coop students. It's surprising that the power that the dollar yields in cases such as this.

The Program is geared to benefit the student in several respects. The first and major item of course, is salary. We try to maintain a competitive salary structure and we continue to update our salaries on an annual basis or sooner as needed.

We also provide transportation expenses for the students from the school to the place of assignment. We found that this is a big assistance.

Upon reaching an assignment location, the personnel have already been geared up for the arrival of the student and have begun to find accommodations for the student. The students generally go back to plants that have had Coops in the past and as such, the personnel at the plant are familiar with the needs of the students and generally know the kinds of facilities to look for. This helps in reducing the amount of downtime we have while a student is trying to get himself situated in housing. If there is a delay we put the student in a motel for several days at our expense. At this time he is given an expense report to itemize his travel costs from school to the assignment.

Another feature we have relates to our benefit program. Permanent full-time employees are on a probationary period for the first three months of employment and upon the first day of the fourth month they then become eligible to participate in the benefit program.

Coop students too, are on a probationary period during their first three months and on the first day of their fourth month they become eligible for a group of the benefits outlined in the Personnel Handbook. When they cease employment and return to school all benefits cease as of the day they last worked. Upon return to work benefits resume on the first work day of their new assignment. We don't provide all benefits, vacations obviously aren't included. The major ones such as hospital, surgical, medical coverage, dental coverage, life insurance, salary continuance are provided. Again, all of these are provided at no cost the same as with regular full-time employees. These benefits are explained in a special insert to the Personnel Handbook addressed to U.S. Coop Students.

Another feature that we have for the students is a tuition grant program which we have established in several schools. Basically the grant states simply that upon completion of the second term of satisfactory employment each student will be entitled to receive a grant of $250 each year. For each continuing year the student must satisfactorily complete an additional acceptable assignment to maintain eligibility.

About three weeks before the anticipated end of a work term we send the student a form asking him to confirm his last day of work. At that time we also ask him to complete the Student Work Report referred to early. We reiterate the need for a candid but objective commentary along with the confidentiality of the Report. We also want to know the approximate date that he will next be available for work. We give the student an expense form to be completed and returned after he is back at school.

In anticipating the student's return, we tell him what his next term's salary will be and where he will be assigned.

During his senior year, we will make contact with the student on several occasions. We will also inquire about his future, let him know we have a job for him, where it will be and the salary to be paid. We suggest that he do some campus interviewing to get a feel for what's available in the market. If he decides to come with us, we will grant him seniority back to the first day of his first work period. This doesn't sound like much except that possibly four years might have elapsed since that time. For retirement purposes he has four years service, for vacation he has four years with the fifth year being the cutoff for three weeks vacation. On the first day of his permanent employment, he goes into the Profit Sharing and Savings Plan by-passing the waiting period.

Throughout my talk I've used the masculine gender because it makes writing and speaking easier, however, our Program is geared for females as well. We currently have three women who are majoring in Industrial Engineering. Neither one has completed more than two work terms so they haven't started on rotation. One individual is working in our Corporate Research facility that provides staff assistance to the Divisions as requested. As a result this student has had an opportunity to travel and get exposure to our different product lines. Needless to say the experience was not only well received but rewarding. She had spent approximately a week in a steel foundry and has requested some future assignments in the foundry. For you people who are not familiar with foundries, they tend to be dirty, dusty, noisey and generally unpleasant places as far as working conditions are concerned. Yet here is a student who is seeking the opportunity to work in a foundry because of exposure she has had through the Program.

Incidentally, for those of you who might be concerned about female students traveling, I can tell you from our limited experience that there is no difference than when the males travel.

One last important feature is the access of the student to the Coop Director. If at any time during the work term the student encounters any difficulty at the plant, he or she may call the Director for guidance and assistance.

That is basically the way we operate the Program. We have found it to be very successful. That's not to say that we have offered every student a job or that every student who was offered a job accepted. Our reason for not offering a job would only be limited by poor economic conditions which thankfully are not too frequent. From the students point of view, we have found that they didn't like the location of the permanent job, they weren't happy with the salary, they didn't like the kind of work we had available, etc.

Unfortunately, our records are not detailed enough to tell how many graduating Coops were offered jobs and how many accepted. About the only information we have relates to the percentage of Coops hired and on board over the last six years. That percentage is 95 and we feel very pleased with that retention rate.

One specific example I can cite is the earliest student we have came into the program in 1969, started working full time in 1973 and today is a plant manager in a small steel foundry. Admittedly, this is fast progress but there is no question that his Coop time did work to his benefit.

Thank you for your attention.

THOMAS V. O'REILLY

Tom assumed the responsibility for the Cooperative Education Program along with Recruiting three years ago. In addition, he is the Director of Salary Administration for the Corporation. He has held a variety of positions in Personnel since he started with Abex 22 years ago.

Tom received his B.S. degree in Management from New York University at nights and has credits towards his M.B.A at the same school

THE SUPERVISOR'S RESPONSIBILITY TO A STUDENT AND TO HIS COMPANY

R. H. Hollister
Section Manager, Development Engineering
Westinghouse Electric Company
South Boston, Virginia

Introduction

From industry's point of view, a cooperative education program is an economical way to recruit potential employes while reaping the benefit of advanced technical training at an attractive price. For the supervisor, it's a challenge to channel the energy of a student into the mainstream of the Department's objectives. Creating an affirmative environment and recognizing the divergent points of view of a student and a permanent employe are keys to integrating a cooperative education program successfully into the industrial world.

* * * * * * * * * * * * *

Why do companies participate in a cooperative education program? Living up to its image, industry takes a course of action that promises a reasonable and predictable payoff. Cooperative education is not charity. A company does not participate because it "feels good", "looks good", or is what others think "socially right." Cooperative education is one of many ways to get a job done.

Participating in a cooperative program is a conscious, planned decision in which the advantages and disadvantages have been carefully considered. Certainly, a permanent placement is less work and perhaps less complicated to administer. But there are certain advantages for a company that are peculiar to a cooperative education program.

First, it's an economically attractive package. Co-op placements cost less in administrative time and expense than permanent placements. Employe benefit costs are reduced because the work periods of a student are not continuous. And, for the most part, a company can get more for its money in specialized, technical training.

Maintaining a positive image with the public is another big advantage for participating in a cooperative education program. Industry is very concerned with what people think. The public represents potential consumers, employes, lobbyists, and stockholders. A cooperative program holds future benefits, especially if the school ranks as a major recruiting source for permanent employment.

For a supervisor, a cooperative arrangement has distinct advantages. Students are much easier to administer than permanent employes. A student's term of employment is shorter, overall, and the supervisor is dealing with career concerns, benefits, and pay in spurts, rather than over an extended period of time. Responsibility for development is also reduced because of the understood transience of the student's employment. Pay ranges remain fairly constant and are a function of a student's year in school.

While prescreening and screening are important, there are fewer employment risks with students. If a student is a marginal performer, or worse, he doesn't return. It's as simple as that. A marginal employe's fluctuating performance, however, can haunt an organization for a long time. Students generally don't require a lot of external stimulation to get a job done. Their motivation curve doesn't seem to level off as quickly as that of a permanent employe.

A good arrangement of work and study periods prevents monotony from becoming commonplace. A student never tires of a job. He perceives it as always changing and different, because assignments vary and he changes. Students need to have plenty to do within the framework of the department's objectives.

A supervisor doesn't have the same kind of motivation problems with students that he or she might encounter with a more experienced employe who has topped his salary range and whose promotional opportunities are clearly limited without further education. A permanent employe's vested interest is <u>job security</u>, a student's is <u>learning about the job</u>.

In an open, affirmative environment, a student is a self-starter. He has a lot to prove to himself and to others. For some it's their first exposure to industry. A student is eager to learn his job, to perform it well and to relate it to his studies. He has a chance to see the relevance and application of his studies in actual work life. Co-op students rarely question the relevancy of an academic course; they understand because they've seen it in action.

Working in "real-time" also allows the student to test some of his career assumptions and decisions. It's a vibrant time in the life of a student and can be very rewarding to those who work with him.

An open environment allows a student to explore, but it also allows the organization to reap the full benefits of employing a student. A supervisor can't expect in-depth experience, but he can expect enthusiasm and a strong desire to learn. Enthusiasm spreads throughout a department. Students ask a lot of questions and challenge the tried-and-true methods known so well. Students can, and do, contribute to an organization. It's important that they, as well as the permanent employes, have a healthy understanding of how each is critical to the department's realizing its objectives. After all, a student wouldn't be there if there wasn't a job that had to be done.

Students tend to set a pace for themselves and for those around them. If a student sincerely believes his job is important, that there's no one else to do it, and that the entire project depends on his doing his part, then he'll push to do the best job he can. The key to motivating a student is to treat him the same as everyone else. If he's treated as a temporary employe with little or no knowledge, then he's going to perform accordingly. But make him part of the team, and he'll soon be your relief pitcher. Even from the beginning, a student should not be treated differently. Applications should be scrutinized with the same criteria as those of a permanent placement. Items such as work history, employment, outside interests, etc., should be considered.

After selecting the best applications, a company should invite candidates to the Plant for an interview--all expenses paid, if possible. This encounter allows the supervisor and the personnel department to evaluate the credentials and suitability of a student. It also gives the student an opportunity to match his interests and abilities with those of the organization. This interview should include an overview of the company, the plant and the community; a review of the department's objectives; a plant tour; and a detailed explanation of the product and manufacturing processes. Most importantly, get to know the student. Identify his interests and concerns, and make him feel at ease.

The student should also have the opportunity to meet other employes in the department and to talk with them privately about anything that interests or concerns him. By the end of the interview, the student should have a clear idea of the nature of the organization, the department, and the employes, and he should perceive the part he would play in that situation.

After an offer is tendered and accepted, the first day on the job is the student's next critical step. A good technique for a supervisor to integrate the student into the mainstream of the department is to assign him to a project. He should work directly with a professional employe assigned to that project and understand his specific responsibilities. If everyone in the section is fully loaded with several projects, don't expect any less of a student. In the work world, a person has to learn to cope with more than one thing at a time.

A student should have a variety of projects that are commensurate with his academic background. Challenging projects along with the routine will keep a student's interest peaked. Everyone associated with a specific project should know its objective, its cost, its timeline, and its potential savings to the organization. If they don't know these things, they don't have a full appreciation for their work and should not be involved.

It's a challenge for the supervisor to integrate the student into the department while realizing that his needs are different. The supervisor is trying to help the student become a "professional." Give him as much responsibility as possible, as quickly as possible. Help the student learn to manage his time and to establish priorities. Through the judicious assignment of projects, the supervisor can develop a good, responsible attitude in the student and help him apply his technical knowledge for the benefit of the organization.

A student wants to do a good job, but he is also examining his own motives and ambitions. Entrance and exit interviews can be very helpful in clarifying where the student is and in identifying what he wants compared to the organization's needs. This interchange also gives the supervisor valuable feedback on his part of the organization as perceived from a different perspective.

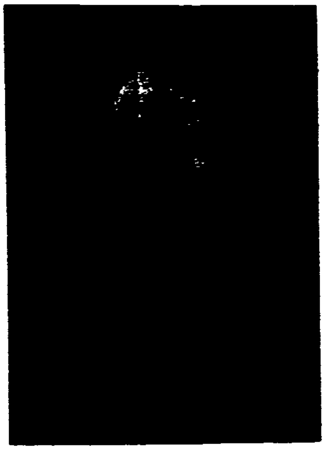
There is no question that students require more time. They ask more questions, challenge more procedures and regularly leave and return. In addition, they frequently need special counseling on personal and professional matters. An organization, especially a supervisor, has to be open and ready for a student.

One of the strongest allies for a supervisor is his company's personnel department. Recruitment and screening is the functional responsibility of personnel and can be expanded to include a cooperative education program. Personnel can maintain a working relationship with the student's school and keep abreast of the changing needs of the organization and how they are being fulfilled by the school.

Schools, on the other hand, need to recognize the pragmatic perspective of industry. Cooperative education is not charity — it's a way to get a job done. Screening by school administrators guarantees that a student's desires match the needs of a company. If this is not done, the relationship between the student and the company is not a productive one.

Schools should take the initiative in student placement and not keep companies guessing. If a student is to have a healthy work experience and if the company is to get its job done, the school must assume responsibility for the qualitative and quantitative aspects of cooperative education.

ROBERT H. HOLLISTER



R. H. Hollister is Development Engineering Manager with the Small Power Transformer Division of the Westinghouse Electric Corporation. He is responsible for the electrical and mechanical design and materials development of 500 kva through 10 mva small power transformers.

Mr. Hollister joined Westinghouse in 1953 as a design engineer at the Transformer Division in Sharon, Pennsylvania. He has been involved in commercial applications of rectangular and circular core-form liquid-filled transformers, and has also worked with dry-type transformers through 3750 kva. He has held a number of management and engineering positions prior to his appointment at the Small Power Transformer Division in South Boston, Virginia in 1968.

Mr. Hollister holds a BEE in Electrical Engineering from the University of Louisville. He is a member of the IEEE in which he has served on several committees, working groups and is an Alternate ANSI C57.12.1. He has authored several technical papers and holds several patents.

LABOR AND MANAGEMENT RELATIONS PROBLEMS

San Diego

Jack D. Leer
Manager, Technical Programs
College Relations
RCA, Incorporated
Cherry Hill, New Jersey

Although my topic for this segment of the panel which is titled - "Labor and Management Relations Problems" has a negative connotation, it is my hope that after this presentation that we all will share an even more positive view of cooperative education just as my Company does. RCA has had a long and successful association with Cooperative Education. As a matter of fact, Cooperative Education at RCA has been going on for over fifty years -- the exact date is not known, but we do know that according to Drexel University's records, they supplied us with a student by the name of N. F. Murphy, who was an EE and started to work in our Camden facility in 1923. As of September 1977, that fine institution has supplied us with nearly 800 cooperative education students over these many years.

In order to get into our subject matter, I think it is important to give you a background of our Cooperative Education Program and its current status. The following are basic statistics which would be representative for a year's experience with co-oping.

. Average about 100 students.
. Ten to twelve divisions participating, some with multi-discipline requirements.
. Fifteen to twenty colleges or institutions sourcing our program. We select from accredited colleges - 4-year and 5-year only curriculums.
. Technical co-ops being assigned in EE, ME and Computer Science.
. Non-technical co-ops working toward degrees in Accounting, Business Administration, Marketing, Materials and Industrial Relations.

Co-op selection is achieved based on a variety of criteria, with the goal of selecting those who appear to have potential for a successful career in their field. We typically interview students at the facility with the cognizant management and local employment professionals making the selection decision. Based on the relationships that we enjoy with certain schools and management, the decision to hire is sometimes delegated to College Relations, basically eliminating the interview process. Incidentally, we have had fine success with this method, which we attribute to Co-op Coordinators excellent referrals.

The cost of co-ops is primarily borne by the Major Operating Units, as they pay for salaries and related expenses. Corporate Staff serves as the coordinating function.

Co-op assignments are made by the locations, and they normally are able to provide interesting and meaningful assignments which relate as closely as possible to the student's course of study and individual interest.

Preferably co-ops are assigned in pairs - one working in industry, while the other is in college. The length of our assignments vary as we try to remain flexible and work with the various college calendars.

The co-op's performance for each work assignment is evaluated in writing, and in many cases, appropriate counseling accompanies the performance review. As a matter of procedure, we do not rotate our co-ops, however, we will attempt to arrange location changes at a student's request, provided it is reasonable.

Salaries for co-ops are based on research and carefully developed estimates of the employment market for co-op students and their year of anticipated degree. Basically, adjustments are made annually and we work with schedules for 5-year curriculums and 4-year curriculums -- both technical and non-technical. Benefits are essentially the same for co-ops as for regular employees, except that Tuition Loans and Refunds are not provided under our educational assistance program, and there is no severance pay in the event of layoff.

Cooperative students are granted one week of paid vacation upon completion of each six months of continuous service credit. In addition, co-ops are reimbursed for transportation from college to their work location and return if the college is outside the work area.

The Company's primary objective is to obtain the services of the co-ops and to train them to take on increasingly complex assignments with the intent of employing them on a full-time basis after graduation.

There are managers who view co-ops as inexpensive, but talented labor, so consequently their philosophy is counter to the traditional line generally held throughout our Company. In either case, all our management is pleased to provide the opportunity to co-ops to gain professional experience.

It has been my impression that all participating locations have a very positive view of co-op employment as exercised in the Company. At a number of locations, the co-ops are held in particularly high esteem. In addition to management, our professional and the majority of our technical employees take a mature, professional approach to co-ops. In general, the co-ops are readily placed into the workforce and are viewed as another regular employee. The fact that a number of managers were former co-ops, undoubtedly has a positive influence on the excellent relationship we experience. The vast majority of the students we employ are talented, motivated and are receiving their educations at fine institutions. Since the work they do is real, useful and varied, management has no difficulty in getting appropriate personnel to serve as mentors. Most of our activities recognize the co-op as a powerful and helpful tool in their workforce.

In the area of management problems, there have been very few, excluding labor relations, which we will cover later in this presentation.

One management problem has been retention, which some locations have had disappointing experiences; however, part of the problem has been the type schools providing the co-ops and the salary expectations of the graduating co-ops. In some cases, the location has not been able to offer a sufficient salary to be competitive without upsetting their internal structure. Part of the solution, it seems to us is to change to other schools whose graduates normally seek more reasonable salary offers. More attention to the co-ops during their assignments and while in school - "care and feeding" process, can also be helpful. We have recently established an internal procedure to assist in this area and are confident that our retention percentage should improve.

Another problem has been implementing affirmative action with minority and female co-ops, particularly in the technical areas. A number of these co-ops have done very well, but the few who have had problems have been magnified and caused more attention than deserved. Our reaction and response to this is to keep trying and to continue to improve our selection process and to focus our attention on those minorities and females who have done well and set them up as role models.

Since its inception in the early 1800's, the Trade Union movement has grown and after passage of the 1935 National Labor Relations Act, the affects of this movement were beginning to be felt by cooperative education programs - both colleges and employers. It was quickly recognized that relationships with each different union had to be established by both adversary parties in order to effect a harmonious relationship. In the early days, Drexel University had a policy which all employers were compelled to comply with which said that -- if a strike occurred and as many as 40% of employees left their jobs, the students must also leave their jobs and report back to their cooperative department. At that time, as is the case today, the principal concern of the Unions has been that co-ops might take jobs away from full-time employees - and if students were not members of the union, they could not be made to participate in a strike.

As an update, there are staff directors of the National Commission for Cooperative Education meeting with officials of the AFL-CIO in Washington for discussions that will hopefully lead to a policy statement of support for cooperative education. The problem is that some local union officials are often antagonistic to cooperative education, especially during periods of high unemployment. Some union officials see co-ops as competitors for jobs that should be given to unemployed union members. The fact is that co-op students are entry level employees and do not replace union members.

Generally speaking, the confusion about cooperative education is on the local, not the national level. Major Unions such as the United Auto Workers and U. S. Steelworkers have been very supportive of cooperative education.

Within RCA there are three categories of Unions that we must deal with in respect to our Cooperative Education Programs. The first is ASPEP - Association of Scientists and Professional Engineering Personnel. This Association is very professional and represents our engineers and scientists in Camden, N. J., Moorestown, N.J., and Hightstown, N. J. facilities. IFTE - International Federation of Professional and Technical Engineers. This Union represents our technicians, draftsmen, methods engineers, etc., in Camden and Moorestown. The third category is the Production and Maintenance Unions found in our production facilities. There are two unions representing our employees at different locations: one is IBEW - International Brotherhood of Electrical Workers and the second is IUE - International Union of Electrical Workers.

In terms of involvement, ASPEP personnel are engaged in Research, Design and Development type work - IFTE members are the "hands on" technicians and IBEW-IUE personnel typically build, test and do maintenance work.

Our basic corporate philosphy on labor relations is a desire to establish and maintain through harmonious cooperation, a standard of conditions and procedure to provide for orderly collective bargaining relations.

In effect, our posture is to deal with our union adversary on the basis of mutual responsibility and respect and to do those things that build positive relations.

Over the years we have experienced few labor problems at those locations represented by one or all of the unions mentioned. As stated earlier, the principal concern of the unions is the issue of job security and secondarily, the issue of work jurisdiction. In both Camden and Moorestown, the main problem has been the issue of productive vs. non-productive work and defining what work is of a learning nature. The co-op in his learning experience is expected to get to know all the equipment he's working with -- leaving a fine line of equipment familiarity and the production of any quantity of product in that learning process.

In our Camden complex, we experienced our most severe labor problems with co-ops several years ago. The real issue in the dispute was "job security" and a hotly contested grievance had reached the point of pending arbitration or Step 5 in a 5-step grievance procedure. The grievance was filed by IFTE. From the Union's point of view, it was a real serious problem, as they were convinced that co-ops were taking jobs from regular union members. The case was settled by agreement of both parties and arbitration was avoided. (Apparently Company officials felt that their position was not that strong and might not hold up in arbitration). In essence, the agreement reached was that co-ops can't be assigned bargaining unit work. Co-ops would be utilized in "non-productive work". In reality, Co-ops have been utilized in productive type work as the Company has taken the position that we can't properly train them without hands on experience, thus getting into the training and familiarity of equipment posture.

Since the agreement has been in effect, there have been few problems except during times of force reduction, when the union feels that jobs are being taken from their constituency. There are several reasons for this location's recent success - first of all they have been careful to do a good job communicating with the union, particularly keeping them advised of key information ahead of time. Additionally, they keep reminding the Union that they plan to perpetuate the Engineering fraternity, and engineering co-ops is one of the key ways of doing this. This constant drumming by Company representatives has resulted in a believable and essentially acceptable position by the Unions. They have also been following the practice of placing co-ops in non-represented areas when practicable to avoid any possible conflict.

We have also experienced a few labor problems at our Moorestown location. The most serious disputes have only reached the 3rd step of their 5-step grievance procedure. Job security and occupation jurisdiction, which parallel in some respects, have shared about equally in the number of disputes that resulted in grievances. Their main problems usually arise with IFTE, but they also have experienced disputes with the local IUE unit. Again, the issue of productive vs. non-productive work and defining what work is of a learning nature, is the root of most issues. This location also enjoys good relations with their unions and they too have used the tool of upfront communications to keep the Unions apprised of pertinent plans and relevant information.

Normally when disputes become written grievances, both the Camden and Moorestown locations resolve them with small monetary settlements, i.e., 4-8 hours pay for a technician, etc.

The other RCA locations that are represented by Unions have enviable records in that they have not experienced labor problems with their co-ops. Approximately half of the locations that use co-ops are not represented by any collective bargaining unit so they have no problem in this area.

At those facilities with union representation, there is another problem that affects their co-op programs, and it is that some departments and managers are prevented or discouraged from using as many co-ops as they would prefer. In effect, a few potential jobs are not filled that might have been otherwise, barring the presence of a union.

In reviewing the Union vs. Co-op situation in our Company, it is readily apparent that we have been experiencing excellent relationships. ASPEP has been little or no problem, and in fact, are very supportive of our co-op program. IFTE has felt most threatened and they have caused us problems at various times. The key in getting along with IFTE and the other unions for that matter, has been the manner of utilizing the co-ops and relating their work to a learning process, not a production oriented situation.

With the practice of good communications and encouraging our personnel to be sensitive to the labor situation, we have generally achieved this condition. The hourly production and maintenance unions have been little or no problem, and in some cases, the majority of their membership aren't even aware of the co-op programs at their plant.

The other question that must be raised is how do the co-ops feel about the Unions? Since the students do not have to join the union(s) they are sometimes unaware of their existence. When there is awareness, there seems to be no attitude problem because they are working with engineers, technicians, and sometimes production workers, and there is usually a cooperative, harmonious working environment that prevails. The ASPEP union is an open shop so membership on the part of engineers is not required; however, they are represented by that union as the sole and exclusive bargaining representative. Both the IFTE and Production-Maintenance Unions have union security clauses in contracts providing for Union shop arrangements.

From my comments you can see that I have attempted to give you a capsule summary of my company's Cooperative Eduction Program, and have concentrated on the area of management and labor relations problems. My contacts with other associates indicate that the RCA/Co-op-Management/Union relations are typical in industry. For example, Drexel University, which started co-oping in 1919, reports that they can only recall two significant labor problems occurring with Co-ops in the Delaware Valley area over these many years. At facilities where there are not salaried unions, problems are non-existent. Everything relating to co-ops is extremely positive. Where salary unions exist, for the relationship to be positive management and professional people working with the program must be sensitive to union concerns and must do a good job in communications. Presently they seem to be doing this. Overall, we feel our problems, both labor and management, have been and are, minimal and manageable. The general view of our management is that the investment we make in Co-op employment, measured by direct benefit to our divisions programs and the contribution we make to the training of future generations of professionals, makes good business sense and is most worthwhile.

JOHN D. LEER

Bachelor of Science, Business Administration, Butler University, 1952

1976 - Present - RCA Corporation, Corporate Staff, College Relations, Campus Relations, College Recruiting, Corporate Engineering Programs and Corporate Cooperative Education Programs.

1973-1976 - RCA, Mobile Communications Division, Meadowlands, PA - Manager Industrial Relations

1969-1973 - National Broadcasting Co., West Coast, Burbank, Claifornia - Manager, Personnel Admin.

1967-1969 - RCA, Instructional Systems Division, Palo Alto, California - Manager, Personnel

1963-1967 - RCA, Information Systems Division, San Francisco, California and Los Angeles California

1961-1963 - RCA, Information Systems Division, Cherry Hill, New Jersey - Manager, Home Office Employment and Employee Services

1955-1960 - RCA, Home Instruments Division, Indianapolis, Indiana, Training Instructor, Employment Representative and Manager, Personnel Records, Seniority and Retirement

Member: College Placement Council, ASEE, CEA, and American Society of Personnel Administration

GOALS: SHORT AND LONG RANGE PLANNING

Bill Thornton
Co-op Coordinator
College Relations and Placement
Milliken and Company
Spartanburg, South Carolina

PAPER NOT
AVAILABLE
AT TIME
OF PRINTING

RWI

SESSION C

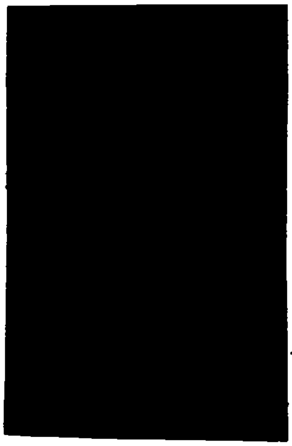
RELATIONS WITH INDUSTRY DIVISION LUNCHEON

B.J. Whitworth
Vice President
Product Reliability
Hughes Tool Company
Houston, Texas

This will be an important meeting for Relations With Industry Division members. The agenda will include the nomination of officers and directors for the Division, and identifying members who are interested in serving on Division committees. Reports from standing and special committees will be summarized, with special attention given to the Division's role in increasing industrial and individual memberships in ASEE. A new activity within the Division will be the establishment of a committee or review board to evaluate suggestions of areas of study or new activities for the Division. Action will be taken on a faculty internship program.

The goals and objectives of the Division's Affirmative Action Committee will be presented. Progress on the Women's Action Group Program will be reported. A preview of the Division's participation in the 1977 Annual Meeting will be discussed.

Time will be provided for members to introduce new business items for the Division.



BILLIE J. WHITWORTH

Education: Texas Tech University, BSIE, 1949; Rice University, MSME, 1955. He joined Hughes Tool Company in Houston in 1949 as a new engineering graduate. He is now Chief Engineer at Hughes. He has served as a company representative to ASEE for several years and is the Gulf-Southwest Section representative for the RWI Division. Campus contacts have been maintained through recruiting activities and by participating in visiting engineer programs. He currently serves on two industrial advisory boards for educational programs. He serves on the Engineers Council of Houston, Technical Careers Committee, which provides resources for advising high school students who express interest in technical careers. He is a member of the American Petroleum Institute and ASME. He is a Registered Professional Engineer.

70

ATTEND AN ASEE SECTION MEETING

GET INVOLVED!

DATE	SECTION	LOCATION
October 14-15, 1977	New England	North Dartmouth, MA
October 21-22, 1977	St. Lawrence	Cornell University, Ithaca, NY
October 30-31, 1977 & November 1, 1977	North Midwest	South Dakota State University
November 5, 1978	Middle-Atlantic	Trenton State College, Trenton, NJ
December 28-30, 1977	Pacific Southwest	California State Univ., Long Beach
March 22-24, 1978	Midwest	Kansas State University
March 30--April 1, 1978	Gulf-Southwest	University of Texas
April 2-4, 1978	Southeastern	University of Virginia
April 7-8, 1978	Illinois-Indiana	Indianapolis, IN
April 7-8, 1978	Pacific Southwest	Jet Propulsion Lab, Pasadena, CA
April 14-15, 1978	North Central	University of Toledo
April 14-15, 1978	Rocky Mountain	South Dakota School of Mines and Technology
May 5, 1978	Middle-Atlantic	General Electric Corp., Croton-on-Hudson

SESSION 3.1
HOW DOES YOUR ORGANIZATION DETERMINE WHETHER AN ENGINEER IS NEEDED FOR AN OCCUPATION VACANCY? — IS THERE A BETTER WAY?

George A. Sold
Employment Director
Detroit Edison Company
Detroit Michigan

Welcome to RWI and the place where we hope to be completely objective and discuss an often neglected subject - Engineering Manpower Needs and Utilization. The speakers all represent well organized and efficient organizations. We asked them whether Engineers really are needed for each so-called engineering job placement. In addition, how is their company assured that it is getting the best trained individual to meet the requirements of the job? If not, what can be done to improve this situation? Hopefully, our speakers will resolve many of these questions and others we've been wanting to discuss. We expect to follow their presentations with a buzz session so that we may all benefit from their expertise in this subject.

Graduate Michigan State University
Member ASEE since 1952
Chairman RWI 1973-74
Chairman North Central Section ASEE Section 71 and 72
Director of the Metropolitan Science Fair 1964.
Sponsored by the Engineering Society of Detroit
Former Administrator College and Professional Employment at Detroit Edison.

RWI

San Diego

UTILIZATION OF ENGINEERS IN FORD MOTOR COMPANY

Edward M. Conklin, Jr.
Manager of Personnel and Organization Operations Staff, Ford Motor Company
Dearborn, Michigan

Introduction

I appreciate the opportunity to meet with you ladies and gentlemen today to discuss the effective utilization of engineers. This subject is an important one to me and to my Company, but let me hasten to acknowledge that we don't feel that we have all the answers. In fact, I am looking forward to hearing the other comments and your thoughts on this subject.

I ask your indulgence if I use Ford Motor Company as my frame of reference. I don't pretend that we are the model for other companies, or even for the automotive industry, — it is simply the Company which I know best.

In the course of the next few minutes, I would like to speak of our engineering personnel, requirements and the direction in which they seem to be headed. I will attempt to give you a thumb nail sketch of what engineers do in the Research, Product and Manufacturing functions of Ford. Next I will highlight some of the major characteristics of the engineering workforce at Ford to give you some insight into the kinds of people we employ. I will also share with you our major recruiting approaches and how we attempt to stimulate the professional development of engineers — both newly hired recruits as well as experienced engineers. It may also be of interest to you to hear of some techniques that we use to provide feedback to engineering school faculty and administrators on the progress of their graduates and our needs for the future. Finally, against this backdrop, I would like to examine with you a few of the issues that our Company and similar companies are facing in regard to engineer utilization.

Engineering Requirements

In 1978, Ford Motor Company celebrates its 75th year. Ingenuity in developing the moving assembly line is what put America on wheels and enabled our Company to be one of the few of the 400 or so nameplates of the 1900's still around today.

The engineers and inventors in those early days were not a sophisticated lot. But they were willing to roll up their sleeves and to get grease and dirt under their fingernails as they tinkered and experimented with such new hardware as tires, transmissions, differentials, steering and braking systems.

Twenty-five years ago, the Company allotted a 667-acre soybean field and $50 million to create an Engineering Center that would consolidate engineering, design, testing and research in one location. The Engineering Staff had grown from 800 in 1939 to 2,600 in 1947 to 4,500 in 1953 when the Engineering and Research Center was built. Today we employ more than 12,000 engineers, designers and support personnel in this Center and by year-end we forecast that that number will have increased. In addition, about 1,500 engineers work at our plants and facilities around the nation.

The essential character of the engineering workforce has evolved during this time span. From those early self-taught mechanics, who could do or at least attempt to do anything, we have become an organization of specialists, highly trained in a wide variety of engineering disciplines, with the latest of facilities and computerized tools at our disposal. We have seen additional emphasis placed on electrical and electronics degrees in contrast to the earlier emphasis on industrial and mechanical engineers.

Engineering Responsibilities

The product diversity at Ford presents substantial challenge to our engineers. Not only do we engineer and manufacture cars and trucks, we are also very much committed to the Aerospace Industry and are one of the world's largest manufacturers of tractors and industrial equipment. With all of our product diversity, there are three types of engineers at Ford — Research, Product, and Manufacturing. Research Engineers apply basic research results to automotive opportunities and potential problems; Product Engineers design, build and test components and prototypes; and Manufacturing Engineers make certain that these components and systems can be mass produced and assembled into vehicles. Let's focus a little more closely on each of these engineering types.

Research Engineers are concerned with knowledge, new and improved materials, better methods of engineering analysis and practice, new processes, and new concepts. Their scope ranges from day-to-day involvement in urgent Company problems, such as exhaust emissions control and corporate average fuel economy, to exploration of long-range ideas, such as new engine concepts like the Stirling engine and dual-displacement engines. Scientists and Engineers in the Analytical Laboratories, many of them with master's and doctor's degrees, work in such fields as nuclear chemistry, mass spectrometry, chromatography, atomic absorption, x-ray fluorescence and diffraction, electron microscopy, metallography and surface analysis.

Product Engineers at Ford apply their technical skills in eight basic fields — engine, transmission and axle, chassis, body and electrical, climate control, electrical and electronics, materials engineering, and vehicle engineering. Vehicle engineers are responsible for stating basic vehicle dimensions, performance and weight objectives in engineering terms for each primary vehicle system. They also maintain surveillance over the product offices responsible for vehicle components to ensure system compatibility. Engineers in the product engineering offices are responsible for the design, development, testing and release of specific systems and component parts.

Manufacturing Engineers determine how best to mass-produce a product efficiently and economically at a specified rate, with every piece meeting engineering specifications. Manufacturing Engineers also evaluate and develop new technologies and advancements in machines, equipment, tools and manufacturing methods. They also plan, design and supervise construction of plant buildings and supervise the installation of machines, equipment and utilities.

All three types of Ford Engineers tend to pursue career paths that keep them in engineering. There are other functional areas of Ford, such as Product Planning and Finance, that seek the engineer who also has an MBA, but on-the-whole, an engineer at Ford remains in engineering.

Engineering Workforce Characteristics

Now that you have seen the broad picture of Ford's engineering jobs, I would like to highlight a few major characteristics of the engineering workforce.

Among Research and Product Engineers at Ford, 82% have at least a bachelor's degree and about a quarter of those have advanced degrees. Seventy-two (72%) percent have degrees in Engineering. Eighteen (18%) percent are not degreed, but are considered to have equivalent experience.

Among Manufacturing Engineers, 50% have at least a bachelor's degree and slightly less than 10% have advanced degrees. Thirty (30%) percent have degrees in Engineering. Fifty (50%) percent are not degreed, but have the necessary experience.

The majors of our degreed engineers extend across a wide spectrum. Two-thirds of our degreed Research and Product Engineers majored in mechanical engineering. Thirteen and one-half (13.5%) percent are electrical engineers, 4% are aeronautical engineers, 2.5% are industrial engineers, 2% are automotive engineers, 2% are chemical engineers and smaller percentages are civil engineers metallurgical engineers, etc.

Forty-two (42%) percent of our degreed Manufacturing Engineers are mechanical engineers, 14% are electrical engineers, 7% are civil engineers, 5% are chemical engineers, 3% are metallurgical engineers, and smaller percentages are aeronautical engineers, automotive engineers, and other types.

Turnover among Ford Engineers has traditionally ranged between 3% and 4% and is normally lower than the average attrition of professional employees in other functional areas in the Company.

Engineering Recruitment

The Company's principal source of inexperienced graduate engineers is the Ford College Graduate Recruiting Program, established in 1959. In 1977, we sent 96 engineering recruiters (usually experienced engineering managers) to 52 college campuses across the nation in their search for well qualified engineering graduates. We were successful in exceeding our recruiting objectives.

There are also large numbers of engineers who apply personally at Company locations in Dearborn and elsewhere, or who send their resumes in response to advertisements or because they know Ford's reputation. However, in recent years we have found it has been necessary to make extensive use of employment agencies in order to recruit sufficient numbers of minority and women engineers at both the entry levels and above.

Another source of inexperienced engineers is the College Cooperative Program, which was established in 1953 for the specific purpose of obtaining qualified engineers. The program provides work experience opportunities with the Company to college students on an alternate work-and-study basis generally during their junior and senior years. This program has been especially helpful in channeling minority and women engineers into the workforce.

Professional Development

Of course, education doesn't end with the receipt of a college diploma. Engineers joining the Company must learn to apply their skills to automotive problems and learn how the Company operates. Therefore the Company provides professional development programs to help them get started properly and to keep them current with new developments.

The initial phase of professional development, The Ford College Graduate Program, permits recently employed graduates to gain on-the-job experience in several positions within a single product engineering office. This is a two-year program which allows inexperienced engineering graduates to rotate through a series of four to six major assignments and become knowledgeable about many of Ford's engineering functions as they apply to one product area. During this time, the individual can better define and plan for personal development as experience and reactions dictate. The program also provides exposure to a variety of people with whom the engineer must learn to work and communicate effectively. The program includes frequent performance discussions with management for assistance and guidance.

Our Continuing Education Program offers engineers flexibility and latitude in choice of subjects and academic programs, and recognizes differences in capability, interests and objectives. Engineers may enroll, with supervisory approval, in individual university courses related to their present position or the next position in prospect, or in graduate degree programs. The Company pays the tuition, registration and fees. Ford also sponsors and arranges a wide variety of technical programs including computer training and courses of particular interest to engineers such as "Fundamentals of Vehicle Design," "Emission Controls and the Combustion Engine," etc. In the management area, we offer seminars, institutes and workshops dealing with decision making, oral and written communications skills, interpersonal skills development, personnel policies and procedures, and the like. Enrollment in these programs is encouraged and a high percent of eligible employes do participate.

Feedback to Engineering Educators

We feel that it is in the Company's self-interest to maintain contact with the academic community and to exchange information with engineering educators on the latest techniques and sophistication employed in automotive engineering and manufacturing. We use a number of approaches to accomplish this, including engineering forums, college sponsors, recruiters and summer employment.

Since 1957 Ford has held eight engineering forums. The most recent one was in 1977 when our engineering and manufacturing management met with engineering educators from 60 colleges and universities for a week-long program. The program included 20 technical seminars at the Engineering and Research Center as well as plant and laboratory visits. Top Company officials served as keynote dinner and luncheon speakers while other members of management hosted appropriate events. The interaction gave educators a greater realization of the challenges of modern automotive engineering as well as a better appreciation of our specific engineering talent needs. We, in turn, became more aware of the education and campus atmosphere which influences graduates and is better able to understand and guide them in their career development.

The Engineering College Sponsor Program fills a similar need. Responsible engineering managers work with designated schools as special liason representatives. The sponsor's primary objective is to develop a close and long-term relationship with the university which will prove to be mutually advantgeous. Most often the sponsor is an alumnus of the school he contacts, although this is not a requirement. Thirty-six engineering colleges are currently included in this program.

College recruiters help to perform a feedback role also. Their regular visits to campuses often put them in touch with engineering educators with resulting mutually beneficial effects. The recruiter can provide information on the progress of recent graduates employed by the Company and can gain information about the college's program and curriculum changes.

A limited number of engineering students and faculty members have been employed at Ford in past summers. These work experiences have given them first-hand information about the level of technology and skill required in our engineering positions, which they can readily transmit to their colleagues on campus. In some instances, this information has been instrumental in reshaping existing courses or developing new ones to meet real needs.

So you see that we make a very deliberate attempt to keep in touch with the institutions and people who produce the engineering graduates we hire. It's good for us and good for you too.

Utilization Issues

Before I close I would like to mention a few issues which we perceive as opportunities to improve the utilization of engineering talent.

It is certainly not news to anyone here that minorities and women are under-represented in the U.S. engineering workforce. The latest figures that I have seen show that Blacks are 1.1% of employed engineers, Hispanics are 1.8%, Asians 2.1% and American Indians .05%. Only the Asians are adequately utilized when compared with representation in the U.S. population.

Women, although they are a majority in the U.S. population, are still a scarcity among engineers -- 1.3% at the last estimate.

Educators and business people must continue to address themselves to these shortages and attempt to find new techniques to attract able minority and women students to engineering careers.

A second issue which we face at Ford and in similar companies is reducing unwanted attrition. Although the turnover of engineers at Ford has never been considered "high" (between 3% and 4% as I said earlier), we nevertheless lose a number of engineers each year that we would rather retain. A recent study showed that 70% of Ford engineers who voluntarily terminated were rated "excellent" or "outstanding." We have attempted to reduce this loss through exit interviews, attitude questionnaires, workforce studies and the like, but with little success. It seems that the bulk of this turnover is due to factors beyond our control.

We also must ensure that engineers are being utilised effectively to do engineering work. This may require eliminating or automating many of the routine aspects of the engineer's job through more extensive use of computers. There must be adequate numbers of support personnel, although at Ford we have not found ratios to be very effective staffing standards. There tends to be too much variation between engineering organisations to apply ratios of engineers-to-designers or engineers-to-technicians. Engineers must be kept current with the state-of-the-art in new materials, technologies and concepts.

Finally, we must develop a system that accurately identifies the engineer possessing the traits necessary to enter management as well as the engineer who may not have these traits or who wishes to remain a technical specialist. We must avoid the mistake of promoting individuals into management based only upon their technical excellence. The individual whose career path leads into management must be afforded an orderly system of personal development through a continuing increase in responsibility, through training and by providing assistance in carrying out supervisory responsibilities. There should be a place for those technical experts who may not have the inclination or aptitude for supervisory or management responsibility.

Conclusion

I hope that my remarks have given you some insight into the utilization of engineers at Ford Motor Company. I would be interested in your comments or criticisms.

PICTURE AND
BIOGRAPHICAL
SKETCH
NOT AVAILABLE
AT TIME
OF PRINTING

ENGINEERING PERSONNEL UTILIZATION AND QUALIFICATIONS —AN ELECTRIC UTILITY VIEW

Robert Dietch
Manager of Engineering Design
Southern California Edison
Rosemead, California

INTRODUCTION

The Southern California Edison Company has a long history of employing engineers. We currently have approximately 800 on the payroll and through our contract work with engineer/constructors and consultants, we indirectly employ on the order of 400 more engineers. The numbers vary considerably over time, but there is no question that engineers and engineering education are very important in our business.

The Edison Company is in the business of providing a product, electricity, which requires annual expenditures of over $500 million for capital facilities to expand, improve and maintain our systems to meet customer and regulatory demands. It is the engineers who provide the planning, research, development, design and construction management to support and improve our capital programs. Engineers are also used extensively in many areas of operation, maintenance, rate making, conservation, load management, environmental assessments, and so forth. We attempt to get full utilization of our engineers through good engineering management.

Because engineers are so important to our business, I would like to share a view of what we expect of engineers, what we are experiencing, what the resulting problems are, and finally, what might be done through engineering education to better prepare graduates for their future in industry.

ENGINEERING FUNCTIONS IN EDISON

Most of the engineers are employed in five departments of the company. As can be seen on Attachment 1, they are: Engineering & Construction (E&C), Advanced Engineering, Power Supply, System Development, and Fuel Supply. Subtitles under each department give some indication of the diverse nature of the engineering work at Edison. The Engineering & Construction Department is the largest employer of engineers. I will concentrate on that area.

Attachment 2 outlines the organizational structure of the E&C Department. Many of the functions are self-descriptive. The basic responsibility of E&C is to engineer and construct all additions and modifications to the Company generating stations, transmission lines, substations, fuel supply systems, and other related facilities. About all we are not responsible for is engineering and constructing subtransmission and distribution lines (i.e., transmission lines with voltages under 66kV). E&C also provides engineering services to other departments on an "as needed" basis.

Attachment 3 lists examples of current engineering work. The work items shown are, for the most part, very complex projects requiring a high degree of innovative and integrated engineering skills. The technologies involved on this list range from nuclear, combined cycle and hydroelectric to solar, wind and geothermal generation resources which illustrate that our engineers must keep current through retraining and continuing education. Notice also that many of the work areas listed are environmental systems such as National Pollution Discharge Elimination Systems (NPDES), water reclamation, and sulfur and nitrogen oxide removal systems.

In actuality, challenging work exists for engineers. The work is complex and requires significant interdiscipline teamwork between engineers and management to get the job done. We use a project management approach for our larger and more complex projects in an attempt to optimize the engineering and construction effort. The project management concept provides a focal point for team direction. It is not necessarily an easier way of getting things done, but it is the most effective for large and/or complex projects requiring team commitment for success.

ENGINEERING MANAGEMENT EXPECTATIONS & FINDINGS

What are the most common ingredients required in engineers from our point of view? I am certain that my list is not all-inclusive and may differ to some degree even with other managers in my company, but I am just as certain that the differences would be directed more toward semantics than substance. Engineers should have:

1. Fundamental knowledge in their chosen engineering field. That is, they have had the core courses and electives to learn the basic theories and application of at least one engineering discipline (e.g., electrical, mechanical, etc.).

2. Fundamental knowledge in engineering economics. This should be required for all undergraduate engineering programs.

3. Ability to apply fundamentals in practice with judgement. Simply said, this is practical judgement gained through education and experience.

4. Ability to communicate using engineering tools. An engineer must be able to interpret and evaluate design and manufacturing drawings, prepare and present organized calculations, and prepare concise, well-organized technical reports. He must also have some knowledge of specifications, contracts, construction/manufacturing plans and equipment as well as industry standards and codes.

5. Ability to work and communicate with people (teamwork). The great majority of engineering accomplishments are done by teams of engineers. The biggest obstacles to successful project completion are usually communications and teamwork--not available engineering technical talent.

6. Knowledge of other disciplines/specialists - when and how to use them. Our engineers must have some basic understanding and appreciation for the work of other scientists, engineers, and technicians in order to get the best our of available resources.

7. Knowledge of management principles and purposes. Some basic knowledge of management theory and application can go a long way toward simplifying the engineer's and manager's life. We all have to work in organization structures with rules hopefully guided by good management principles. Knowing management philosophies and guidelines helps the engineer become more of a contributor and less of an administrative burden.

The expectations listed are, I believe, realistic and achievable by most engineers. It all comes down to when and how. There are many factors impinging on the rate at which an engineer can achieve what I will call productive maturity. Some of the factors are basic intelligence, initiative, education, industry management, and training. Of the factors that we can influence to accelerate the rate of growth of engineering maturity, I believe education is the most important. There is no question that industry can either make or break a potentially good engineer, but my intent is to convey the message that new engineers, fresh out of college, can and should be higher on their engineering maturity curves when entering the job market than they are today.

For example, of the seven ingredients listed above, it is my perception that the majority of new engineers enter our company with only item one in their portfolio of saleable skills. No one would suggest that students could master all seven items in any four-year college curriculum, but they should have <u>some</u> acquaintance with all seven. It appears that new graduates are oriented toward knowing theory, equations and proper calculations without the practical follow through of knowing what comes next. They seem to be trained toward R&D or "paper engineering," not being held responsible beyond calculated answers to questions or proving theorems. Yet, the final product of the great majority of engineering in industry requires so much more from the engineers. Practical application from theory through production or construction does not appear to be addressed in the colleges and this, I believe, is penalizing engineering graduates and industry.

RESULTING PROBLEMS FOR ENGINEERS & INDUSTRY

The perceived lack of practical engineering being taught in college poses a number of problems to both the engineers and industry management. Some examples are:

1. More training is required before an engineer becomes productive. Some of the simple things could easily be captured in college (e.g., preparing and interpreting construction and manufacturing drawings, acquaintance with codes and standards, technical writing, letter writing, and engineering economics, etc.).

2. Engineers take longer to become productive in areas requiring knowledge of hardware or application engineering.

3. New engineers can become disillusioned: (a) They may perceive that the company is at fault because the work may not meet expectations as conceived in college; (b) Some feel above getting into the "dirty work" required of engineering jobs; (c) Some perceive R&D as one of two roads to glory; (d) Some perceive management as the second escape.

4. Management sometimes tends to view new graduates as burdens.

5. A manager squeezed for results will hire for experience.

6. Industry becomes disillusioned with acadamia.

7. Acadamia becomes disillusioned with industry.

WHAT CAN BE DONE

There are things that can be done to accelerate the student's growth and readiness for work in industry. There may well be limitations either because of limitations of college administration or industry support, but the suggestions are not unrealistic from our point of view. The suggestions are:

1. College professors and counselors should devote more time to learning and understanding industry needs and providing students with career counseling based on the realities of industry needs.

2. Industry should work closer with the colleges and express needs openly.

3. Summer employment and co-op programs should be pursued more actively by the colleges for the students.

4. College engineering faculty and advisors should have experience working in industry.

5. Classroom and laboratory problems should be representative of the "real and now world of industry." Industry can supply examples for problems and projects.

6. Bring project management and other management concepts into play on project assignments.

7. Use interdiscipline project assignments in upper level courses; require students to go through the phases of conceptual and preliminary planning, engineering, design and manufacturing or construction planning. Go as far as possible to achieve a total "process" understanding.

8. Make more use of engineers as guest lecturers to explain in detail what they do in industry.

SUMMARY & CONCLUSIONS

Our experience indicates that engineering education could be improved to accelerate and improve the engineer's transition from classroom to industry. Our expectations are high, but realistic and in line with other industries producing hard products. The improvements cannot be made by the acadamians alone; industry must clearly express its needs and support the changes. Industry and engineering educators working together should be able to develop programs or changes to programs which would better serve the need of industry and the students while still upholding the high scholastic standards of our colleges and universities.

EDUCATION

BSEE - California State University-San Diego
MSEE - University of Southern California

AFFILIATIONS

Member, Institue of Electrical and Electronics Engineers (IEEE)
Member, Pacific Coast Electrical Association

OTHER

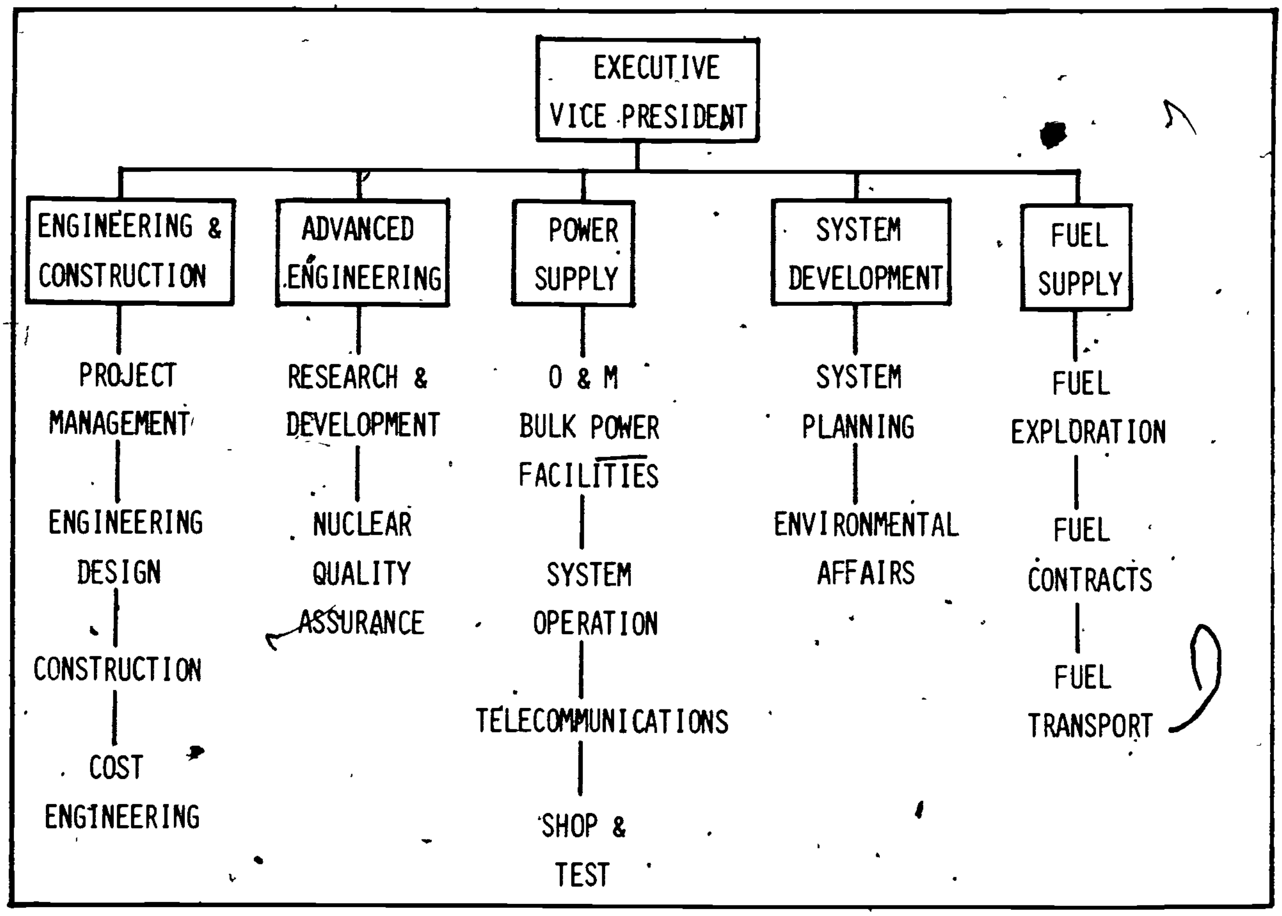
Registered Professional Engineer, California

COMPANY & RESPONSIBILITY

Southern California Edison Company
Manager of Engineering Design - Responsible for the engineering and design of the company's generation and generation-related facilities.

ATTACHMENT 1

PRIMARY ENGINEERING AREAS



ATTACHMENT 3

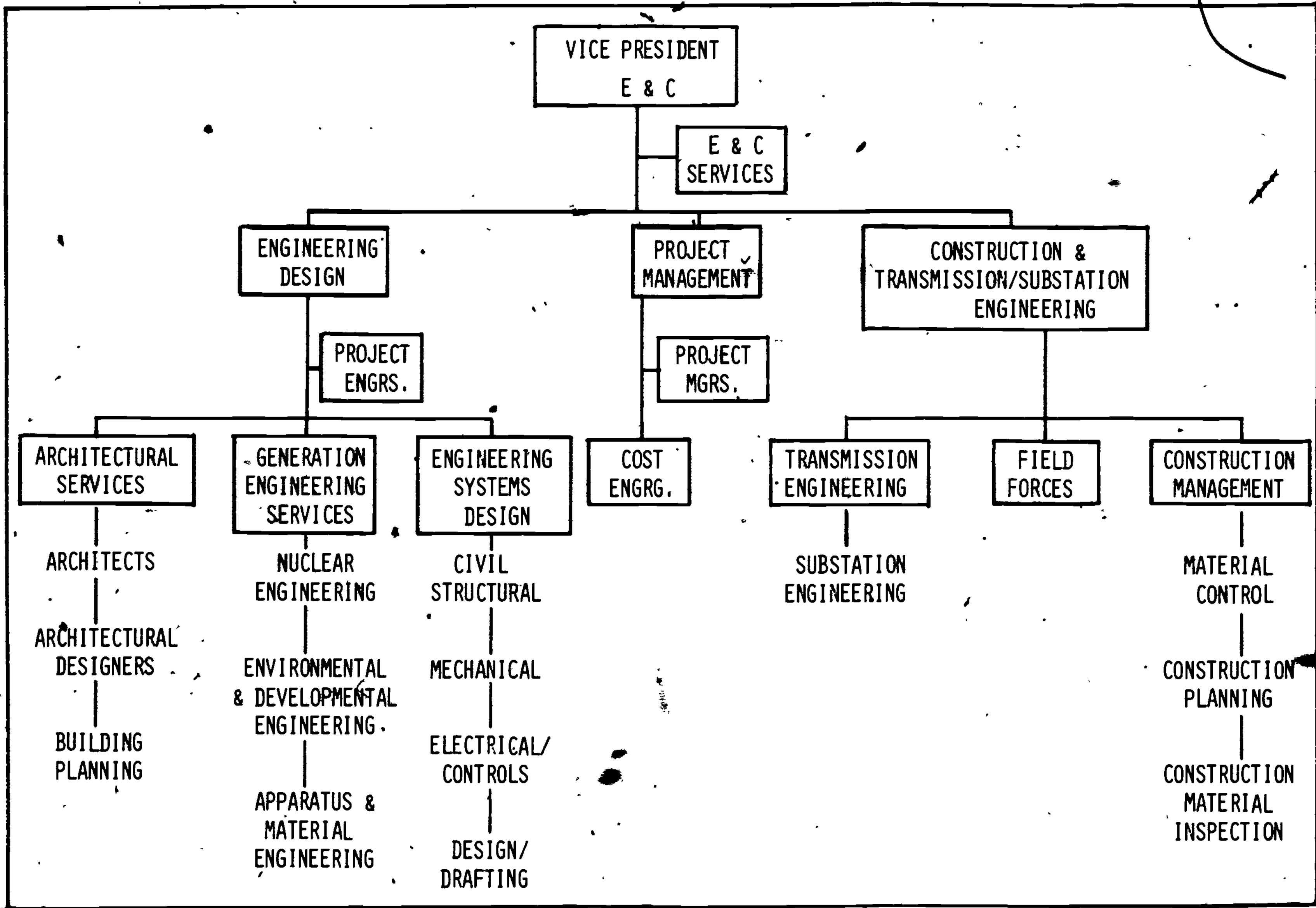
EXAMPLES OF ENGINEERING WORK

- SAN ONOFRE 2 & 3
- SAN ONOFRE 1
- LONG BEACH COMBINED CYCLE
- BIG CREEK-HYDRO ADDITION
- COOLWATER COMBINED CYCLE
- YUMA AXIS-COMBUSTION TURBINE
- SEISMIC REANALYSIS-SONGS 1
- FUEL OIL PIPELINE ADDITIONS
- NPDES
- SOLAR POWER
- WIND POWER
- FUEL CELLS
- LUCERNE VALLEY COMBINED CYCLE
- COAL USE STUDIES
- GEOTHERMAL GENERATION
- WATER RECLAMATION
- SO_x REMOVAL SYSTEMS
- NO_x REMOVAL SYSTEMS
- PARTICULATE REMOVAL SYSTEMS
- SF_6 INSULATED SUBSTATIONS & TRANSMISSION

AND MANY MORE

ATTACHMENT 2

ENGINEERING & CONSTRUCTION DEPARTMENT



A JOB REQUIREMENT FOR RECENT ENGINEERING GRADUATES FOR A PARTICULAR JOB?

Frank S. Buroughs, Jr.
C. F. Braun & Company
Alhambra, California

A consultant recently told me that we speak at a rate of about 150 words per minute, while we hear at about 500 words per minute. If he is correct, you will have some idle time during this presentation. Let's see if we can use that time to reinforce the points I hope to communicate.

Consider our session topic today in the context of your first job, substituting your position for that of engineer. And try to recall whether your professional skills were the most important factor in doing that job. Then let's match your experience with my view of the problem we face in engineering today.

I believe our topic could be discussed in the forum of any profession. As you will see, I'm convinced that we are considering a broader subject, but for now, let's consider the special field of engineering.

Our recruiting and selection process follows a predictable pattern. Needs are established in terms of numbers of specific degrees and levels of training. Arrangements are made with college placement centers. The personnel recruiter conducts interviews on campus. And selected candidates are invited to come and discuss the job with department supervisors.

You may be surprised to learn that technical ability is seldom an issue in this whole process. We find that the colleges provide a reliable program of engineering study. And the graduate who meets our desired standard of academic achievement will usually satisfy the technical needs of the job. Yet, with all of the effort that goes into the evaluation, too often we find later that we do not have the right person in the job. That realization may come when the engineer quits because we failed to adequately describe the nature of the work. Or, it may come when we see that the engineer is not getting the job done. Either way, it has been an expensive mistake for all concerned. And one which, in my view, can be reduced, if not eliminated, with better communication.

Whether an engineer is required for a particular job must be determined by the nature of the task, the organizational framework, and the available staff. Considered from the viewpoint of an engineering company, the question is fundamental to profitable operation. That is, organizing and staffing will ideally be planned to ensure that engineers are assigned only those tasks requiring engineering skills. Designers, technologists, and other technical support personnel will then be assigned to other tasks such that the job is done with as little underutilization of individual skills as possible.

Sound utopian? Well, let's see why our actual jobs often fall short of this model of perfection. A job usually consists of the following activities. Computation and analysis by engineering discipline. Design and drafting to produce working documents. And coordination of these technical activities with purchasing, cost-estimating, scheduling, and manufacturing or construction. This allocation of tasks is frequently an accurate reflection of an organizational structure that has evolved through experience in "getting the job done". And, in spite of the interface problems, task definition and organizational approach are <u>not</u> the usual flaws in our model job.

Where, then, do we most often miss perfection? To the continuing dismay of engineering and personnel managers, it is in our difficulty with recruitment and selection of the "right" personnel for our organization. By "right", I mean those individuals who possess not only the needed technical skills, but also an essential characteristic - the ability to communicate effectively. While this staffing problem occurs at all levels in an organization, let's limit our discussion to the entering level, recent graduate engineer.

Employers need to be more explicit in describing to colleges and students the communication skills that are necessary for a successful engineering career. Colleges need to emphasize the importance of these skills, along with technical subjects. And engineering students need to practice and polish these skills with the same diligence they give to mathematics. Note that I haven't referred to written presentation or oral presentation, or even mentioned effective listening. The simple fact is that good communication requires all these skills. And our graduate engineer who is right for the job must demonstrate that competence.

You may well ask, where do we start? The training surely should begin in our primary and secondary schools. As concerned citizens, we can and should see that it does. At the college level, remedial instruction and more practice in communication are required. If this means we must sacrifice some technical material or extend the training period, so be it. Our graduate must have the tools needed to do the job. In recognition of this, many companies offer their engineers a variety of continuing-education programs and on-the-job training in communication. Industry has no choice. We must improve the productivity and proper utilization of our engineering talent.

This need for training in communication is not new. Over thirty years ago, Carl Braun recognized that better presentation was vital to our company. He answered that need through the publication of a series of books devoted to giving explicit and practical help to employees with their writing. The elements that he stressed then still need to be stressed today.

Our aim in good presentation is to clearly present facts in a way that will sell our ideas to others and win their cooperation. We want our readers or listeners to think along with us. We want them to accept what we say, to agree, and then to take some action. In short, we want their understanding and their willing and sympathetic help.

How do we train engineers to achieve this? Well, first we have to get rid of some mistaken ideas. For example, here is an excerpt of what we tell our engineers about facts.

"Word has somehow got around among engineers and business men that Facts speak for themselves. Pure nonsense, as every lawyer knows. Facts do not speak for themselves. To begin with, they are shy things that someone must dig out by hard work. And then they are useless unless they have a champion to talk for them. Let's not lean on Facts doing their own talking. What may seem fact to us, may seem but ill-founded opinion to the other fellow. It's up to us to show plainly why we hold the opinions that we do."

We also need to instill an understanding that, while we work in and with larger and larger groups, our presentation is directed to individuals. Each reader or listener is our judge. Each has a viewpoint, perhaps even prejudices, that we must consider when we make our case and invite agreement. In our presentation, then, we seek to imagine ourselves in the other fellow's shoes. When we start from a point where the writer and reader are one, we develop our thoughts with an awareness of the reader's needs, providing neither too much nor too little information.

Another thing we need to teach is to stop when we've said it all. If our message is to inform, further words may raise doubts or confusion. If we want action, let's ask for it. Suggest a plan. Offer a solution to the problem. That is, clearly indicate to the reader or listener that the communication is completed and the ball is in his court. If we have done our job right, we will get the response we desire.

Going back to our recruitment and selection process, how can we increase the odds that our recent graduate will have a successful engineering career? I believe the answer is clear. We can, in addition to providing training, adjust our priorities to give greater emphasis to communication skills in personnel evaluation, in defining the job, and in our merit-reward systems. Good engineering is far more than precise calculations. It is clear, to-the-point, informative specifications and reports. It is coordinating and directing many individual efforts toward a common goal. And it is, above all, the means of transforming a mental concept into an economic, operable reality. No wonder that we must have good exchange of information.

If engineers were communicating effectively among themselves and with nonengineers, we shouldn't need to ask today's topic question. The engineers will tell us, in no uncertain terms, what the particular job requires in both engineering and support talent. The problem, which perhaps you faced in your first job, is fine-tuning our communication channels, both for transmission and reception.

FRANK S BURROUGHS, JR

Frank Burroughs is a native Californian. Born in Los Angeles in 1925, he attended the University of Southern California where he received his BS in Chemical Engineering in 1945. Following a period of service as a naval officer, he returned to USC and earned his MS in Chemical Engineering in 1948.

After completing his university work, he joined C F Braun as a process engineer. His career with Braun has involved research, engineering, sales, and management activities. As a vice president, he is responsible for Braun's Engineering Division and the Computer Systems and Personnel Departments.

He is a member of the American Institute of Chemical Engineers and the American Chemical Society.

ASEE

1977—78 PLANNED REGIONAL EFFECTIVE TEACHING INSTITUTES

<u>St. Lawrence Section (English)</u>
M. M. Douglass
Department of Civil Engineering
Sir George Williams Campus
Concordia University
Montreal, Quebec, Canada H3G 1M8
(514) 879-8032

<u>St. Lawrence Section (French)</u>
I am sure one will be run here but have not received any information to date.

<u>Southeastern Section</u>
Robert J. Beil
Box 1571
Vanderbilt University
Nashville, Tennessee 37235
Date: October 7-8, 1977
Place: University of Tennessee at Nashville
Topic: Learning Styles and Teaching Styles
Main Presenter: Dr. Joseph E. Hill

<u>New England Section</u>
Dwight G. Scott
Mechanical Engineering Department
University of New Brunswick
Box 4400
Fredericton, New Brunswick
Canada E3B 5A3
(506) 453-4513
Date: April 10-11, 1978

<u>Illinois-Indiana Section</u>
Charles Lentz
Department of Electrical Technology
Purdue University
West Lafayette, Indiana 47907
(317) 493-2597

and

Mitchell Jolles
Department of Aerospace and Mechanical Engineering
University of Notre Dame
Notre Dame, Indiana 46556

Date: September 26-27, 1977
Topic: Some simple steps we can all take to improve our teaching
Resource Person: Professor Alan J. Brainard

<u>Midwest Section</u>
Richard Graham
Mechanical Engineering Department
Wichita State University
Wichita, Kansas 67208
(316) 689-3402 or 3403
Date: March 22, 1978

<u>Gulf-Southwest Section</u>
Walter S. Reed
Department of Mechanical Engineering
University of Texas
Austin, Texas 78712
(512) 471-1331

<u>Pacific Northwest Section</u>
Allan Torvi
Mechanical Engineering Department
University of Calgary
Calgary, Alberta, Canada T2N 1N4
(403) 284-5790

<u>Pacific Southwest Section</u>
Clyde N. Holland
Coordinator of Civil Engineering
Northern Arizona University
Flagstaff, Arizona 86001
(602) 523-5252

<u>Rocky Mountain Section (East Side)</u>
Cary Fisher (Major)
U.S.A.F. Academy
Colorado Springs, Colorado 80840
(303) 472-2555 or 4196
Date: November 17-18, 1977
Topic: Instructional Design for Individualized Learning
Resource Person: Dr. Lee Harrisberger
Place: Air Force Academy

<u>Rocky Mountain Section (West Side)</u>
Hurshchell Urie
Weber State College
Ogden, Utah 84403

<u>Regional ETI Coordinator</u>
Joseph S. Boland III
Electrical Engineering Department
Auburn University
Auburn, Alabama 36830
(205) 826-4330

RWI

San Diego

SESSION 3.2

WOMEN IN ENGINEERING AND SCIENCE

Donna S. Frohreich
Assistant Professor
School of Engineering
University of the Pacific
Stockton, California

PAPER NOT AVAILABLE AT TIME OF PRINTING

DONNA S. FROHREICH

Donna S. Frohreich received an A.B. (with Distinction) in sociology and a M.A. in education from Stanford University. From 1968 until 1974 she was assistant professor and coordinator of programs for women in engineering at Purdue University. While at Purdue she developed an extensive plan for attracting and retaining women engineering students. She initiated the "Directory of College and University Programs for Women in Engineering." In 1974 she was named Dow Outstanding Young Faculty Member from the Illinois-Indiana section of ASEE. Ms. Frohreich is currently assistant professor and coordinator of cooperative education in the School of Engineering, University of the Pacific, Stockton, California. She also coordinates the NSF "Women in Engineering" program conducted by University of California Extension, Davis. Ms. Frohreich is chair'n of the RWI Women's Action Group.

RWI

WOMEN STUDENT'S PLANS FOR CAREERS IN ENGINEERING

Mary Diederich Ott
College of Engineering
Cornell University
Ithaca, New York

Summary

Based on national survey results, men and women freshman students in engineering differ in their plans for careers in engineering. They differ in regard to field choice and marriage-career plans. Both men's and women's responses indicated a need for more information about the profession.

* * * *

A major survey program was undertaken in 1975 to determine the characteristics and attitudes of men and women engineering students. The program included surveys at the beginning and at the end of the freshman year for students who were freshmen in engineering in fall 1975 or in fall 1976. The survey results provide information concerning students' plans for careers in engineering. These results are the focus of this paper.

Method

Survey Population and Sample

The survey results reported here refer to the population of all first-time engineering freshmen who entered one of forty-two schools during the fall 1975 or fall 1976 terms and who continued in engineering at the same school throughout the freshman year.

We estimate there were approximately 17,700 students in the population of freshmen in spring 1976, of whom approximately 14.3% were women. In spring 1977, an estimated 19,400 students were in the population of freshmen, and about 15.8% were women.

A sample of sixteen of the forty-two schools was selected to participate in the surveys. Sample selection procedures are described elsewhere.[1] Students at fifteen of the sixteen schools participated in the surveys in both fall 1975 and spring 1976. Four hundred ninety-six men and 487 women completed both of these surveys. Students at thirteen of the schools participated in both the fall 1976 and spring 1977 surveys. Five hundred and eighty men and 535 women completed these surveys. Of those eligible to complete the spring surveys, 36% of the men and 45% of the women in the fall 1975 freshman sample completed the spring 1976 survey. Forty percent of the men and 50% of the women in the fall 1976 freshman sample completed the spring 1977 survey.

Although there was a substantial degree of student non-response to the spring surveys, the inclusion of data for two different entering classes allowed us to determine whether the results which were obtained were stable. Non-response adjustment procedures were included in the analysis of the survey data in an attempt to minimize non-response bias.

The Questionnaire

In fall 1975, the first group of freshmen completed the College Student Questionnaire (CSQ)[1] developed by the Educational Testing Service, as well as a 30-item questionnaire developed for this study. In fall 1976 the second group of freshmen completed an 80-item questionnaire which included a number of items from the previous fall's survey. The two groups of freshmen completed a 60-item questionnaire in the spring of freshman year. This questionnaire contained some items from the CSQ as well as others developed for this study.

Analysis

Data were analyzed in terms of estimates of the proportions of men and of women in the population who would have a given response to a question. In order to make valid estimates of the population proportions, the data were subjected to statistical weighting procedures. The weights had a number of components. The first was based on the student selection probability for each school, and adjusted the sample to represent all students in the population. The second was an adjustment for student non-response. The third adjusted for non-participation of certain schools.

The precision of the estimated proportions was gauged by obtaining estimates of the standard errors of the estimated proportions. We also estimated the precision of the difference between the estimated proportions for men and women. By comparing the difference in the estimated proportions of men and women giving a certain response with the standard error of the difference, we determined whether the differences in estimated proportions were statistically significant.

Results

I will now discuss the results of these surveys. Note that all the students who completed the spring survey had also completed the fall survey. To achieve comparability of the fall and spring survey responses, data from the fall surveys were only included in this analysis if the student also completed the spring survey.

I will discuss three areas: field choice, marriage-career plans, and attitudes toward the engineering profession.

Field Choice

Student's preferences for major fields differed by sex (see table 1). In the spring of each year, a smaller percentage of women students than of men students (approximately 89% of the women and 96% of the men) indicated an intention to major in one of the engineering fields. However, there was no non-engineering major field which was chosen by a significantly greater proportion of women than of men.

Each year, significantly smaller proportions of women than of men were interested in majoring in electrical engineering. In the first year, but not in the second, significantly smaller proportions of women than of men were interested in majoring in mechanical engineering. These differences in field preference continue established patterns. From 1970-71 through 1973-74, 24% of men and 13% of women in engineering received bachelors degrees in electrical, electronic, or communications engineering. Seventeen percent of men and 9% of women received bachelors degrees in mechanical engineering.[2]

It would be very interesting to learn why electrical engineering and perhaps mechanical engineering are less appealing to female than to male engineering students.

Marriage-Career Plans

Perucci has examined temporal patterns in marriage and childbearing for women scientists and engineers.[3] We sought to obtain projected patterns of childbearing in relation to employment for these women engineering students. Information from the National Longitudinal Surveys of labor market experience indicates that premarital attitudes of young women toward labor force activity of mothers of young children are predictive of the women's own labor force participation when they have children.[4] Thus, we obtained information concerning women students' plans for combining childbearing with careers. We did so in two ways:

(1) At the beginning of the freshman year, students indicated their preferred marriage-career status for a time ten years in the future (generally age 28). Women's responses to this question are indicated in table 2.

(2) The surveys at the end of the freshman year determined the age at which the same students preferred to have their first child and the age at which they first wanted to stop working for six months or more. An average of 55% of the women preferred to have their first child between ages 24 to 26 or 27 to 29. Of those women who wanted to have their first child between ages 24 and 29, about 40% each year wanted to first stop working during the three-year period in which they planned to have their first child. About 5% expressed an interest in stopping work before the childbearing period. Thus a maximum of about 45% of the women who planned to have their first child between the ages of 24 to 29 years plan to stop working for longer than six months during that period. Apparently, the others (55% or more of the childbearing group) plan to continue working on a full-time or part-time basis when their children are young.

Comparisons of men's and women's responses to the spring survey questions concerning career plans indicated that men and women tended to have different career plans. Women tended to prefer starting full-time professional work earlier than the men did (see table 3). Whereas larger percentages of men than of women preferred to start part-time professional work between 21 and 23 years of age, larger percentages of women than of men preferred to start part-time work between 30 to 32 years of age. It appears that men preferred to start part-time professional work while still in school, whereas larger percentages of women than of men were interested in working part-time after they finished school.

In addition, larger proportions of women than of men preferred to first stop working for periods longer than six months between the ages of 24 and 29 years of age. (About 88% of the women in this group were interested in having a child at that time.)

Finally, larger proportions of women than of men preferred to return to full-time work between 33 and 38 years of age.

This examination of the career and personal plans of men and women students indicates a great deal of variation among the responses of each group. It is clear that many women planned to have work patterns similar to those of the majority of men. However, many other women engineering students will require flexibility from their employers in regard to part-time work and returning to work after periods of unemployment. Job retraining programs may become increasingly important in engineering.

Attitudes Toward the Engineering Profession

Students were asked to indicate their preferred and their expected work situations. Students frequently did not expect to work in their preferred work situation. Rather, about 66% of men and women expected to work in a medium to large firm or corporation, whereas only about 41% preferred to work in this situation. Many respondents who preferred to work in their own businesses or in research organizations did not expect to work in these situations. Finally, larger proportions of men than of women preferred to operate their own businesses.

Most of the students overestimated the proportion of women among practicing engineers in the U.S. Their estimates approximated the proportion of women among freshman engineering students at universities, rather than among practicing engineers. Apparently these students are unaware that the increase in the numbers of women engineers has been very recent.

A significantly larger proportion of men than of women students agreed that they had understood the nature of an engineering career before they started college. In fact, about 50% of the women and 38% of the men indicated they had not understood the nature of an engineering career. Nevertheless, there was no significant difference between the proportions of men and women who agreed that they were strongly motivated to be engineers.

Students' responses concerning the engineering profession indicate the need for programs to acquaint them with the nature of an engineering career.

Acknowledgments

This report is based upon work supported by the National Science Foundation under Grant No. EPP75-18013. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of the National Science Foundation. Malcolm Burton, Robert Gardner, David Johnson, Howard Kramer, Judith Long Laws and Dorothy Nelkin contributed to the selection of survey items. Robert Gardner supervised the spring 1976 survey administration. David Chapman provided statistical consultation. I particularly wish to acknowledge the assistance of the staff and students at the participating schools.

References

1. Ott, M.D., "The Men and Women of the Class of '79," in the Annals of Engineering Education, Engineering Education, vol. 67, no. 3, Dec. 1976, pp. 226-232.

2. Data from the annual surveys of "Degrees and Other Formal Awards Conferred," conducted by HEW's National Center for Education Statistics, Washington, D.C.

3. Perucci, C.C., "Minority Status and the Pursuit of Professional Careers: Women in Science and Engineering," Social Forces, vol. 49, 1970, pp. 245-257.

4. Parnes, H.S., "The National Longitudinal Surveys: New Vistas for Labor Market Research," American Economic Review, vol. 65, 1975, pp. 244-249.

TABLE 1. Differences in major field preferences.

Major field preference	Spring 1976 Men	Spring 1976 Women	Spring 1977 Men	Spring 1977 Women
	Estimated Proportions			
1. None in engineering	4%	11%*	3%	12%*
2. Electrical engineering	17	8 *	22	9 *
3. Mechanical engineering	19	8 *	16	14
4. Chemical engineering	17	17	16	15
5. Civil engineering	11	17	14	10

* Difference in proportions between men and women significant at .01.

TABLE 2. Women's marriage-career preferences in fall of freshman year.

Marriage-career preferences	Estimated Proportions Fall 1975	Fall 1976
1. Single, full-time job	8%	8%
2. Married, no children, full-time job	32	46
3. Married, no children, part-time job	1	2
4. Married, no children, unemployed	0	0
5. Married, children, full-time job	20	19
6. Married, children, part-time job	26	19
7. Married, children, unemployed	7	4
No response	5	2

TABLE 3. Age preferences for career-related activities.

	Spring 1976 Men	Spring 1976 Women	Spring 1977 Men	Spring 1977 Women
	Estimated Proportions			
Age to start full-time professional work				
1. 21 to 23	47%	63%	48%	62%
2. 24 to 26	36	24	36	29 *
Age to start part-time professional work				
1. 21 to 23	24	14	18	8
2. 30 to 32	0	6	0	4
Age to first stop working for six months				
1. 24 to 26	2	8	3	8
2. 27 to 29	3	18	2	17
Age to return to full-time work				
1. 33 to 35	1	8	2	8
2. 36 to 38	1	7	1	8

* Difference significant at .05.
All other differences in proportions between men and women are significant at the .01 level.

MARY DIEDERICH OTT

Mary Diederich Ott majored in physics at Seton Hill College in Greensburg, Pennsylvania. She obtained an M.S. in physics and a Ph.D. in education at the University of Chicago. Since 1971 Dr. Ott has been associated with the College of Engineering at Cornell University. As a lecturer from 1971 to 1974, she developed and evaluated an audio-tutorial physics course. As a research associate since 1974, she has served as a consultant to teaching assistants and faculty, conducted educational research for the College of Engineering, and directed a conference on "Women in Engineering ... Beyond Recruitment." In 1976 Dr. Ott worked at the National Center for Education Statistics of HEW in Washington, D.C. She is currently conducting research on the characteristics, attitudes and experiences of women engineering students.

RWI

BAY AREA MODEL NETWORK FOR WOMEN IN SCIENCE

Anise Whiteman
Coordinator, Women in Science Program
Mills College
Department of Math and Computer Science,
Oakland, California

FULL-TIME SCIENTISTS AND ENGINEERS EMPLOYED IN UNIVERSITIES AND COLLEGES 1976

Field of Employment	Total	Men	Women	Women as % of Total
TOTAL	230,539	194,610	35,929	15.6
ENGINEERS	22,799	22,352	477	2.0
PHYSICAL SCI.	34,442	31,942	2,500	7.3
Chemists	14,172	12,651	1,521	10.7
Physicists	10,867	10,465	402	3.7
MATH SCI.	23,081	19,988	3,093	13.4
LIFE SCI.	92,589	73,910	18,679	20.2
Agric. sci.	12,963	11,546	1,417	10.9
Biol. sci.	34,744	27,757	6,987	20.1
Med. sci.	44,882	34,607	10,275	22.9

The above figures indicate that despite an increased awareness, generated by the women's movement, of the inequalities in career opportunities and incomes for women, affirmative action programs and efforts by government, industry and business to recruit more women, there has not been a significant increase in the numbers of women preparing for and pursuing careers in non-traditional scientific and technical careers. Recent research indicates that a number of factors are contributing to this underutilization of human resources.

In 1973, the sociologist Lucy Sells identified as the "critical filter" which prevents women from entering any undergraduate major fields except the lower paying ones which have traditionally been pursued by female students (i.e. humanities, education and the arts).1 The effect of this inadequate preparation has been that the economic prospects and status of women remains unpromising:

> ...the earnings gap between men and women has widened in the past twenty years, although there are more women working outside the home today than there were 20 years ago. Women holding full-time jobs now average $6,800 a year, 43% less than the $11,800 men earn. Women earned about 36% less than men 20 years ago.2

Until such time as high school girls and college women begin to take the mathematics which profide the foundation for careers in scientific and technical fields; so long as traditional fields of study are chosen by young women, their career options and hence their economic prospects will remain limited. The limited range of career options for young women, appears to be a function of stereotyping of mathematics and technical studies as belonging to the male domain according to recent research. By the time girls are in junior high, they have accepted assumptions that girls are not good at and should not be interested in mathematics. However, prior to junior high, these attitudes toward mathematics are not evident among students themselves.3 However, teachers and counselors do tend to view mathematics as more appropriate for boys and feel that boys do better in mathematics. Thus, young girls still tend to aspire to careers in teaching, nursing, and clerical fields. The stereotypical assumptions of teachers, counselors and parents about sex-appropriate careers for girls are reinforced by the lack of visibility of women in careers in technical and scientific fields. This:

> ...the problem seems circular: Girls avoid mathematics and science in high school, college and graduate school because they perceive it as unrealted to their career goals. As long as they avoid the courses

they are unable to compete for careers in those areas at a later time. 'The few women who aspire and attain careers in sciences, the less likely attitudes and views of these careers as 'masculine' will change. As long as these career areas are perceived as 'masculine' only a few young women will be encouraged toward them.4

One model for breaking through the circle of math avoidance, and lack of visibility of women in non-traditional careers has been developing in the San Francisco Bay Area since 1975. The Bay Area Network for Women in Science is a unique cooperative effort by people at all levels and types of educational institutions, and representatives from industry, government, business and research institutions working together to overcome math avoidance in girls and young women. A number of techniques and methods are employed in overcoming math avoidance in order to encourage young women to pursue studies and careers in scientific and technical fields: providing professional women role models who are non-stereotypical examples of women working in scientific and technical fields and developing programs in supportive environments which permit young girls and women with successful experiences doing mathematics. In addition, the Network serves as an "old girls" network to provide young women with personal contacts and mentors to assist them in establishing careers.

The Bay Area Network for Women in Science has held a number of conferences for high school girls, providing them with "hands on" experiences in science and math, encouraging personal contact with professional women and disseminating information about careers in scientific and technical fields. These conferences have grown as the result of a conference held at Mills College in April 1976. This conference, entitled "Educating Women for Science: A Continuous Spectrum" used as the basis for discussion in one of its workshops a discussion of Action Programs. The concept of action programs had developed from a conference for 7-12th grade girls which had been held at Mills one month earlier, sponsored by Mill College and the Lawrence Hall of Science, University of California, Berkeley. The goals of the High school conference were to increase young women's interest in math and science, to foster awareness of career opportunities in math and science related fields, and to provide students with an opportunity to meet and morm personal contacts with women working in traditionally male occupations. These conferences were seen as the beginning of a continuing effort to break through the circle of stereotypical thinking about women in non-traditional fields and to encourage preparation for careers in scientific and technical fields through the study of mathematics and science.

The plan to use these conferences as a keystone for building an active intervention program has succeeded with a vengeance. Since the initial conferences (the one for professionals and the first one for high school girls), a conference "Women in Science and Technology" was held at Mills in October 1976, four conferences were held at different sites throughout the Bay Area in April 1976, and four more conferences are being planned to be held simultaneously at four different sites throughout the Bay Area in February 1978. In addition, a two-day regional science careers conference, funded by the NSF was held at Mills in March 1977. This conference attracted freshman and sophomore college women from 30 Bay Area colleges and universities.

Activities of the Network have reached the following audiences (approximate numbers):

1500 girls from grades 7-12 have participated in conferences and workshops.

550 elementary school girls have attended classes and workshops at the Lawrence Hall of Science, University of California, Berkeley.

600 college women have participated in conferences and programs.

8-- educators (teachers, counselors and administrators) and scientists have attended conferences and programs.

150 parents have attended programs especially addressed to them.

400 network members have volunteered time and services as planners, speakers, panelists, workshop leaders and liaison persons for the various events.

Prior to the establishment of the network and its activities, a number of programs had already been developed to encourage young women to consider careers in non-traditional scientific and technical fields, most notably the Women in Science Program developed by Dr. Lenore Blum, Head of the Department of Mathematics and Computer Science at Mills College and the "Math for Girls" program developed by Nancy Kreinberg at the Lawrence Hall of Science. The experience gained through these programs was the cornerstone upon which the activities of the network were built. These programs have demonstrated that the cycle of stereotyping and math avoidance can be broken through the development of programs which provide supportive environments, experience doing mathematics and exposure to role models for young women.

The Women in Science Program at Mills began with the development of a pre-calculus course which prepared students for the calculus sequence in one semester, no matter what inadequacies existed in their backgrounds. This was done by streamlining the traditional college algebra course to emphasize the concepts which would be necessary for the calculus and by a system of peer-taught workshops which provided students with the computational and algebraic skills which they were missing due to inadequate mathematics preparation in high school. In addition, internships in industrial and research organizations were developed to provide students with the opportunity to see how the concepts they were learning in the classroom could be applied in the actual "world of work". A dual-degree engineering program with

Stanford University, the University of California, Berkeley and Boston University was developed. A Curricular/Career Model Project in cooperation with Mills' Center for Career Planning and funded by the Women's Educational Equity Act, has been developed. The Curricular/Career Project coordinates career information through a series of audiovisual presentations, panels of women in scientific and technical fields, guest speakers and seminars with material learned in the classroom. An unexpected outgrowth of the internship program and the Curricular/Career Project has been the development of non-credit "mini-courses" in which volunteers from industry conduct short courses for students in order to give them specific skills necessary for use during internships.

The "Math for Girls" program at the Lawrence Hall of science is a class held once a week for eight weeks in which girls from 6 to 14 are encouraged to explore mathematical concepts and applications under the tutelage of young women graduate students in a non-threatening environment. This year, Lawrence Hall of Science has received funding from the U.S. Office of Education, Title IV for the "Equals Institute", a teacher training program in sex-fair mathematics instruction.

The Mills programs, programs developed at the Lawrence Hall of Science and the series of conferences all provide students, parents, scientists and educators with a variety of models and approaches for encouraging young women to prepare for and pursue careers in scientific and technical areas. These model projects will continue to develop, to institute new programs and to conduct research on way to overcome math avoidance and sex-role stereotyping through the establishment of a Consortium for Women in Math and Science which has just been funded by the Carnegie Corporation. This funding will permit the Bay Area Network for Women in Science to establish a resource center, develop and disseminate information and assist other institutions in developing programs to further mathematics and science education for young women.

The Consortium will maintain the momentum of Network efforts and strengthen and expand both program and research activities. It will be established on the Mills campus in the Spring of 1978. The Consortium will act as a coordination agency and research base for projects and studies, and will include a nationwide dissemination program for students, educators, legislators and the general public. Initial activities will focus on consolidating Network activities. A Consortium resource center and switchboard will be located on the Mills Campus. A booklet describing Network activities will be produced. Pre-collegieate activities of the Consortium (including in-service and pre-service programs for teachers, counselors, parents and administrators) will be based at the Lawrence Hall of Science at the University of California Berkeley under the direction of Nancy Kreinberg. Collegiate activities (including consulting services) will be based at Mills College under the direction of Lenore Blum.

References

* Summarized from a 1976 Survey by the NSF.

(1) Sells, Lucy W., in Developing Opportunities for Minorities in Graduate Education, Proceedings of the Conference on Minority Graduate Education, University of California, Berkeley, May 11-12, 1975, pp 37-39.

(2) Scientific Engineering Technical Manpower Comments, Vol. 12, No. 10, 1975, p.7

(4) Fox, Lynn H., "Women and the career relevance of mathematics and science," School Science and Mathematics, Vol. LXXVI, No. 4, April, 1976, p. 350.

ANISE WHITEMAN

Education: B.A. (Phi Beta Kappa) Mills College '74 Currently working on Masters in Public Administration, California State University, Hayward.

For the past 2 years, I have been working as coordinator of the Women in Science Programs at Mills College (NSF Science Careers Conference, WEEA Curricular/Career Model Project, Women in Science Program). I am a reentry woman and am pursuing a second career after having raised a family. My primary interests are in program design and evaluation with emphasis on programs encouraging women to pursue non-traditional careers and continuing education.

SESSION 3.3

REGISTRATION AND CERTIFICATION OF ENGINEERING TECHNOLOGY GRADUATES

Francis V. Cannon, Jr.
Dean of Engineering
Milwaukee School of Engineering
Milwaukee, Wisconsin

The explosion of technology and its application in recent years has resulted in an expansion of assignments for the members of the engineering technical team. Many of these assignments have direct relationship to public welfare and safety.

Today, numerous engineering technologist graduates are functioning in capacities historically associated with the engineer. Near term attention needs to be directed to developing national and state policies that protect the public and at the same time allow the engineering technologist to perform the range of activities for which he or she is reasonably prepared by virtue of education and experience.

Classically, legal registration accompanied by licensing has served to identify to the public those members of a grouping or profession who meet certain minimum educational and experience criteria.

How is the capable engineering technologist to be identified for the public? Should engineering registration and licensing opportunities be extended to include engineering technologists or is a separate registration and licensing category needed? These questions and others are touched on by the presentors in this session. Hopefully, the thoughts and discussion shared in this session will move us one step closer to resolution of the issues surrounding registration, licensing and certification of engineering technology graduates.

FRANCIS V. CANNON, JR.

Dean of Engineering & Professor, Electrical Engineering, Milwaukee School of Engineering; B.S.E.E., M.S.O.E. '63; M.S.E.E., Marquette '69; Reg. Prof. Eng. - Wisconsin; Regional Chairman, Engineering Technology Committee, ECPD; Member, ASEE AdHoc Engineering Manpower Committee; Member, IEEE, NSPE, ASEE; Teaching Interests: Electronics, Automatic Control Theory; Engineering Economy, Student Projects

REGISTRATION OF ENGINEERING TECHNOLOGISTS: SOME CURRENT OBSERVATIONS

Robert C. Thornton
Chairman, Engineering Technology Devision
Northrop University
Inglewood, California

The purpose of registering engineers is to "safeguard life, health and property, and to promote the public welfare." The EIT examination is primarily an academic test of knowledge of the basic and engineering sciences. ECPD accredited technology programs contain these basics in their technical core curriculum. The Engineering Technologist must meet the same quantitative and qualitative criteria of professional performance before being licensed. There is no professional reason for eliminating qualified technologists from becoming registered professional engineers.

Engineering registration boards are faced with increasing numbers of engineering technology graduates desiring to become registered as professional engineers. According to a recent projection, in 1982, American colleges will grant 35,000 baccalaurate degrees in engineering. At the same time, over 11,000 students will receive baccalaurate degrees in engineering technology; therefore, one out of every four "engineering" graduates will be a BSET or BET.

Should a four-year engineering graduate with a baccalaurate degree be permitted to take the examination on engineering fundamentals? If he is allowed to take the examination and passes, should he be classified as an "Engineer-In-Training?" If he is allowed to take the examination on principles and passes it, should he be registered as a professional engineer assuming that he meets experience criteria?

Perhaps if the two-track concept had been adopted in 1955 as recommended by the ASEE Grinter Report, we would not be faced with this problem; but engineering programs moved toward a more scientific and theoretical curricula. Colleges "squeezed in more mathematics and science as well as humanities and social sciences; they squeezed out design, english composition and public speaking; and they shortened the credit hour requirement by 10% in addition."[1]

Much of these changes in education programs were made without the benefit of input from engineers in practice or industry representatives. The new curricula, heavy in science and mathematics with applied course work eliminated, did not meet the practice-oriented requirements of industry. Only about 20% of engineering graduates follow research-oriented careers. The greatest demand is for practice-oriented graduates. This is the vacuum that the engineering technologist is filling.

The engineering technologist is more than a technician. In fact, many engineering technology programs leading to the four-year degree closely resemble regular engineering programs, and the basic science and engineering science content is such that the graduate is qualified to pass the EIT examination. It is precisely the growth of engineering technology, the quality of technology programs, and the fact that technologists are passing the EIT and becoming registered; that is, raising questions or creating concern in academic circles.

While educators argue the question, industry hardly differentiates between engineers and engineering technologists. Technologists are being hired to do the same jobs as their engineering counterparts, titles are the same, and differences in starting salaries are so small as to be negligible. As far as the employer is concerned, he is hiring an engineer at the hardware level, and as D.E. Irwin[2] asked, "When technologists perform the same work as engineers who obtained registration doing this work - on what basis are technologists denied registration?"

R. John Miner[3] surveyed fifty-five states and territories' boards regarding the current policies with respect to BET applicants: "Of the forty-eight boards responding to the questionnaire, all but two indicated that a BET is eligible for full P.E. registration under one or more of the following provisions:

Experience only	9 states
Education and Experience	8 states
Experience and Examination	38 states
Education, Experience and Examination	42 states

The U.S. Civil Service Commission recently modified their GS ratings so that engineering technology graduates could qualify for professional engineering positions under the alternate method of qualifying. "Candidates who have completed all the requirements for a bachelor's degree in Engineering Technology (BET) including 60 semester hours of courses in the physical, mathematical and engineering sciences and in engineering as listed in the basic requirements above, in an accredited college or in a program accredited by the Engineer's Council for Professional Development (ECPD), and who pass the EIT examination, may be rated eligible for certain engineering positions at GS-5. Eligibility is limited to positions that are within or closely related to the specialty field of the Engineering Technology program."

The only requirement for taking the EIT examination in the State of California for the past 40 years is filing the application and payment of the filing fee. (Professional Engineers Act 1977). Engineering disciplines now licensed by the Board of Registration for Professional Engineers are:

Agricultural Engineering
Chemical Engineering
Civil Engineering
Consulting Engineering
Control System Engineering
Corrosion Engineering
Electrical Engineering
Fire Protection Engineering
Industrial Engineering
Manufacturing Engineering
Mechanical Engineering
Metallurgical Engineering
Nuclear Engineering
Petroleum Engineering
Quality Engineering
Safety Engineering
Structural Engineering
Traffic Engineering

In addition, ceramic and aerospace have been approved by the board, but not implemented by the Department of Consumer Affairs.

Quality and Manufacturing were open under the "grandfather" clause until October 1, 1977 and January 1, 1978 respectively. All branches require at least six years of professional engineering experience acceptable to the board, and successful completion of the EIT examination or eligibility for a waiver of it. Since 1975, the board has accepted applications for registration in nine of the eleven approved new technical disciplines. Each new approved discipline had a "grandfather" period not less than one year.

The Professional Engineers Act defines "Professional Engineer" (6701) and the reason for registration (6704):

6701. "Professional Engineer" within the meaning and intent of this act refers to a person engaged in professional practice of rendering service or creative work requiring education, training and experience in engineering sciences and the application of special knowledge of the mathematical, physical and engineering sciences in such professional or creative work.

6704. In order to safeguard life, health, property, and public welfare, only persons registered under the provisions of this chapter shall be entitled to take and use the titles "consulting engineer", "professional engineer", or "registered engineer", or any combination of such titles, and according to registration with the board the titles "civil engineer", "structural engineer", "chemical engineer", "electrical engineer", "industrial engineer", "mechanical engineer", "metallurgical engineer", petroleum engineer", "engineer-in-training" or the titles in such other branches as the board may establish.

A distinction in terminology exists between civil, electrical, mechanical, etc., as "that branch of professional engineering" and the other licensed professions (manufacturing, traffic, quality, etc.) as "that specialty branch of professional engineering", (so-called TITLE Registration).

Article 4.460 of the board rules provides the following credit for Engineering Technology:

(a) 1. The board may give one-half year of experience credit for each year of study completed in an approved curriculum leading to a degree in engineering technology except that the maximum of such experience credit shall be two years per applicant.

2. The board has approved the curricula leading to a degree in engineering technology which has been accredited by the Engineers' Council for Professional Development.

Note - Graduates of ECPD accredited engineering and related science degree programs receive credit for each year of study.

In order to "safeguard life, health, property and public welfare" was the justification for the passage of our first registration laws and is still the only justification for having such laws. In no way should licensing be a device to protect the "profession" or to enhance the prestige of the engineer. The question that should be asked is, "Are technologists in the performance of their jobs accountable for their work, subject to a code of professional ethics and as responsive to 'health, welfare and safety' as engineers?"

To my knowledge, there is no record that any technologists who have been licensed have failed to "safeguard life, health, property and public welfare." The record indicates that they have on the contrary performed professionally, that they are perhaps even more responsive to concerns of "health, welfare and safety" as a result of their training in applied practice and awareness of materials, processes, product development, quality control and testing. Their course work in the humanities and social sciences make them just as sensitive to public responsibilities as engineers.

Considering the large number of "registered professional engineers" who have achieved that status by routes which required neither a written examination or a college degree, I find it difficult to understand the rationale of those who oppose the registration of technologists "for the good of the profession" or "protection of health, welfare and safety." They have not proven their case that technologists are not competent and should therefore not be licensed.

REFERENCES

1. NSPE - Long Range Objectives for Engineering Education, Revised 9/15/77.
2. "Needs of Industry for Four-Year Technologists", D.E. Irwin, Corporate Education Services of General Electric.
3. "Professional Registration - Engineers Only", R. John Miner, Assistant Professor, Electrical Electronics, University of Houston.

Robert C. Thornton

Education: Loyola University, Los Angeles, B.A. 1970

Military Service:
U.S. Army Air Corp, World War II
U.S. Air Force, Korea

Industrial Experience:
AiResearch Manufacturing, structures
Western Air Lines, modification and overhaul

Northrop Aircraft, materials and process engineering

Lockheed Aircraft, structures, tooling

Publications:
"Modern Materials and Processes for Aircraft".
Materials Notebook:
Part I Metallurgy
Part II Engineering Materials
Part III Materials Evaluation

THE ENGINEERING TECHNOLOGIST: JOB ASSIGNMENTS AND PRACTICE NEEDS

Richard J. Ungrodt
Vice President - Academic Affairs
Milwaukee School of Engineering
Milwaukee, Wisconsin

Entry Level - Job Assignments

Job assignments for baccalaureate engineering technology graduates parellel those of the baccalaureate engineering graduates. There are obviously extensive variations in job titles and job functions for all types of technical personnel. This interface between baccalaureate graduates in engineering and engineering technology has become the focus of concern both by ASEE as well as many technical societies.

Initial or entry level job titles, as well as job functions and responsibilities, are often quite similar for both. This should be expected at the entry level since both types of individuals are beginners and require maturing experience prior to advancement into more challenging activities. Their academic programs when considered from the viewpoint of technical content are generally more similar than they are different. This interface occurs particularly in those industries where employment includes immediate job responsibilities.

The smaller company or one that utilizes fewer engineers is often more concerned with the immediate productivity of the new employee and might in fact favor the employment of a qualified engineering technology graduate in certain types of jobs. Larger industries may be more highly structured with job descriptions, job titles, and classifications which are more specific and which might discriminate more sharply in hiring practices.

All industries are looking for predictable, productive, performers with potential for advancement into areas of greater technical responsibility and/or to management of the technical activities. The beginning years and early experience produce for both engineering and engineering technology graduates involvement in practical day-to-day problem solving activities.

Satisfactory performance on the job can lead to advancement either within the technical discipline or into supervisory or other technically related functions. In any event further development including academic study becomes a necessity. Continuing education in the form of credit and/or non-credit programs is a common characteristic of the successful young member of the engineering profession.

The Four Dimensions of Job Assignments

The career progression of engineers has been documented and reported over the years. Reports show that a large percentage are advanced out of their technical specialty into various related functions. The interface between engineers and engineering technologists is also evident in this type of career progression. There are four dimensions to the job assignments involving the development and career growth of any member of the engineering profession. The four dimensions include: (1) theoretical knowledge, (2) practical skills (3) job functions and (4) rate of career growth.

Figure I illustrates a simple two dimensional model of the technical manpower spectrum which is commonly utilized to identify the various members in the spectrum of the engineering profession. The factors related to theoretical or practical knowledge have continually shifted over the past few years as more and more scientific and technical subjects have become incorporated in the educational programs of both engineering and engineering technology students. This trend has progressed to the present day at which we find some rather sophisticated state-of-the-art subjects taught requiring considerable theoretical background in math and science which were not present just a few years ago. The change in academic content of engineering technology curricula follow the changing needs of industry and its new technical developments.

The third dimension of a job assignment relates to the nature of the function performed on the job. This job function classification was first identified in 1955 by the Relations-With-Industry Division of ASEE in a brochure titled "Description of Design, Manufacturing, Sales Engineering Positions in Industry for the Guidance of Engineering Students". Figure II illustrates those functions in three simplified categories - research, design and development; production and manufacturing; and sales and management. Although these designations are overly simplified they permit the classification of various members of the technical manpower team who are involved in many different work activities. These engineering positions range from management of the technical enterprise to the research and development of innovative ideas, and from the production and manufacturing of devices and systems, to the application, maintenance, sales and servicing of those complex technical devices and systems. The individual's choice of a particular position will be controlled to a great extent by the personal attributes and characteristics, personality, personal motivation, and interests of that individual as they match the job functions of the position chosen.

Myron Tribus in March 1975 presented a somewhat similar view in identifying the various job functions in the engineering profession. He called them the "Ings", the "doing" or "engineering" face of a cube representing technology. Figure III is found in his paper "The Three Faces of Technology and the Challenge to Engineering Education". The three sides of the cube were used to illustrate the-ICS, the-INGS, and the-TIONS of technology. (Dr. Tribus credits J. Herbert Holloman with orginating the three names for the faces of the cube. The "doing" or "engineering" face identifies job functions ranging over a wide spectrum from the highly sophisticated and technical job functions to people oriented job functions as well as service type job functions.

Job functions thus provide the third dimension to the two dimensional chart of theoretical knowledge and practical skills. Figure IV illustrates this third dimension and thus will allow for the appropriate identification or classification of the various members of the technical manpower spectrum who have similar job functions but might have differing entry level enducational backgrounds. Thus the interface of engineering graduates and engineering graduates and engineering technology graduates working in similar professional engineeringfunctions can be better visualized and understood.

The fourth dimension of any job assignment relates to the rate of career growth of the individual. A careful review of high performers in the engineering profession indicates that they step progressivly through a series of four distinct career stages while many others stagnate along the way. Dalton, Thompson, and Wilson interviewed 150 engineers over a two year period and found key differences not only in the way engineers did things in each stage, but in the specific things or functions they performed. The four stages are identified by the authors as:

Stage I - Responsibility to a Mentor
Stage II - Taking Responsibility on Oneself
Stage III - Taking Responsibility for Others
Stabe IV - Responsibility for the Organization

The first stage, "Responsibility to a Mentor" is characterized by the Learning required of all entry level professionals. During this apprentice-type stage the young professional works under fairly close supervision and must acquire technical, organizational, and personal knowledge. The mentor relationship is particularly critical in terms of motivating and teaching the necessary techniques and developing the habit to get things done.

Stage III, "Taking Responsibility on Oneself" usually occurs when the experience, performance, and understanding of the young professional warrants an advancement to the level of job function. The greater responsibility assigned with less close supervision allows greater decision making freedom in planning projects. A key career decision which faces the young engineering technologist or engineer at this time is the dilemma concerning specialization versus generalization. Some specialization is almost necessary to obtain the visibility and exhibit the performance which will establish the confidence of management in the young professional as a knowledgeable person. Generalists on the other hand develop a broad background which hopefully will permit them to integrate the work of others and thus be assigned the management of the overall project.

Stage III, "Taking Responsibility for Others" may be reached in a short time by some, while others may never advance to this stage during their entire career. The individual now begins to act as mentor for others and increases contacts outside of the organization. The leadership skills involve a new orientation toward teaching and sharing ones knowledge with others. This stage may lead to additional responsibilities in areas such as marketing or the financial aspects of the technical endeavor.

Stage IV, "Responsibility for the Organization" is attained by relatively few technical-professional people. At this stage in their careers they have a significant influence over the future direction of the organization, and will be involved in wide and varied interactions both inside and outside of the organization. One of their major concerns will be identifying and developing people with potential to fill key positions in the organization in the future.

The various stages of career growth can be considered as a fourth dimension of the engineering manpower spectrum. Although a strong relationship exists with job functions, this fourth dimension relates primarily to time or rate of career growth. The time required to attain a particular career stage is not only time variable, but is distinctly individual and personal. It is based on the ability to become a predictable, productive performer, on the individual's developed skills in interpersonal relationships and on psychological adjustments necessary to successfully advance through the various career stages.

Changing Job Assignments

One major company has indicated the transition from the use of engineers to engineering technologists in certain positions. Their internal document includes a paragraph headed "Transition from use of engineers to technologists" and reads as follows:

"The extent of the need for baccalaureate technology program graduates will not be clearly determined until a constant flow of technologists becomes available to employers. The present supply appears to be increasing significantly. The need for technologists became evident when the supply of engineers normally employed at the technologist level disappeared. Increasing demand for engineers over the past decade along with the relatively fixed or decreasing supply, made it necessary to utilize "regular" engineering graduates for the growing number of positions in engineering planning, design, research, development, and operations. Today, more and more positions in manufacturing, purchasing, quality control, field engineering, production, construction, operations, sales and services, formerly performed by regular engineering graduates, are being opened to technologists as employers learn to separate these functions and activities from creative engineering planning, development, and design."

As more baccalaureate engineering technologists become available, more industries will utilize their services in those unique areas where they can best function.

Practice Needs - Registration

The practice needs of any individual are highly personal and psychologically complex. The various social or psychological needs are common to many workers, however professional persons also exhibit the need for professional recognition as well as the need to serve others. The recognition of the professional has been characteristically afforded by membership ranks in technical/professional societies and also by the license to practice. Licensing has been generally under the control of the state through the peer group, the only really knowledgeable individuals who are in a position to judge the professional competence of the practitioner. In the United States the registration procedures for engineering graduates was developed in the 1930's and now utilizes two examinations which are strictly academic in nature and a third requirement of experience obtained over a time period during which the individual is to accumulate experience of such a nature and level as to be acceptable to the peer group. Academic tests are easy to administer, however, critical evaluation of "progressive responsible experience" which also demonstrates professional attitude and ethical conduct is not as objective as academic exams. The work experience is not generally acquired under a closely controlled internship. The current procedures for critically reviewing the nature of the professional experience and the required development of professional attitudes and professional responsibility leaves much to be desired. Licensing procedures vary from state to state with some rather arbitrary criteria being required in some states.

Practice Needs - Certification - ICET

Certification of engineering technicians was initiated in order to keep the two-year engineering technicians as close to the engineering profession as possible and thus to discourage their involvement in union activities. Thus the Institute for Certification of Engineering Technicians (ICET) was established in 1961 by the National Society of Professional Engineers. ICET has established three certification grades which are associate engineering technician, engineering technician, and senior engineering technician. The Institute's Board of Trustees consists of four registered Professional Engineers and four Senior Engineering Technicians. The engineer members are appointed by the President of the National Society of Professional Engineers. The technician members are selected by the Board itself from among those qualified in the grade of Senior Engineering Technician. All applications for certification are reviewed for appropriate action by the Board. All Rules of Procedure must be approved by the Board of Directors of the National Society of Professional Engineers.

Practice Needs - Certification - ETCI

As the four-year engineering technologists came on the scene the ICET included procedures for four-year graduates to be initially certified in the second category as Associate Engineering Technicians. As baccalaureate engineering technology graduates were advanced in industry, the interface with baccalaureate engineering graduates became evident. Many became registered by reason of both examination and experience. This trend has produced concerns in both the National Council of Engineering Examiners as well as in NSPE.

NSPE took action to establish another certification procedure for the baccalaureate graduates of engineering technology even through the ICET procedures already recognized this group. In July 1976 the Engineering Technologist Certification Institute (ETCI) was established by NSPE. It is also governed by eight trustees - four of whom are appointed by NSPE. The Rules of Procedure for ETCI must also be approved by the Board of Directors of NSPE. ETCI has established two certification grades - Associate Engineering Technologist and Certified Engineering Technologist. At the present time there has been no mass movement for certification by the ETCI.

The nature of the job assignments given engineering technologists is such that they have the opportunity through individual performance and productivity to be advanced along parallel paths with other members of the profession. It is logical therefore that they are motivated to seek full professional recognition when they warrant such recognition. Until such time as this opportunity is legally removed, it is not likely that ETCI will be popular with the technologists.

Conclusion

The progression in job assignments of any motivated, dedicated, professionally competent person is basically an individual challenge. Technical competence is a necessary but not a sufficient condition to reach full professional service and status. There must be certain personal characteristics, quality of character and personality which will unmistakably establish the trust and confidence necessary for advancement into new and challenging responsibilities. It is important that individuals so motivated recognize the many facturs which affect their progression. Some of these include: The need to be organizationally acceptable, to be both physically and emotionally acceptable, have drive, being professionally energetic, dependable, a predictable performer, and mentally endowed with a high degree of intelligence.

Recognition by the other members of the profession of the professional growth and development of the individual is always desired by that individual. To quote Herbert Hoover: - "But the professional himself looks back at the unending stream of goodness which flows from his successes with satifications that few professions may know. And the verdict of his fellow professionals is all the accolade he wants".

Richard J. Ungrodt is Vice President for Academic Affairs at the Milwaukee School of Engineering where he has served for 31 years as teacher, department chairman, and administrator.

Current activities in ASEE include Long Range Planning Committee, Projects Board, and Committee on Accreditation Processes. Previously served as Chairman of TCC and related committees. 1972 recipient of James H. McGraw Award.

Currently serving as Director for ECPD representing the Society of Manufacturing Engineers.

Serving ECPD on the Executive Review Steering Committee, the Accreditation Planning Committee, and the Special Task Force on Allied Engineering Professions.

President, Milwaukee Chapter, Wisconsin Society of Professional Engineers.

Advisor to the University of Petroleum and Minerals in Saudi Arabia.

TECHNOLOGIST AND TECHNICIAN CERTIFICATION PROGRAMS

Joseph M. Snarponis, C.E.T.
Director of Education Services
National Society of Professional Engineers
Washington, D.C.

Background

The National Society of Professional Engineers is well-known for its many decades of contributions to the growth of engineering as a profession. Engineering registration has become virtually synonymous with NSPE. However, NSPE's activities for two decades to promote the use, recognition, and quality of the entire engineering team are not so well known. In mid-1961 NSPE founded the Institute for the Certification of Engineering Technicians (ICET). And in 1975, following four years of careful, extensive study, NSPE established the Engineering Technologist Certification Institute (ETCI). ETCI certification will be available for the first time to an entire graduating class in the spring of 1978. ICET has grown to become the largest program of its type in the world with more than 60,000 certifications being completed and significant recognition of this voluntary certification being experienced by more than 50% of those who have been certified. In order to explore some of the ramifications that certification has for the future quality and utility of practicing engineering teams and educational practices, the evolution of certification in ICET and ETCI should be first understood.

Technician Certification - ICET

Technician certification criteria initially paralleled those used in engineering registration. Education, experience, and professional engineering endorsements were used to certify technicians in one of three levels - Associate Engineering Technician, Engineering Technician, and Senior Engineering Technician. On January 1, 1973, an examination was required for certification unless a degree in engineering technology had been earned from a program that had been accredited by the Engineers' Council for Professional Development. Figure 1 shows the requirement for certification in the various levels.

Note that individuals with baccalaureate degrees in engineering technology are permitted to certify directly into the Engineering Technician level. This was permitted following a study conducted by the NSPE that showed BET graduates being assigned something akin to advanced technician duties when employed in R&D settings and quasi-engineering responsibilities when employed in production settings. In both instances the assignments tended to be somewhat different from either traditional engineering or engineering-technician functions. But since the functions had been documented on neither the technician nor the engineer levels, the BET tended to be placed in both. The trend was to involve the BET graduate in the role of functional system or sub-system management and coordination roles. Compounding the ambiguity surrounding the role of the BET was the educationally unspecified target in the manpower spectrum and the varied treatment of the BET in state engineering registration laws. In short, BET graduates found themselves accepted in the manpower market place but without a functionally defined identity and with the door to professional engineering registration open in many states.

Considering carefully the National Council of Engineering Examiners (NCEE) recommendation to the states that BETs not be permitted to register as professional engineers, NSPE accepted the responsibility to define an identity for the obviously valuable BET graduate. Two additional studies confirmed and further delimited the nature of the BET role in the market place and the Engineering Technologist Certification Institute (STCI) was established to provide the BET with a job-related definition as an engineering technologist with a logical role in accomplishing engineering team functions. Implicit in this decision is the belief that the technologist performs a valuable function different from the technician and engineer and that faulure to define this function operationally will unnecessarily penalize individuals with BET degrees once the NCEE recommendation is implemented.

Technologist Certification - ETCI

ETCI certification for technologists has two levels - Associate Technologist and Certified Technologist. The criteria for each is described in the following excerpt from the ETCI brochure:

> Certification Criteria for the AT grade will be a baccalaureate degree in engineering technology earned through a program that has been accredited by the Engineers' Council for Professional Development (ECPD).
>
> Certification criteria for the CT grade will be a baccalaureate degree in engineering technology earned through a program that has been accredited by ECPD plus five years of engineering technologists experience

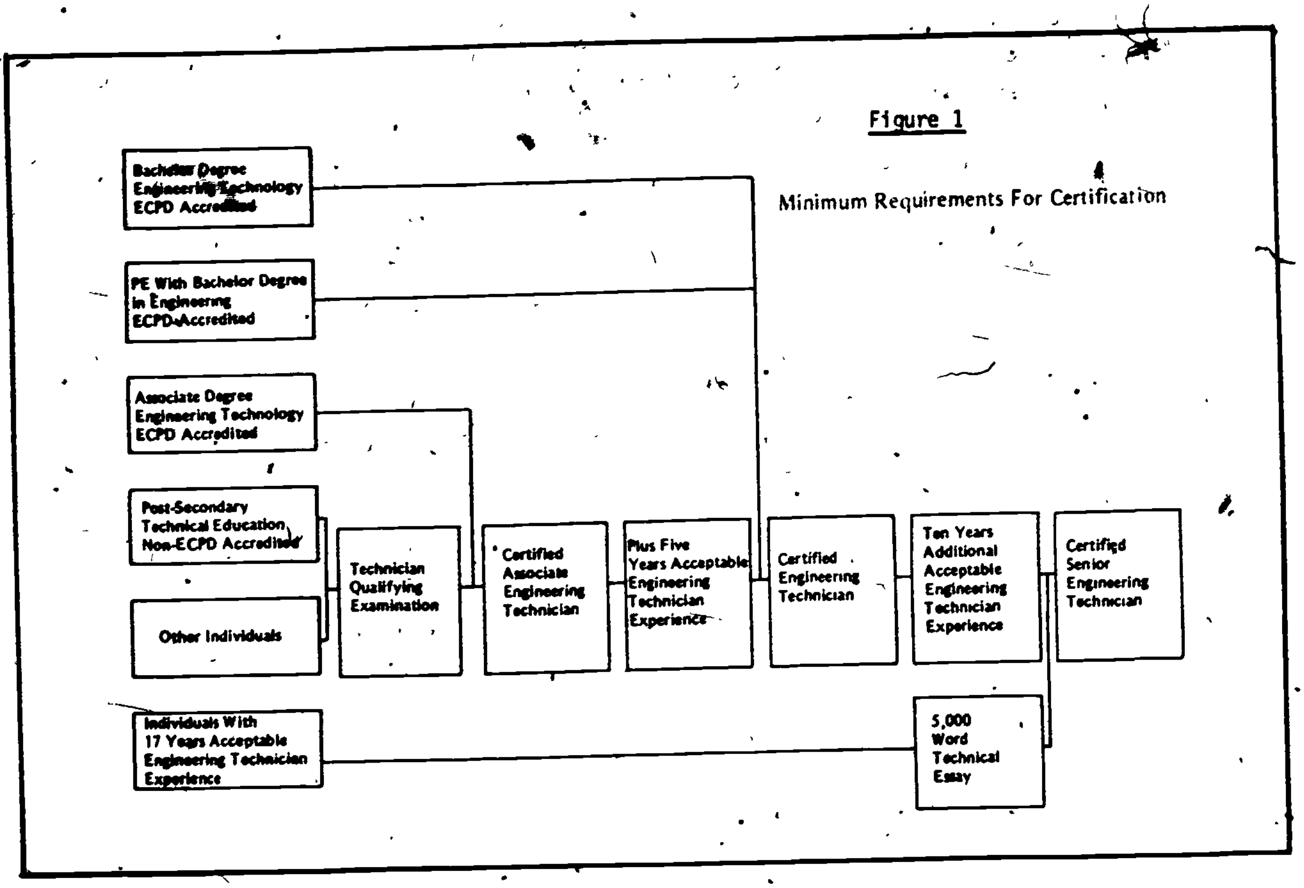


Figure 1
Minimum Requirements For Certification
Bachelor Degree Engineering Technology ECPD Accredited
PE With Bachelor Degree in Engineering ECPD Accredited
Associate Degree Engineering Technology ECPD Accredited
Post-Secondary Technical Education Non-ECPD Accredited
Other Individuals
Technician Qualifying Examination
Certified Associate Engineering Technician
Plus Five Years Acceptable Engineering Technician Experience
Certified Engineering Technician
Ten Years Additional Acceptable Engineering Technician Experience
Certified Senior Engineering Technician
Individuals With 17 Years Acceptable Engineering Technician Experience
5,000 Word Technical Essay

accumulated after the date of the ECPD accredited baccalaureate in technology degree. Experience will be evaluated by endorsement of two PEs or other approved supervisory or professional level persons.

Note that the BET degree from an ECPD accredited program is presently required for either level but that an examination is required for each level beginning in 1980. This difference anticipates development of a strategy to appropriately define operationally the job task responsibilities of the technologist as a basis for the certification examinations. Work on this complicated, technical, and extremely sensitive project has begun and is approaching the stage where extensive input from industry, education, technicians, engineers, technologists, and other affected parties will be sought. Hence, during the period up to 1980 ETCI will become a major forum for communicating information relating to technologist job functions and responsibilities. A framework within which this forum can be implemented has been designed, operationally tested and widely accepted on a national basis in technical and administrative segments of a major segment of the national economy.

A Framework for Certification

Certification systems for technicians and technologists must interface on a very specific and functional level with engineering registration if the engineering team is to perform in the acceptable to optimum range of effectiveness. To the extent that the interfaces lack precision, performance of the team deteriorates with a resultant loss of quality and productivity and increased costs in engineering output. On the humanistic side, personal satisfaction is also directly related to the degree of precision with which team members are functionally interfaced through job assignments. Engineers employed in technician functions are not adequately challenged, become dissatisfied, performance deteriorates, and turnover is probable. On the other hand technicians assigned to genuine engineering duties would most likely be uncomfortable and perform marginally with few exceptions. Technologists by reason of their education are prone to both over and under assignment. Therefore, the strategy for certification of technicians and technologists must consider the diversity encountered across technical fields and industries in assigning duties and responsibilities.

ICET has developed and is currently in the process of field testing a job-related certification system in the field of transportation engineering technology. Examinations are prepared on an individual basis on "work elements" that the technician indicates he has mastered and his supervising engineer or certified technician endorses as having been actually correctly performed in accordance with elements necessary to document capability on an acceptable level with realistic flexibility.

In effect a separate sub-test is available for each work element and the technician is examined only on work elements he requests, performance of which has been verified by supervisor endorsement. The system encourages certification in multiple technical sub-fields and provides a basis for career planning, studies, work assignment, manpower planning, and many other important activities. Most importantly it documents what an individual has demonstrated the ability and knowledge to do on-the-job. Simultaneously it delimits on an operational basis the realm of technician duties and responsibilities thereby providing a basis for the necessary interfaces with technologists and engineers in an engineering team environment. Technicians, engineers, educators, and employers have reacted very favorably to this approach to certification. For example, the work element inventories have been welcomed by educators for use in planning curricula and continuing education courses. The same strategy will be utilized for developing technologist certification examinations. The major difference will be in the degree of specificity of the work elements. For example, technician work elements in transportation are divided into six sub-fields, the technologist sub-field will be broader because of their systems-coordinator orientation. Figure 3 illustrates this on a hypothetical basis because the technologist committees will just begin their work in the near future.

Sub-fields of technician responsibilities within the transportation field are much more specialized than those of the technologist or engineer. Also, technologist fields tend to be more specialized than engineers. This is because increasingly theoretical education enables one to define and design solutions for problems that are not routine. Technicians, in contrast, are best prepared for troubleshooting and efficiently utilizing established procedures and techniques in more specific technical environments. Consequently, in transportation ICET's research has identified 522 job elements or tasks in the transportation field, and these are classified into six sub-fields. There is some overlap in these job elements across sub-fields. It is logical to expect that when technologist job elements are specified they will be fewer and more general than for technicians with fewer sub-fields. Generality of job elements and sub-fields will be most evident in the engineer category.

Implications of Job-Based Credentials

Without job definition in these specific terms confusion as to the appropriate roles of technicians, technologists, and engineers will continue in education, practice, registration laws and procedures, and personnel practices.

Certification is a logical procedure for establishing the competency of technicians and technologists on a job-related basis. The approach being utilized by ICET and ETCI does not encroach upon the academic freedom of institutions or professors, but complements the educational process by documenting specific abilities that have been proven by performance. This is beneficial to the certified individual because it is meaningful to employers in nationally defined terms. For engineering, registration remains the most appropriate credential because of the complexities of insuring

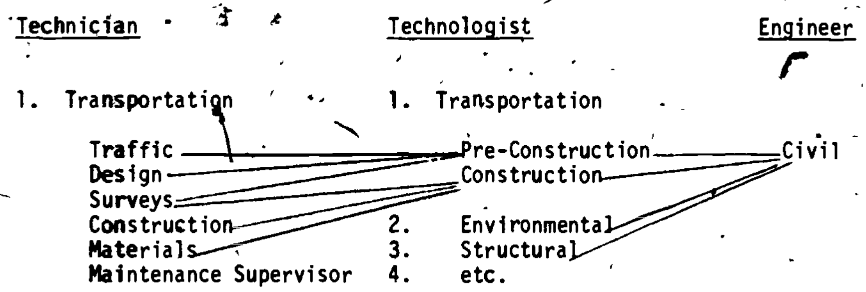
Figure 2

	WORK ELEMENTS											
	CONSTRUCTION		DESIGN		MATERIALS		TRAFFIC OPER.		SURVEYS		MAINTENANCE	
LEVEL	General	Special	General	Special	General	Special	General	Special	General	Special	General	Special
I	4 3	10 4	6 5	9 3	7 6	27 7	8 6	11 4	11 9	12 4		
II	7 6	25 2 7	10 8	10 3 5	10 8	37 6 7	11 9	15 3 6	16 13	16 3 5		
III	13 10	10 2 7 3	13 10	8 3 3 5	10 8	24 4 7 7	17 14	14 0 4 7	17 14	15 0 4 7	22 18	22 0 0 7
IV	9 7	A 0 4 3	5 4	A 0 2 3	7 6	27 0 2 4 7	6 5	11 0 1 4 5	5 4	A 0 3 6	5 4	A 0 0 9
TOTALS	33 26	45 32	34 27	27 27	34 28	115 51	42 34	51 34	49 40	43 32	27 22	22 16

public health and safety and the attendant liability. A true team approach based upon documented specific competencies of all team members can improve engineering products during design, production, and utilization thereby best serving the public. NSPE is actively pursuing this worthy objective through its ICET and ETCI programs.

Figure 3

Hypothetical Sub-Fields of Technical Functions of Technicians, Technologists, and Engineers



Mr. Snarponis has served six years as Executive Secretary of NSPE's Institute for the Certification of Engineering Technicians and has also been the Executive Secretary of the Engineering Technologist Certification Institute since it was established in 1976. Prior to his association with NSPE, he was the Director of Career Programs at Hagerstown Junior College and a Research Associate with the Pennsylvania Department of Education. In a private consulting capacity Mr. Snarponis has completed more than forty research projects primarily in the field of vocational-technical education and has authored numerous articles on the interfacing of education and industry. He studied business administration at the Pennsylvania State University and earned a B.S. degree in business education from Bloomsburg State College and a M. S. in education research from Bucknell University. Currently Mr. Snarponis is a doctoral candidate at the American University. The author is a graduate of the Systems Engineering Management School of General Electric's Missile and Space Division and was a Ford Foundation fellow during his M. S. work.

DON'T FORGET

1978 ASEE ANNUAL CONFERENCE
UNIVERSITY OF BRITISH COLUMBIA
JUNE 19-22, 1978
VANCOUVER, B.D.
VANCOUVER, B.C., CANADA

1979 ASEE ANNUAL CONFERENCE
LOUISIANA STATE UNIVERSITY
JUNE 25-29, 1979
BATON ROUGE, LOUISIANA

SESSION 3.4 A

MANAGING VITALITY

[illegible] iller
[illegible] Human Resources
IBM General Products Division
San Jose, California

INTRODUCTION

Managing vitality, causing an organization and its people to generate the power today which will make tomorrow's success possible, is an important managerial function. Continuing education is an activity which supports vitality improvement but the goal cannot be reached by simply adding courses and educational programs. A vital organization starts with a mission of importance--a challenge. Second, increasing vitality requires design and implementation of organizations and work environments which challenge people, support human growth and provide payouts for both individual and organization. Third, increasing vitality requires that individuals accept responsibility for enhancing their own capability and applying their skills to the goals of the enterprise. Fourth, work should be organized in ways which build learning into the process--learning for both the organization and the people.

The Managing Vitality workshop will start by building an understanding of what vitality is. The group also will work at identification of the design characteristics of environments and organizations that can be utilized to enhance vitality. Both the positive and negative aspects of work environments will be discussed and group participation in simulations or exercises will enhance understanding of quality work environments. A broad spectrum of vitality enhancing techniques, organization and individually based, will be explored and contributions will be expected from the participants.

The workshop should benefit anyone who manages professionals; anyone who designs, administers or teaches in learning programs for the adult professional; anyone who wishes to increase his or her own vitality through discovery of a more challenging, rewarding growth-oriented way of living and working.

ELEMENTS OF THE WORKSHOP PROGRAM

The following topic areas will be explored through lecture, process and discussion. Many of the topics will lead to exercises and group participation events which will help assure that the participants gain some usable concepts, tools and techniques.

Vitality

Members of the group will identify vitality by using examples from their own experience and discuss activities which enhance or destroy vitality in organizations and people. In the context of this program, vitality is seen as the power an organization or individual generates today to assure survival and success tomorrow. Participants will try to identify the components of this power. For example, is it problem-solving capability, energy, creativity, or commitment? Can we measure this power? In addition, the group will identify ways to sample and analyze the organizational climate to determine the existence of vitality inhibiting or supporting conditions through identification of norms or unwritten rules. Ways to identify, sample and analyze organization climate:

- Identify evidences of the presence or lack of vitality
- Assessing ways to enhance vitality both organizational and individual
- Obsolescence--Kinds, causes, and cures
- Image, strategy and expectations as contributors to vitality

Work

Discussions will cover the aspects of work which lead to learning, growth and psychic income. The negatives will also be identified by drawing on participants own task experiences. Some concepts of job redesign and organizational change will be reviewed. Trends in the nature of work and our values about work will be covered and the group will try to determine how they affect vitality. What we know about work will be presented through the following:

- Work inputs and outputs
- Psychological requirements and priorities
- Job design and development
- Group dynamics and organizational design.

Human Growth and Learning

In order for the individual and organization to maintain and extend effectiveness, there must be learning and growth. Growth is represented by an increase in capability which makes it possible to do something tomorrow that the individual or organization can't do today. Some concepts of learning both for individuals and organizations will be explored. These will include:

- Bridging concepts
- Experiment and feedback
- Hermispheric dominance of brain function and its affect on learning
- Unlearning--Opening the possibility for new learning

Continued Education

How continued formal study blends with and supplements growth through living and working will be explored. The participants will explore the reasons why people engage in continuing education. Some concepts of course design, fields or areas of importance to adults, and interfacing between organizations and educational institutions will also be covered. This discussion will include:

- Finding out what is needed
- Delivery systems
- Organization based courses versus university based courses
- Intensive versus semester programs (Program packaging)

Career/Life Management

The importance of taking responsibility for what happens in our lives and engaging in processes of continuing assessment and planning will be covered. Some examples of assessment processes will be sampled by the participants including:

- Self assessment and opportunity assessment
- Career phases or stages
- Managing personal change
- Teaching career/life management techniques.

Strategy and Tactics

A strategy provides an overall theme and direction for an organization or an individual. A strategy is part of the goal setting process. The group will examine how different strategies and ways of intervening to create change result in different outcomes. Discussion of strategy and tactics will be used to tie all the workshop subjects together. Topics covered will include:

- Modeling or defining a good organization
- Communicating organization values an and goals
- Human resource management--Four concepts
- Managing organizational change

CONCLUSION

Rapid technological and social change both raise the priority for learning how to increase and enhance vitality, manage change and create lifelong growth and development. This workshop is designed to give the person who is responsible for managing and making an organization successful, an understanding of the issues, a strategy and some tools and techniques. For those who provide continued education, it should assist by building an understanding of work climate, techniques for extending and enhancing effectiveness other than continuing education and the relationship of these to educational programs.

SUGGESTED READINGS

Steele, Fritz and Jenks, Stephen. The Feel of the Workplace. Reading, MA, Addison-Wesley, 1977.

Miller, Donald B. Personal Vitality. Reading, MA, Addison-Wesley, 1977.

O'Toole, James F. Work Learning, and the American Future. San Francisco, CA, Jossey-Bass, 1977.

Jourard, Sidney, M. Health Personality. New York, NY. Macmillan Publishing Company, 1974.

Francis, Dave and Woodcock, Mike. People at Work. La Jolla, CA, University Associates, 1975.

Samples, Robert. Metaphoric Mind. Reading, MA, Addison-Wesley, 1976.

Don began his professional career with a B.S. in mechanical engineering from the University of Rochester. Later he earned a M.B.A. at Columbia. At Columbia he was assistant to the dean of engineering. Joining IBM in 1952, his many assignments have included general management of development laboratories, engineering education, personnel research and director of personnel.

A member of ASME, SAM, IEEE, ASTD, and ASEE, he has carried on extensive professional activities. He is on the board of CES and is a fellow of the Society for Advancement of Management.

He is the author of a book, Personal Vitality, and a workbook recently published by Addison-Wesley.

1979 College Industry Education Conference
January 23 - 26, 1979
Admiral Semmes Hotel
Mobile, Alabama

SESSION 3.4B

MARKET ANALYSIS FOR CES PRODUCTS

Ray A. Svenson
Dean of Methods, Planning and Results
Bell Systems Center for Technical Education
Lisle, Illinois

OBJECTIVE

The seminar is intended to provide you with ideas and some practice in the following areas:

Define the goals of your CES enterprise.

Identify customers and segment the market.

Systematically diagnose customer needs.

Gain involvement and commitment of the customers in the CES program.

Develop a program planning and priority system.

Sell your plans to your own management and/or boards.

SEMINAR FORMAT

The focus will be on each individual conferee developing ideas and action plans for his/her own CES program.

The seminar leader will present one approach to the Market Analysis and Strategic Planning tasks based on personal experience. This approach will be used as a means for stimulating discussion about other approaches and for generating new ideas. We intend that each conferee should gain as much from the other conferees and from his/her own idea generation as from the seminar leader.

Each conferee will develop ideas and plans for market analysis in his own CES organization. These ideas will be critiqued by the seminar leader and other conferees.

WHO SHOULD ATTEND

You should attend if you are:

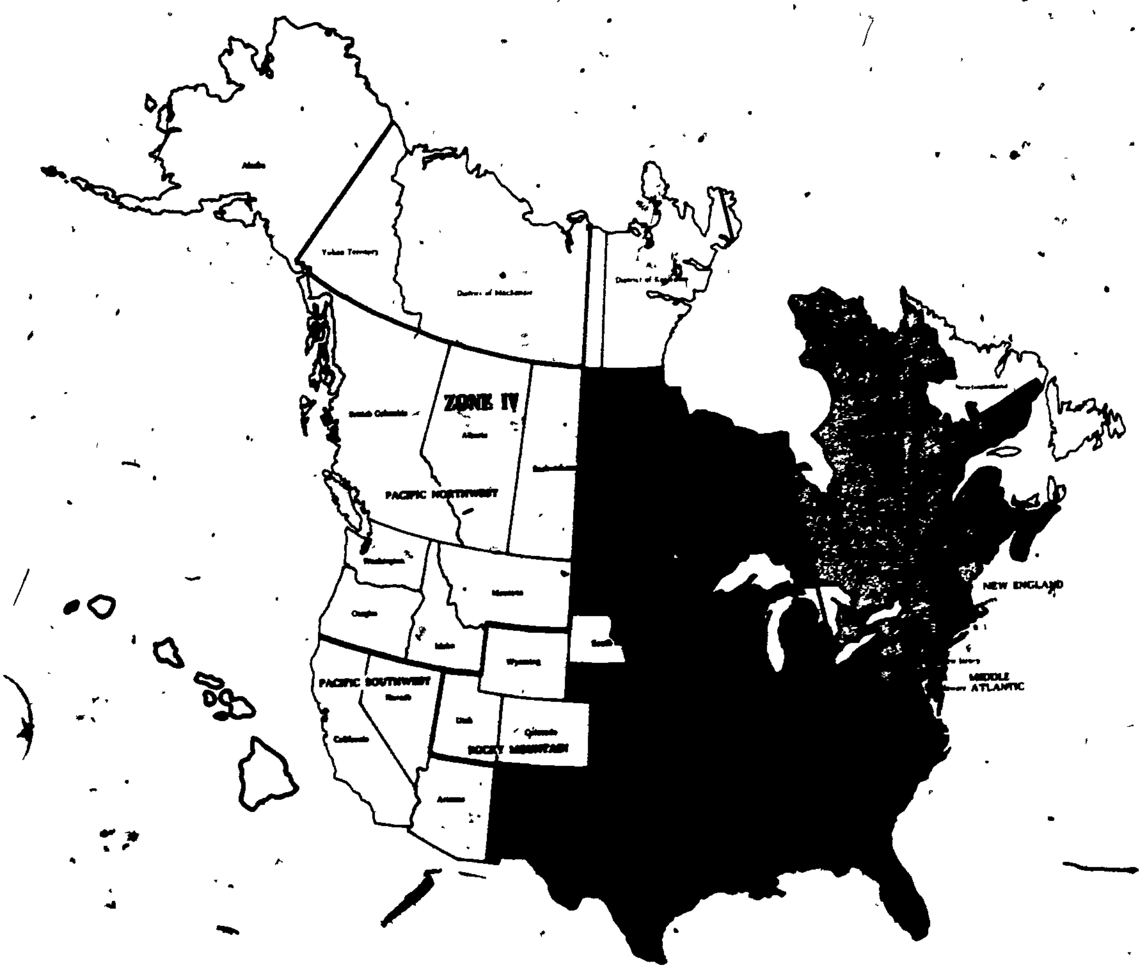
A. A Director of a CES organization.

B. You believe there is a real need for CES programs.

C. Your organization is in business to meet that need.

SEMINAR LEADER

Ray Svenson, Dean of Planning, Methods and Results, Bell System Center for Technical Education, Lisle, Illinois.
Ray has spent the last 5½ years doing the tasks listed in the objective. Other background includes 4 years systems development at Bell Labs, and 6 years at AT&T Headquarters on the Engineering staff in various systems planning and methods assignments. Academic background includes BSEE, Michigan Tech. and MSEE, California Institute of Technology.



THE ASEE ZONES

SESSION 3.4C
PERSONALIZED CONTINUING ENGINEERING EDUCATION OVERCOMING IMPLEMENTATION BARRIERS

Dean Griffith
Director, Continuing Education Studies
University of Texas at Austin
Austin, Texas

A WORKSHOP

Are you starting a new personalized education program for practicing engineers? Or planning a new program using personalized education techniques? Are you running into improvement barriers in an existing program? Maybe you are merely curious to learn how personalized education has been, is being, and can be employed in programs for practicing professionals. If one or more of the above describe your interests, you will want to attend this workshop.

Each afternoon, Wednesday, January 25, and Thursday, January 26, from 2:00-3:30 p.m, members of the CES PCEESIG will lead a <u>general</u> discussion of questions most frequently asked about personalized continuing engineering education (PCEE) such as:

- Who is using PCEE?
- Why is PCEE being used? Where is PCEE used?
- When is PCEE used and when should PCEE not be used?
- What are examples of PCEE?
- Where can PCEE materials be obtained?
- Is personalized learning used for business education?
- What is criterion referenced instruction?
- What is contract learning? What is career management?
- What are the barriers to implementation of PCEE by universities? By industry? By technical societies? By private educational enterprenuers?

These discussions will be led by the following charter members of PCEESIG:

Joe Biedenbach   Dean Griffith
Jay Gilbert   Ollie Holt
Ziggy Shelton

IMPLEMENTATION IN UNIVERSITIES

On Wednesday, January 25, from 3:45-5:30 p.m. workshop participants will address the techniques by which barriers to implementation of PCEE in <u>UNIVERSITIES</u> can be successfully overcome. Creation of totally new academic organizations, evolutionary development of existing organizations, and consortium development will be highlighted in this session. Workshop participants will have ample time to present their implementation concerns for discussion and for alternative solution suggestions.

IMPLEMENTATION IN INDUSTRY

On Thursday, January 26, from 3:45-5:30 p.m., workshop participants will address techniques by which PCEE has been successfully implemented in <u>INDUSTRY</u>. Solutions to the problems of creating learning environments, learning strategies, learning centers, and new learning media will be discussed. Workshop participants are encouraged to share their implementation problems and/or successful solutions at the workshop. Special emphasis will be placed on Magers criterion referenced instructional system and the modifications necessary to adapt it to different industrial environments, especially in high technology organizations.

Participants at these workshops should be prepared to define the clientele they wish to serve, as well as the typical behavioral objectives for which they are designing personalized instructional.

Dean E. Griffith is Alumni Visiting Professor of Engineering at Clemson University, on leave from The University of Texas at Austin, where he is Director of Continuing Engineering Studies. Dean is a director of the Texas Association for Community Service and Continuing Education, a professional member of the National University Extension Association and a charter member of the Continuing Education for the Professions Section, NUEA. Dean has served on the National Continuing Education Committee of the American Institute of Chemical Engineers, on the Projects Board, ASEE, and in various positions for the Continuing Engineering Studies Division, ASEE including a member of the Board of Directors, and Chairman of the CES Task Forces. Dean is chairman of the Continuing Personalized Engineering Education Special Interest Group and is a member of the Long Range Planning Committee, ASEE. Dean's personal interests are reflected in his Clemson project: "Increasing the Margins of Excellence in the External Master of Engineering Program."

SESSION 3.4D

TRAINING MEASUREMENT AND EVALUATION

Kim Smart
Training Manager, Tests and Measurements
Bell Systems Center for Technical Education
Lisle, Illinois

PAPER NOT
AVAILABLE
AT TIME
OF PRINTING

KIM L. SMART

Education: B.A. Capital University, M.S. and Ph.D Ohio University. Major: Experimental Psychology. Member of American Psychological Association, Midwestern Psychological Association and American Educational Research Association. Currently: Training Supervisor-Tests and Measurements, Bell System Center for Technical Education. Responsibilities include student evaluation, course follow-up evaluation, testing and attitude assessment. Before joining the Bell System, held positions constructing and administering civil service examinations, and in educational research for a branch of the U.S. Dept. of Defense.

WOULD YOU LIKE TO HOST THE CIEC IN YOUR REGION?

If your organization would like to host the College Industry Education Conference in some future years the site selection committee of the five divisions sponsoring the conference would like to hear from you. Professor George Maler at the University of Colorado is currently the chairman of the long range planning committee and site selection committee. The College Industry Education Conference is held each January and we earnestly soliciate proposals for being the host of this conference.

SESSION 3.4E

MEDIA SELECTION

R. H. Anderson
Instructional Technologist
Bell System Center for Technical Education
Lisle, Illinois

This workshop deals with the use of media as a technique for distributing continuing education programs for engineers, scientists, technologists and so forth in industry.

The decisions necessary to determine what types of media to use in particular situations is at best a difficult one. This workshop will attempt to get at some of the problems that confront an individual when they decide to develop their instructional program utilizing media. Some of the major topics that will be discussed in detail in the time allowed will include:

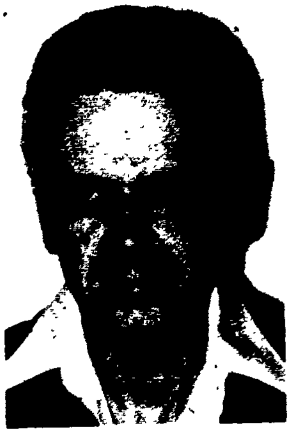
1. My views of the way instructors and instructional technology developers usually make decisions. The pros and cons of the success of these techniques will be amplified.

2. A proposed alternative method for making media decisions based on actual lesson needs and the capabilities that exist for different media. The pros and cons of these different media will be presented.

3. Several learning exercises for the workshop participants utilizing different media techniques will be employed.

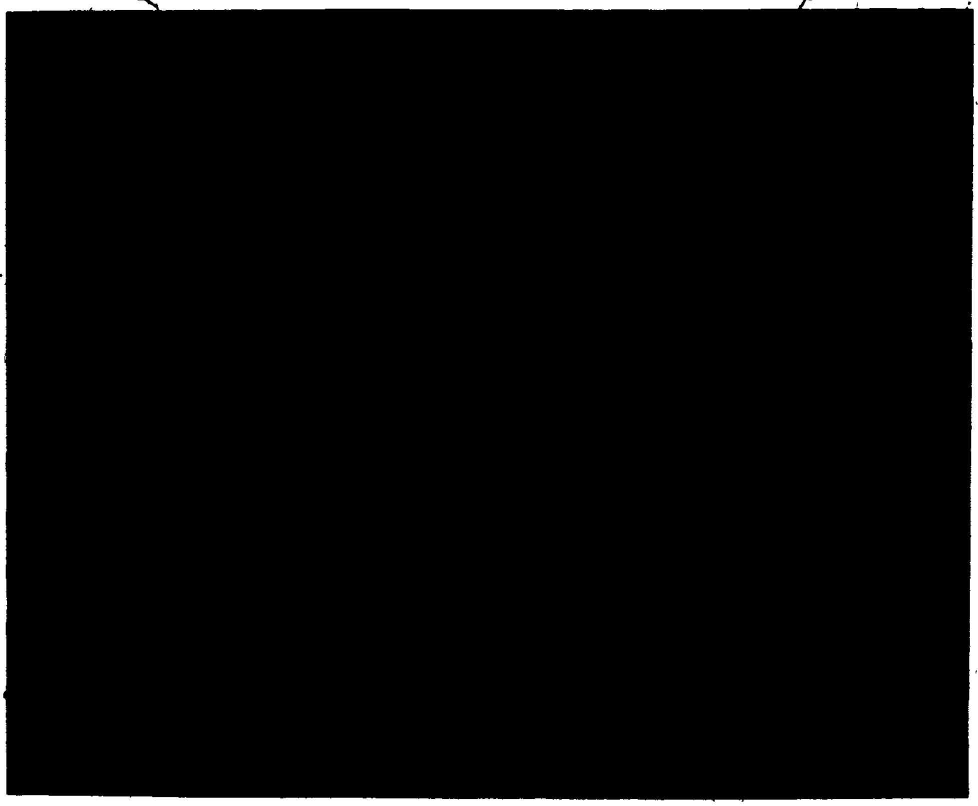
4. A discussion of some of the major issues that must be addressed and solved when an individual decides to prepare audio visual materials will be discussed in detail.

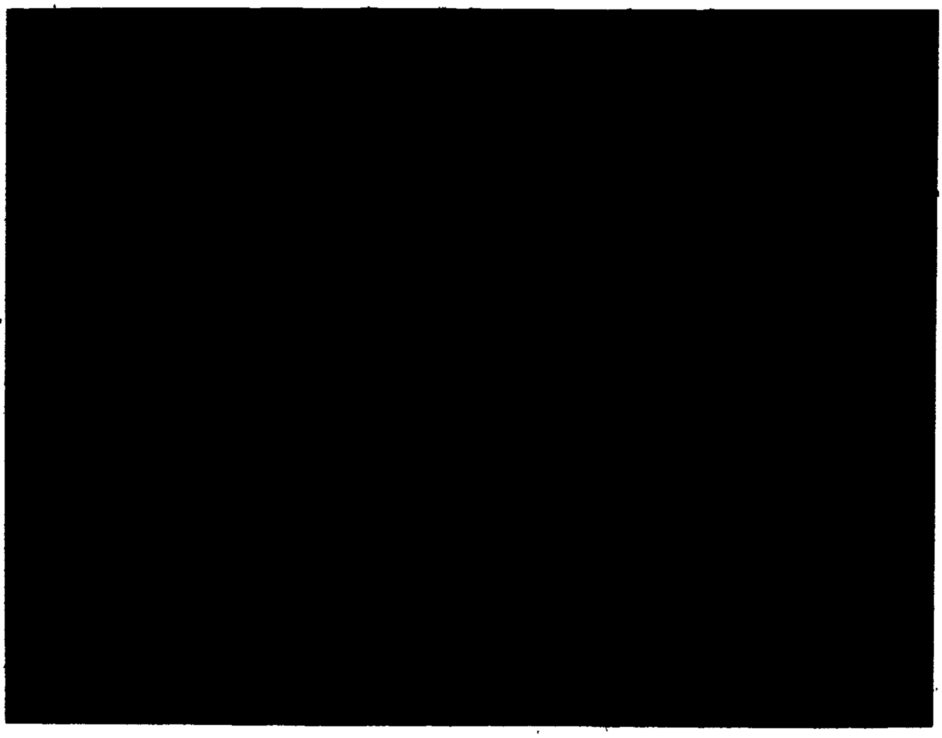
The program format will be such that the participants will have a great deal of interchange of ideas among themselves to get the most from the time spent.



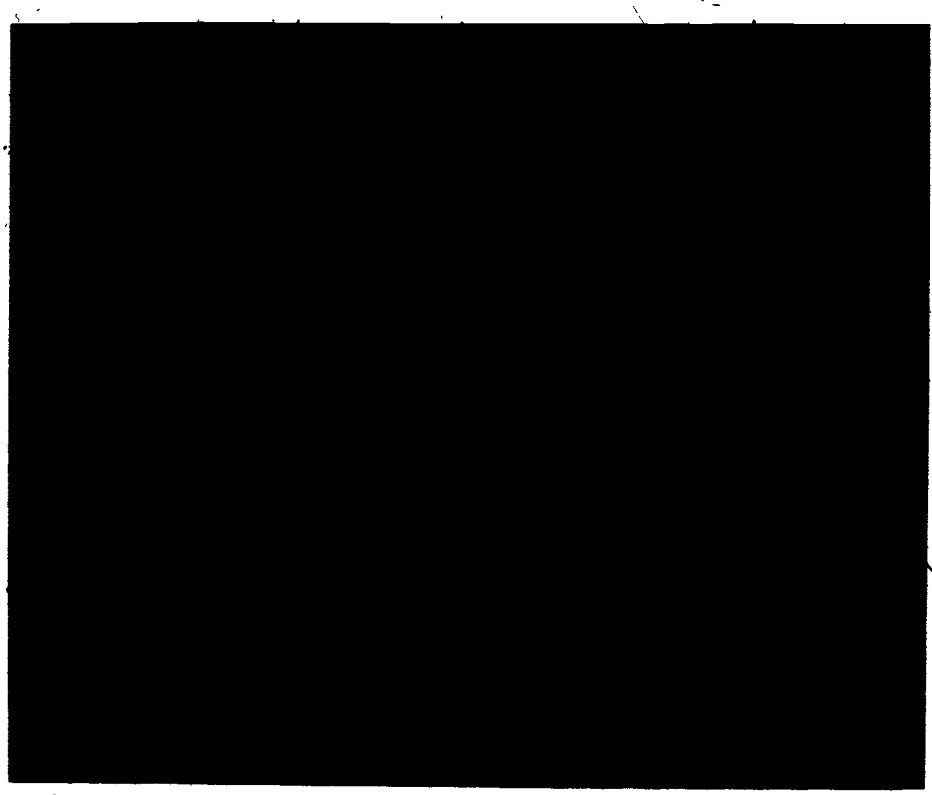
Ron Anderson worked in various training organizations in the Illinois Bell Telephone Company and is presently an Instructional Technologist for the Bell System Center for Technical Education, an American Telephone and Telegraph Company school located in Lisle, Ill. He has published articles on media and learning in the NSPI research journal Improving Human Performance and is the author of the book Selecting and Developing Media for Instruction co-published by Van Nostrand Reinhold and ASTD. He serves on the Board of Directors for the ASTD Media Division and is a member of the Curriculum Council for the NAVA - Indiana University semi-annual seminars on effective communications.

1979
College Industry Education Conference
Mobile, Alabama
January 23—26, 1979

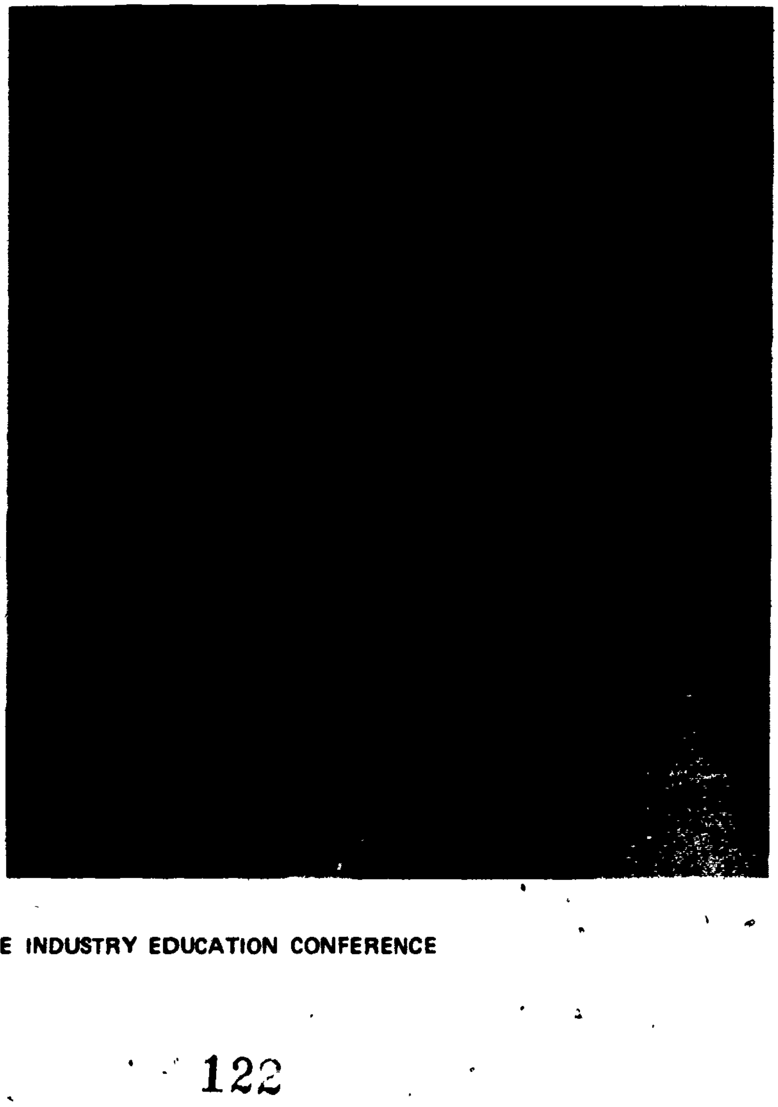


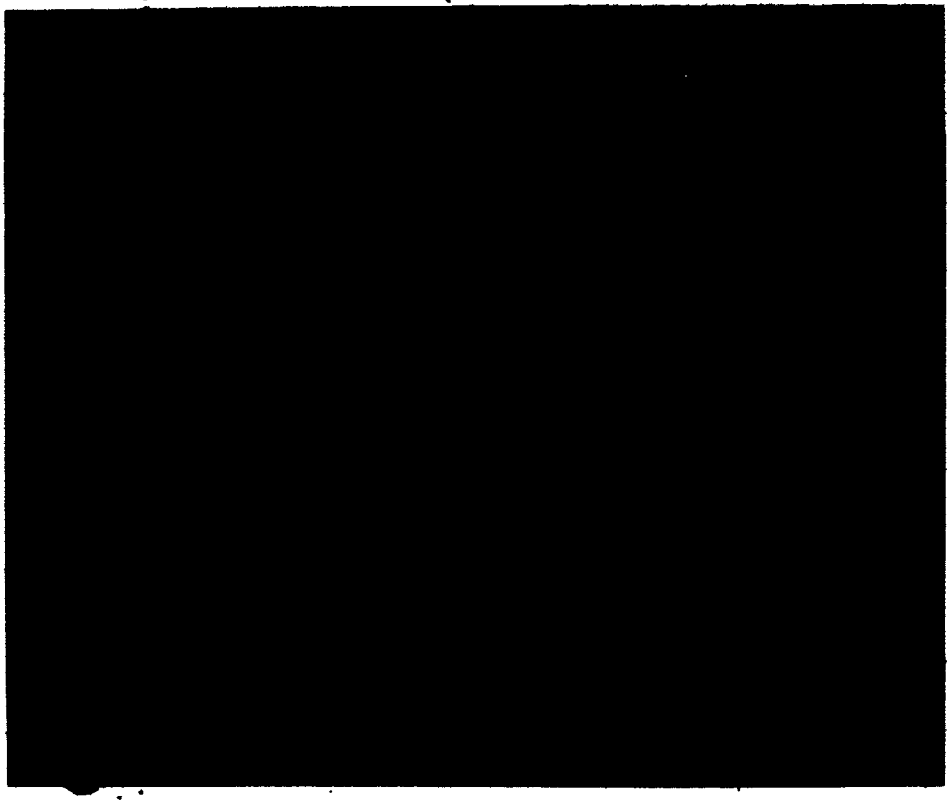


The Bellingrath Home in Bellingrath Gardens, Theodore, Alabama, near Mobile, was built in 1935 of handmade brick and wrought iron lacework over a century old. The exterior is a mingling of French, English, and Mediterranean influences while the interior represents a blending English Renaissance and Colonial American decor. It houses the Bessis Morse Bellingrath Collection of antique furniture, fine china, priceless silver and rare porcelains. The Home is open to the public and visits are made in small groups in the company of a hostess and/or one of the former Bellingrath servants. This picture was taken when the azaleas were in full bloom which is usually during the latter part of February to the middle of March.

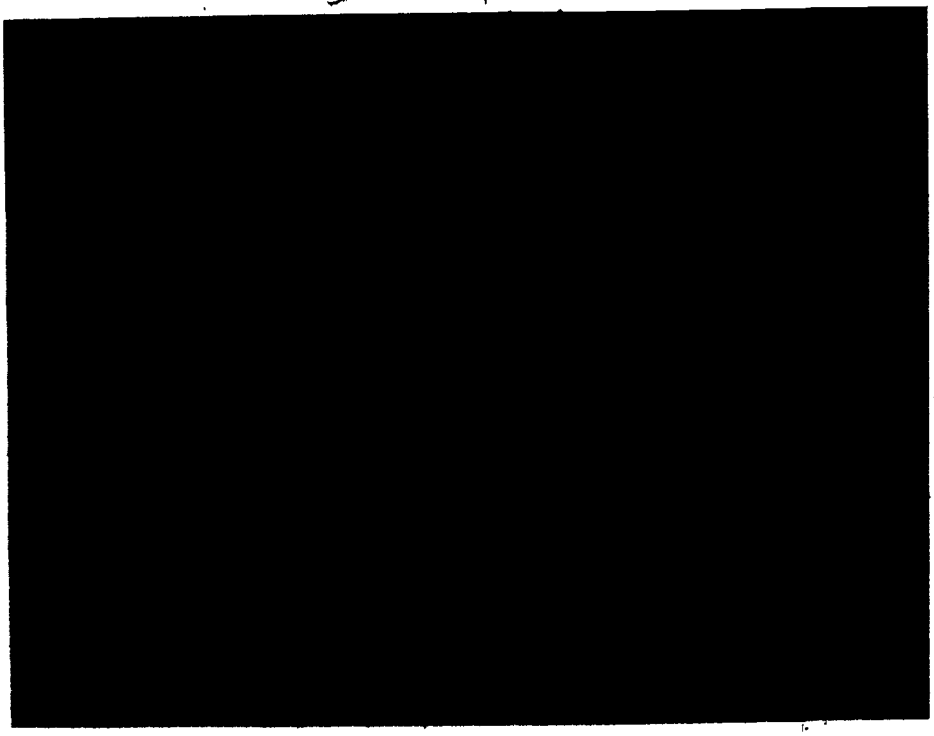


GROWING PORT CITY....... an aerial view of Mobile, Alabama, is dominated in the foreground by its $10 million Municipal Auditorium-Theater complex. The 34-story First National Bank Building towers over business district in upper center and the Alabama State Docks fringe the west bank of the Movile River.





Senior Bowl Game annually fills spacious Ladd Stadium with spectators and attracts national attention through network televised half-time show. Held each January, the game pits top college senior football players of the South against the best the North has to offer. The Senior Bowl Game is the first professional appearance for the players.



PURE WHITE SANDS AND
SOFT SURF..........
of Dauphin Island, south of Mobile, is a favorite playground of many vacationists who travel South during the entire year.

WOULD YOU LIKE TO HOST THE FIE CONFERENCE IN YOUR REGION?

If you would like to host the Frontiers In Education Conference in you region at some future date the executive boards of the Education Group of the IEEE and the ERM Division of ASEE would appreciate your proposal. Professor Lois Greenfield, College of Engineering, University of Wisconsin at Madison is the site selection committee chairman for the next several years. She would appreciate hearing from you and indicating your interest for being the host for future FIE meetings. As ybu know this conference is becoming very attractive to many educators in the field of education and it would be a good activity for your institution.

RWI

San Diego

SESSION 4.1

INDUSTRIAL TRAINING PROGRAMS

Kenneth C. Briegel
Research Supervisor
Honeywell, Incorporated
Minneapolis, Minnesota

Co-Sponsoring Groups: Engineering Technology Division, Relating With Industry, and International Division

Industry continues to face the training problem for the Engineering Team namely, the Engineering Technician, Engineering Technologist, and the Engineer.

1. Training programs for the new graduate starting on the job.
2. Training programs for the team member already on the job.
3. Training programs for the team members ten or more years since graduation.

Industry attempts to keep the Engineering Team motivated to keep up with the advancing technologies.

Industry has planned programs for the Engineering Team members who have reached a point in time where the need for updating arises.

Industrial training programs are important and should be considered a vital part of the Engineering Team of today and tomorrow.

Dr. Francisco Trevino from the Monterey Institute of Technology, Monterey, Mexico, will address this session on "The Continuing Education for Professionals in Engineering in Mexico."

Dr. William Snow, the Director of Personnel Research from Rockwell International, will present "How Do We Assess the Effectiveness of Engineering Training Programs."

John W. Anderson, Corporate Vice President, Honeywell Inc., Minneapolis, Minnesota, will present "Do Engineering Supervisors Suffer Adolescence.

It is hoped that this session will meet the needs looked for by Industry in training the Engineering Team.

Kenneth C. Briegel, Past Chairman of the Board of the American Society of Certified Engineering Technicians. Served as National President for two years. Graduate of University of Minnesota. Honeywell Research Supervisor, Technicians Laboratory. One of the first four Senior Engineering Technicians to serve on the Institute for the Certification of Engineering Technicians Board of Trustees. He holds ICET Certificate #2. Served two terms as Chairman of the ICET Board. U.S. Navy technical advisor in WW II and Korean War. Presently Chairman of Region VI of the Engineering Technology Committee for ECPD, Chairman of the Engineering Technology Division, American Society for Engineering Education (ASEE). A member of the Board of Trustees at Northwestern Electronics Institute and is also active in civic and church activities.

DO ENGINEERING SUPERVISORS SUFFER OBSOLESCENCE?

John W. Andersen
Corporate Vice President
Honeywell, Incorporated
Minneapolis, Minnesota

Introduction

Mark Twain is generally credited with the observation that everybody talks about the weather but nobody does anything about it. It is my opinion that his remark can be rather easily paraphrased to apply to technical obsolescence of the engineering workforce. Certainly everybody related with engineering has talked about it at one time or another, but I submit that relatively little has been done in an effective manner to reverse the broad trend towards obsolescence. In the case of engineering supervisors I fear that not even much talking is being done about their obsolescence and less is being done to combat it.

I think one can personalize this situation by comparing the relationship of the supervisor to his employer with that of either spouse to his or her mate. When a husband and wife team have lived together for several years an obsolescence is very likely to set in. The characteristics of that obsolescence are very subtle. Each party is likely to think that improvements have been made, adjustments have been accomplished (at least by one partner) and yet the effectiveness of the relationship tends to be running down hill. To counter this type of personal obsolescence the first and major step is to recognize that a deteriorating situation exists. Then reasons for the obsolescence have to be analyzed, a willingness to change has to be demonstrated by both parties, and actions are necessary in order to eliminate the staleness that has developed. No doubt this analog could be continued rather extensively into the factors of marriage which include emotional, financial, and physical elements. I think I've carried it far enough to show that a meaningful parallelism exists and to remind myself to get back to the specific subject covered by the title of my talk.

Definition of Obsolescence

As one refers to technical obsolescence of an engineer, one generally thinks of the inability of the individual to utilize some of the current techniques or advanced technical theories to attack a problem or to develop a concept. The definition of obsolescence of a supervisor however is significantly broader. I describe it as that characteristic which makes the total performance of a supervisor less effective than one who is a younger competitor. It includes those elements of performance which can be lost through disuse or improper use. It also includes those elements of performance which have not been acquired. It can be said, I believe, that obsolescence is not only caused by a person who is falling behind in the parade in which he is marching but because he is not marching in the proper parade at all. An engineering supervisor must recognize that his is a multifaceted job and he must take action to expand his abilities in all segments. A supervisor must take advantage of the opportunity of experiencing growth in all the responsibilities of his job.

Job Description of a First Line Supervisor

It is recognized that there is a large school of thought which states that the description of one's job, the responsibilities for which a person is to be accountable, should not include personal characteristics. The theory goes that any person's superior should be interested only in the results accomplished and the environment that's created. He should not be concerned about those personal characteristics which might be important to bring these things into being. To me, however, the description of the position of a first line supervisor is made up of near-equal amounts of quantifiable characteristics and subjective elements which are heavily judgmental.

The position of a first line supervisor has at least the following seven elements of responsibility:

1. He must be a technical leader of his group (this does not mean that he has to be <u>the</u> technical expert of his group).

2. He must be skilled in planning, scheduling, and a control of events against time.

3. He must be able to make measurements of the risks involved in the assignment that he has been given and to devise methods whereby those risks can be controlled or contingency plans provided.

4. He must develop skills in human relationships with his subordinates, with his peers, and with his bosses.

5. He has to be responsible for the financial aspects of his assignment (create budgets, develop subgoals for his subordinates, and review progress against these goals and budgets).

6. He must devise programs which will develop his people to the maximum of their capabilities.

7. He must recognize that he is a part of Management and as such is the primary representative of management's policies and points of view to the non-supervisory personnel.

Venturing into that dangerous realm of personal characteristics of a supervisor, it is my conviction that a fully qualified first-line supervisor has to have or to develop characteristics in the following categories:

1. He should be a leader without being a dictator.

2. He should earn the respect of his subordinates (be respected for his talent, for his integrity, and for his knowledge).

3. He must demonstrate confidence in himself, in the programs for which he is responsible, and in the company for whom he works.

4. He should be a self-starter.

5. He should be innovative in the approaches that he takes to people, to planning, and to technical problems.

6. He must develop skills of interpersonal relationships (downward to his subordinates, sideways to his peers, and upwards to his superiors).

7. He must be a team builder (an extension of interpersonal relationships), and

8. He should demonstrate enthusiasm and a "can do" attitude.

Training

From what has been said in the last two sections, it probably appears as though I am discussing management by objectives rather than obsolescence. I believe you agree that a good understanding of the responsibilities and characteristics of the job is necessary whether one is considering management by objectives or a program of fighting obsolescence. If both the individual and his supervisor recognize the important elements of the job and the important characteristics of the person in the job, a major step has been taken towards combating or avoiding obsolescence.

Fighting obsolescence, as with career development, is an individual, personalized matter. Each of us comes to a job-situation with some basic training, a set of experiences and his/her individual personal traits. Where one goes from there is primarily up to the individual. I don't deny that luck and timing are seemingly important. Health also plays an important role. But, even including these semi-uncontrollable factors, your future is primarily in your own hands --- with its roots in your personal ambitions and dedication.

Just like the married couple, however, an individual and his boss must be conscious of changes going on in them and around them. Experiences on the job, therefore, are extremely important. Assignments are obviously an important part of gaining of experience. Too many employers and too many employees allow a person to remain in the same assignments because it is comfortable to the individual and efficient for the employer. Obsolescence is frequently a sure-fired output of such a procedure. Someone said once that the only difference between a rut and a grave is the depth of the hole. It is mandatory that the individual realize what is taking place. It is incumbent on him to do something to cause a change in his course.

It would be possible for us to take any of the elements of the responsibilities of the first line supervisor and discuss the importance of training towards the avoidance of obsolescence of the individual. I'd like to touch briefly on just one: The technical leadership of the first line supervisor.

It is my observation that training programs which are designed to fight obsolescence are generally directed at the non-supervisory individuals in a given team of employees. It becomes apparent relatively quickly when a given team lacks up-to-date capabilities or the specialties of new technologies that their output become pedestrian in character and non-competitive in the marketplace. The remedy for this situation generally is to hire some specialists or to have a crash program to train existing employees in new skills. Too often, I believe, the real cause of the difficulty is overlooked -- the technical competence of the first line supervisor. Although these methods of offsetting obsolescence in a non-supervisory workforce may be reasonably effective, they have self-defeating elements as related to most first line supervisors. First of all, it appears to the supervisor that the technical capabilities of his subordinates are more important to his employer than those that he holds. Secondly and more insidious is the fact that he now is even less confident of his capabilities of his true leadership of his own group. The apparentness of his obsolescence become intensified in his own mind and in the eyes of his subordinates. Respect for him, I believe, is reduced. His ability to measure risks and to provide plans to offset the problems associated with risks have deteriorated further.

Fortunate for industry many of the individuals who are chosen as first line supervisors have strong personal characteristics. They are self-starters, they do have pride in their position of leadership, they fight the characteristics which I've described. Some join their subordinates in the improvement programs; some do studying on their own.

I believe, however, there are better ways of accomplishing continuing education for the supervisory workforce. Since each is expected to have all the personal characteristics listed above and to be capable of handling the responsibilities also listed above, he generally must fall in the category of possessing the powers to walk on water and to leap over tall buildings without a running start. The point I'm trying to make is that all types of training of supervisors have to be made as short-cut as possible. There are so many new skills which he should acquire that abridged or summary courses would appear to be logical and sufficient to extend his knowledge in the new technologies. It is extremely important, however, that he is knowledgeable enough to maintain his self-confidence, to measure technical risks with which he is involved, and to encourage innovative concepts with regards to problems that face his group.

All available methods of delivering this special technical training should be explored and considered for use. Local universities do conduct live and televised courses which are refreshers or extensions into new technologies. I personally would have found video-taped courses very useful during stages of my career. I believe the number and the quality of these tapes are being increased. Providing a tutor as a supplement to a videotape has proven to be a very effective method of delivering technical training. It is important that the methods used be flexible so that the supervisor can vary the pace but structured enough to be a discipline.

The output of the continuing education on this one part of a supervisor's job, namely, his ability to provide technical leadership has been demonstrated to have a significant and rapid impact on the individual, on his subordinates, his associates, and his employer's business. If he and his employer develop training programs to ensure his being generally up-to-date technically, he will continue to be a leader. If not, he will follow someone else's lead or do nothing.

Training in this one segment of my list of responsibilities is not the panacea of all potential weaknesses of first line supervisors. Other elements in the list have to be attacked also. My primary objective has been to point out that we in industry seem to be more concerned with the non-technical elements of a first line supervisor's job in an engineering department than we are with the technical content of his position. I do not believe that the emphasis on other elements of his responsibilities should be changed. I am merely suggesting that this one has been overlooked for too long. It not only deserves, but must receive, attention for an organization to maintain its viability and competitive edge.

Supervisors of engineers and/or technologists can and do become obsolete in a number of fashions. It is extremely important to recognize that his obsolescence is generally multiplied throughout the group of people who report to him. If the obsolescence of the first line supervisor is not properly stemmed, the total output of his group can be seriously reduced both in quality and in quantity. It is a challenge that he and his superiors must recognize and attack.

John W. Anderson's current position is Corporate Vice President at Honeywell Inc. One of his assignments is the promotion of continuing education for professional employees.

Since joining Honeywell in 1941 as an engineer in a Special Projects Group, he has served in a multiplicity of positions in engineering departments and general management. From 1970 through 1976 he was Vice President and Group Executive of Honeywell's Aerospace and Defense Group.

Anderson received BS degrees in EE, ME and Mathematics from the University of Michigan in 1939. He did graduate work at MIT for two years while working as a Research Assistant.

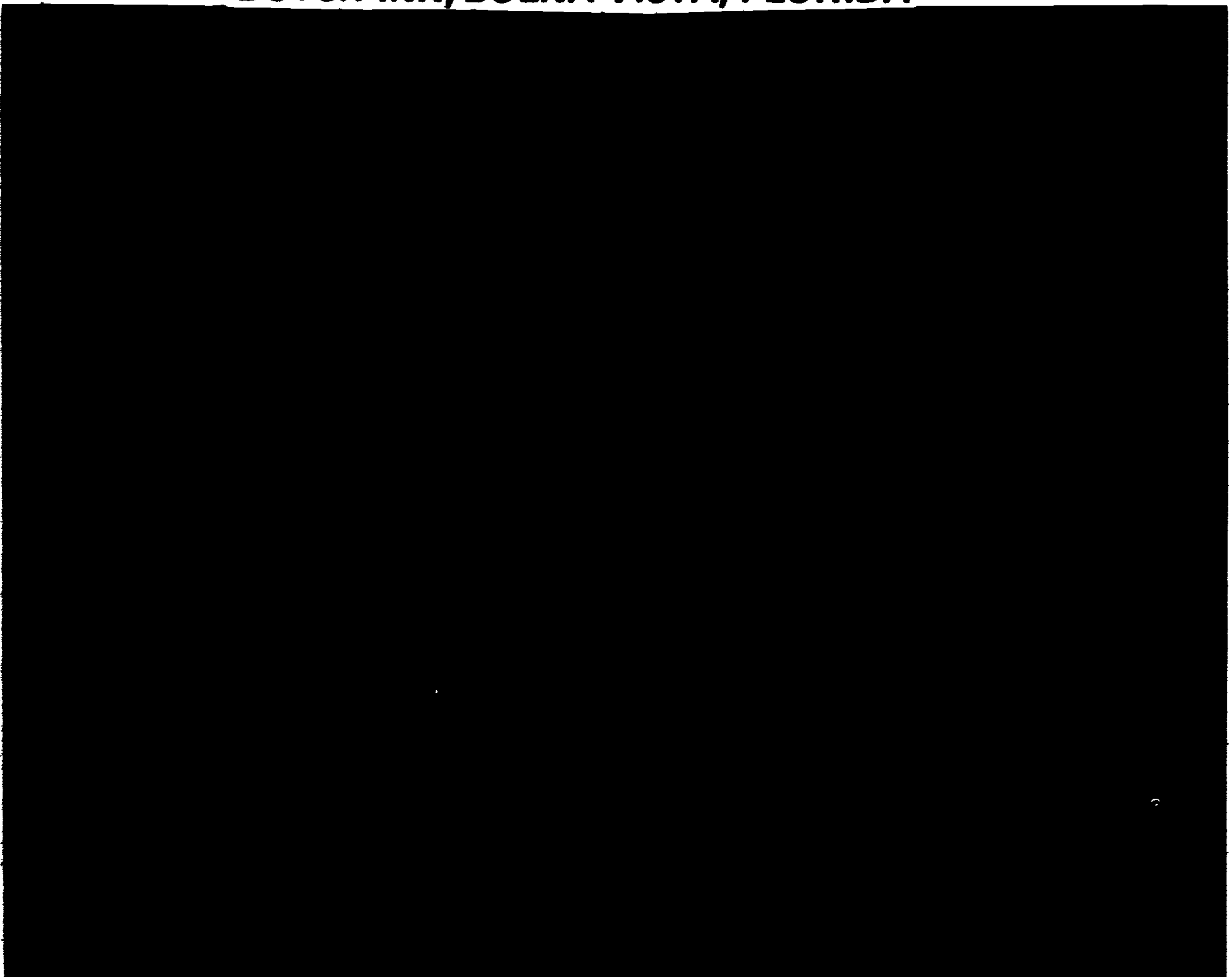
RWI

CONTINUED EDUCATION FOR PROFESSIONALS IN ENGINEERING IN MEXICO

Dr. Francisco A. Trevino
Monterrey Institute of Technology
Monterrey, Mexico

PAPER NOT
AVAILABLE
AT TIME
OF PRINTING.

SITE OF 1978
FRONTIERS IN EDUCATION CONFERENCE
OCTOBER 22,-25, 1978
DUTCH INN, BUENA VISTA, FLORIDA



ADJACENT TO DISNEY WORLD

SESSION 4.2

THE COLLEGE AND UNIVERSITY ROLE IN CULTIVATING NEW COOPERATIVE EDUCATION EMPLOYERS

William T. (Tom) Padgett
Director of Cooperative Education Program
Auburn University
Auburn, Alabama

The title of this session could imply that there is a great need for more co-op jobs in the field of engineering. Is there a need to develop more engineering cooperative education employers? Can the colleges and universities supply the current demand for engineering co-op students? Engineering co-op positions are going unfilled across the country, so perhaps there is another meaning to the title!

There has always been and always will be a need for more "quality" co-op employers. What is a quality Co-op Employer and how do they come into being? It will be the purpose of this session to explore the answer to that question.

When a facet of cooperative education is discussed, it is always best to have input from an experienced employer as well as from an experienced college/university coordinator. This session will bring together the thoughts and ideas of the Director of Cooperative Education at North Carolina State University and the Coordinator of Cooperative Education at Georgia Power Co. Together they have had years of experience in the field of Cooperative Education and their presentations on "The College and University Role in Cultivating New Cooperative Education Employers" should be most interesting and informative.

After the formal presentations, time will be available for the conference participants to question the speakers and to add their thoughts and ideas to those presented by the speakers.

Mr. William T. (Tom) Padgett has been Associate Director of Cooperative Education at Auburn University since September, 1973. Prior to that he served as Research Associate in Electrical Engineering and Assistant Director of Cooperative Education at Auburn University. From 1963 to 1967 he was employed as an electrical design engineer with General Electric Company in Syracuse, New York and in Portsmouth, Virginia. He received the BEE in 1963 and the MS in 1970 both from Auburn University. Mr. Padgett is a member of the Cooperative Education Division of ASEE, the Cooperative Education Association, and the Alabama Cooperative Education Association.

INTERFACING INDUSTRIAL AND EDUCATIONAL PHILOSOPHIES OF COOPERATIVE EDUCATION FROM THE INDUSTRIAL POINT OF VIEW

Richard A. Johnson
Coordinator of Special Projects
Georgia Power Company
Atlanta, Georgia

In order for a University or Employer to develop a good Cooperative Education Program, I felt that it would be best to review both of their philosophies in order to interface the two. The educational institution's cooperative philosophy is, of course, stated from an industrial point of view.

Industrial Philosophy

Why should industry want to participate in a Cooperative Education program? It identifies highly-qualified students before these students have graduated. This gives industry an opportunity to train and develop these individuals for permanent positions with that industry after they graduate from college. Hopefully, after these students have spent some time with an industry as a co-op student, they will want to remain as a permanent employee. If this holds true, recruiting and training costs will certainly be lower than if the company did not have a co-op program. For industry, cooperative students are a continuous source of qualified and proven candidates to fill permanent, professional positions within the corporate structure.

What should be industry's obligation to the students? One of the most important should be that the work assignment must be related to the students' academic pursuits. This gives the students an opportunity to apply what they are learning in school to a real work situation. It also gives them an opportunity to find out whether or not they would have the aptitude or desire for this type of a future permanent vocation. The students' job experience should be structured to increase the difficulty and/or responsibility upon each recurring quarter/semester. This tends to challenge the students as well as maintain their interest. Another industry obligation should be to make certain that the co-ops' supervisors schedule quarterly or semester evaluations before the students complete their work assignments and return to school. At the same time the students should be allowed to complete work reports. This gives them an opportunity to inform the industrial and college coordinators of the content of their experience. It also grants them occasion to submit ideas for improvement in the assignment. Ideally, the evaluation and work report should be given together in conference with the students and supervisors. This creates a communication flow between the co-ops' supervisors and the co-ops, which hopefully will be beneficial to both.

Students appear to appreciate a strong company communications program. Ideally, communications should be established between the students and their supervisors. Additional programs could be offered to the students through company-sponsored information programs, company magazines, dinner meetings for the students, and in-house student publications. Communications give the students a voice and also a better insight into the operation and function of the organization.

Last, but not least, applicable salaries and benefits should be offered to the students for the work they have completed. Raises should be given to the students upon their return each subsequent quarter/semester. These should be viewed as an incentive to retain the students as well as reward them for a job well done.

What consideration should industry extend to the educational institution? Encouragement should be given to school officials to visit students on the job in order to see that the students are applying academics to the world of work. Briefings by company officials, on their organization, co-op philosophy, etc., for the school's faculty and staff should be supported as a means of strengthening the relationship between the two associations. Company information may be made available to the school by placing them on the company's mailing list for bulletins, newspapers, and other publications. Also, if a policy has been written governing the company's Cooperative Education program, it should be furnished in order that they may review it and find it consistent with their policy. A combination and fulfillment of the above promotes a better understanding for the company by the institution.

One very important obligation to the school is for the industry to appoint a contact person or if possible a full-time coordinator for their Cooperative Program. For smoothness of operation as well as consistent application of educational and industrial policy, an appointment to this area is essential. Schools, as well as students, appreciate having someone upon whom they can depend to answer. Now that we have covered some industrial philosophy let's consider the Educational Philosophy.

Educational Philosophy From the Industrial Point of View

What is the need for the institution to take part in a Cooperative Education Program. Initially, it would seem the institution would keep better informed of industry's needs by the input received from the student through their work experience. This, combined with the industry contacts developed through the program, would increase their effectiveness in meeting industry's requirements for the right type of graduate. By meeting this need, companies could quickly become interested in the institution and develop other programs, i.e. funding, furnishing employees as visiting professors, and bringing the institutions' faculty into their work environment for project assignments and training program, thus making the co-op program profitable and essential to the well-being of a dynamic academic institution.

Over a period of time students that are employed by a particular company would relate their experiences to their peers. They would describe the program and this could possibly create additional interest in the institution. Through the student working with members of industry, these members may have sons or daughters of college age and direct them to the Cooperative Education student's college. Thus, a recruiting tool for the institution is created.

What about the institution's obligation to industry? As stated earlier, by having a co-op program the institution would keep better informed of industry's needs. To carry it a step further, it would seem that the institution would want to review its curriculum design to discern if it has industrial application. It has been brought to my attention that many schools have varied their curriculum design to meet industry's needs. This, of course, is well received by industry. Corporation recruiters would then seek out that particular institutions' graduates for permanent employment. The institution would then have a continuous flow of students because the job market would be available to latter.

Encouraging open communication by the institution for company officials to tour facilities, meet faculty, staff, etc. should be done. Again this strengthens the relationship between the two groups. By this method, industry better understands the operation of the institution's program and some of the problems they there encountered.

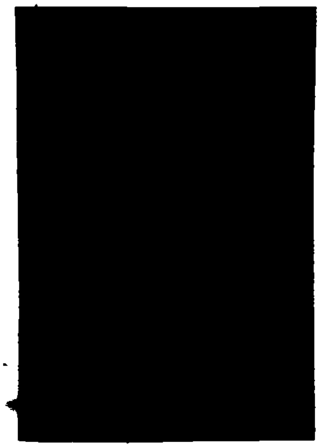
Earlier, I suggested that industry have a full-time coordinator. For the same reasons, this is also a valid recommendation for the institution.

The institution should set requirements for employers to meet before allowing them to co-op any of their students. They should possibly require a visit to the company by co-op officials. Co-op assignments should be discussed in detail in order to determine whether that particular industry meets the standards set by the school. A joint decision should then be made by the institution and industry to determine if their cooperative education philosophies match, and an agreement can be reached to institute a program. The educational institution certainly has an obligation to the students. They should make certain that the work assignment established by industry is related to the student's academic study. This is necessary in order for the student to receive the most effective benefit, i.e. academics applied to a real work situation.

Students should be observed on a regular basis at their work locations. Some companys' sponsor the institutions co-op officials, and accompany them while touring the industrial work locations. This is essential to let the students know that both industry and school officials are interested in their well-being as well as their progress. After completing their work assignment and returning to school, students should be counseled, with regard to their experiences, by the school's co-op representatives. For the students' sake, it is imperative that the school, which has an established program, convey the cooperative education philosophy to the company beginning a new program. Training, academic application to the work assignment, regular evaluations, and communication with the students are part of the philosophy.

Upon review, interfacing the two philosophies is not too difficult if a sincere effort is made by both parties. In order to develop a good program it should be student-centered.

Foremost concern by industry and educators should be for the development of the students through some of the previously suggested programs. Joint communications, by way of company/school publications, company/school visits would enhance this developmental endeavor. With industry and education joining forces in cultivating a program with the students' interest at heart, the improvement of all three is assured.



Mr. Richard A. Johnson is currently Coordinator of Special Projects for the Georgia Power Company headquartered in Atlanta, Georgia. He is responsible for their Cooperative Education Program, Engineer-In-Training, Educational Assistance Program, and Exit Interview Program as well as Career Counseling and policy writing. He received his AA degree from Manatee Junior College in Bradenton, Florida and his BBA degree from Georgia State University in Atlanta. He is currently pursuing a Juris Doctorate Degree. Mr. Johnson is a member of the Cooperative Division of the ASEE, the Cooperative Education Association, and the Georgia College Placement Association.

THE COLLEGE AND UNIVERSITY ROLE IN CULTIVATING NEW COOPERATIVE EDUCATION EMPLOYERS

Dr. John V. Hemme
Director of Cooperative Education
North Carolina State University
Raleigh, North Carolina

Abstract

This paper discusses the various steps involved in developing a cooperative education program with new employers. It includes a brief background on North Carolina State University and its cooperative engineering education program from which the various procedures discussed have evolved. The procedures or steps covered include the program employment needs, identification of potential employers, the initial contact and follow-up, application information, the selection process and the work period evaluation.

Background

North Carolina State University is the Land-Grant university of the state of North Carolina located in Raleigh, the state capital. The University consists of eight schools (Engineering, Forest Resources, Textiles, Physical and Mathematical Sciences, Humanities and Social Studies, Agriculture and Life Sciences, Education, and Design) the first five of which have cooperative education programs.

The co-op program in the School of Engineering was started in 1968-69 with the first placement of students in the summer of 1969. It has grown to the current enrollment of 275 students with over 85 employers. Approximately two-thirds of the students are placed in North Carolina and one-third out of state.

With this brief background of the school and its cooperative engineering education program, let us look at the task of cultivating new cooperative education employers. For the purpose of this discussion, the term "cultivate" is interpreted as including the finding of new employers and the following development of the program with the new employers for the mutual benefit of the employers, the students, and the University.

Program Employment Needs

Before seeking employment opportunities it is, of course, necessary to know the types of employment opportunities needed which in turn are dependent upon the curricula included in the co-op program. At N.C. State, the engineering curricula include electrical, mechanical, civil, materials, nuclear, industrial, chemical, aerospace and agricultural engineering. Also included are furniture manufacturing and management and engineering operations. With this large number of engineering curricula, it is obvious that a wide variety of employment opportunities are needed. However, the bulk of the student enrollment is in civil, electrical, mechanical, chemical and industrial engineering.

In addition to satisfying the curricula needs, geographic considerations are often of importance to the students. These employment opportunities must be developed predominantly throughout the local state. In addition to these, many opportunities should be provided in other states in the region and even in some distant states.

Identification of Potential Employers

How are the potential employment opportunities identified? First, one should call on personal knowledge of the area and region. Second, there are a variety of sources available such as the following:

1. The yellow pages of the local telephone directory.
2. Telephone directories in other cities - usually available in libraries.
3. Directories of manufacturers published by most states.
4. The Thomas Register.
5. Advertisements in professional society publications.
6. Co-op offices in the areas of interest.
7. The student being placed.
8. The school placement office.

The above sources are especially helpful in the starting of a co-op program but are used less frequently as an employer file is built up. Distant geographic placements usually will require using these sources, especially other co-op offices and the student requesting placement in that area.

The Initial Contact

Best results at N.C. State University have been obtained by making the initial contact by telephone. Preferably the general manager or a top level administrator should be the first contact. If the top management is favorably impressed, not only is time saved but also the chances for establishing a successful program are enhanced. If the organization does not already have an established program or the management is not familiar with the plan, then the job of selling the idea should begin there with top management where eventually it must be approved. If the employer has a program or has been considering it, then further discussion will be referred to the co-op coordinator or the personnel department for implementation or future planning. There are occasions of course when it is advisable to initiate talks with the engineering manager, the training director, or the personnel manager especially if one of these is an acquaintance, and it seems more appropriate to start there. If it is known that the organization has a co-op program, then the coordinator should be contacted directly. In any event the initial contact should be as brief and concise as possible to convey the concept and potential advantages with the follow-up discussions giving details.

Generally the initial contact when made by letter is not as effective as the telephone contact. Frequently, if the letter is sent to a top manager of a company that does not have a co-op program, it will be immediately referred to someone else for handling and may be forgotten or at best take much longer than the telephone contact in which discussion equivalent to several letters may take place in a few minutes. Also the letter contact does not have the personal touch nor the capability of answering questions that immediately arise in the employer's mind.

The third party contact should be used only for special situations. One such example would be that of the student who lives in a distant state and desires to work in his or her hometown. In this case, the student may be asked to contact and visit prospective employers in his or her hometown when at home for holidays such as Christmas. When doing this, the student should be given brochures explaining the program. These brochures should be left with each employer contacted with instructions that the co-op office will contact the interested employers with full details when the student returns. Thus the preliminary interview will have taken place with those companies or employers interested. This method is especially effective when contacting companies with co-op programs.

An alternative to this method for a distant placement is to have the student's parents mail eight or ten addresses and telephone numbers of prospective employers in their area to the student at school who in turn gives them to the co-op office for the initial telephone contact. The co-op office then follows up as usual.

Still another use of a third party in assisting in a distant placement is through a school co-op coordinator in or near the student's hometown. This usually will not meet with reluctance especially when the job market is good and that co-op office being called upon has more job opportunities than students. The coordinator at the distant school may be asked to assist in actually placing the student, if that seems appropriate, or simply be asked to give the names and telephone numbers of potential employment opportunities.

Follow-Up

After the initial contact, the follow-up is very important for the success of establishing a co-op program with an employer who does not have a co-op plan and is not familiar with it. If the employer expresses an interest during the initial contact, then a brochure and any other relevant information should be mailed giving clear details of the operation of the program. The material should not be voluminous but sufficient to give a basic understanding of the objectives sought and the responsibilities of the school, the student and the employer. In the cover letter, offer to answer any questions that may arise and if feasible, offer to visit the employer to discuss details of the program with him and members of the staff if he desires. In addition to discussing the various aspects of the co-op program, it is also desirable to give the employer a copy of the school catalog containing the various curricula offered along with course descriptions. Also such a meeting affords the school coordinator the opportunity to learn first hand the needs and interests of the employer and the nature of the type jobs that the co-op students will have there.

The school coordinator should learn the employers needs and interests, the nature of the business as determined by a plant tour if possible, and job descriptions either verbal or written as in brochures used by employers for recruiting. This is most helpful when the coordinator returns to the campus so that he may pass it on to the students. Such information is usually the only basis for the student to know whether he or she may be interested in that particular employer. Company brochures and written job descriptions should be made accessible to prospective co-op students in an orderly file. As the program grows, co-op student reports may also be added to the file. Some employers send to the school copies of the co-op reports made by the student for the employer, and the reports are also good to include in the file for prospective students. These latter reports frequently are much more descriptive of the job than the written reports turned in to the co-op office by the student upon returning from a work period.

For an employer considering the starting of a co-op plan, it is helpful to provide a list of other employers who are participating. Frequently it is possible for the employers to exchange ideas and thus enhance the beginning of a new employment opportunity. Along this same line of thought, new co-op employers should be encouraged to join the local and national cooperative education organizations such as the state association, if there is one in the state, and the CED and the CEA at the national level.

A cordial invitation should be extended to the employer to visit the campus and meet the dean or deans of the schools of interest and any department heads of the fields of interest. The closer the school-industry relationship, the greater the chance to develop and maintain a good and lasting program.

Applications

The applications for co-op positions should provide the employer with such information about the students that will enable a decision to be made regarding the suitability of the candidates based upon the backgrounds and accomplishments of the applicants. The application should include a resume or employer application form, a schedule showing the periods of school with courses and periods of work, a co-op calendar, and a copy of the courses completed with the grades. Also with these items a cover letter should be included stating the student's full name, the curriculum and classification, the starting date and the number of work periods scheduled with the total months of work experience that these periods give. These are all essential items that the employers need for their planning. The cover letter also serves as a letter of recommendation which many organizations require.

Selection Process

Usually the selection process begins with more than one student applying for each job opportunity and each student applying for a maximum of three opportunities at the same time. This process permits the employers to consider the students they believe to be the best qualified for their needs, and it also permits the students to consider the employment opportunities in which they are most interested. Interviews by the employers either at the plant or on campus are encouraged for the mutual benefit of both parties. After the interviews are completed, the employers make offers to the students of their choice and the students must either accept or reject within a reasonable time.

Thus, if a student has submitted three applications and receives three offers, he must make a choice of one and reject the other two. In this case, the student accepting gets his first choice and that employer gets his first choice. The other two employers would either get no student or a second choice student or perhaps a first choice student from subsequent applications. Such a process is somewhat cumbersome and entails more work on the part of the coordinators than if the student submits only one application at the time. However, it is felt that better matches are made by the former process since both parties have the chance for more than one consideration. Also a fringe benefit is that the students gain experience in having interviews and learn first hand what several potential employers have to offer in the way of careers.

Work Periods

During the work periods, telephone contact with the employer coordinator is made to determine how the co-op students are performing. If the coordinator does not have close contact with the students, then it is advisable to talk directly with the student's supervisor and the student. If there are problems that are apparent, then a visit to the work site should be arranged to discuss the situation and attempt to resolve the problem. Very few problems in the engineering program at N.C. State University have arisen requiring such action. Of course visitations are desirable to maintain good relations and mutual understanding whether there may or may not be problems of concern. However, because of the expense and time involved, visitations are usually limited to those students on their first work period.

Evaluation

About two weeks prior to the end of each work period, evaluation forms are mailed to the employers for each student with the request that the immediate supervisors fill out the forms. Also it is requested that the supervisors go over the evaluations with the students prior to their return to campus. Thus if questions arise about the evaluation, the student may discuss them with the supervisor. The supervisors mail a copy of their evaluations to the co-op office at school.

When the students return to the campus from each work period, they are required to complete a written work report, turn it in to the co-op office and arrange to review it and the employer evaluation with the school coordinator. At this time the nature of the job may be determined and also the degree to which the student was satisfied with the work period. Elements of dissatisfaction are discussed with the employer coordinator usually by telephone. Frequently the problems with dissatisfaction may be resolved by placing the student in a different department with a new supervisor or simply giving the student more responsibility if this seems to be the best solution. If it turns out that the student does not fit into the type work the employer has to offer or if the student's interests are not what he or she originally thought, then a new employment opportunity is usually sought.

Summary

When all of the elements, which have been very briefly touched upon in this discussion, are carefully considered and followed with a lot of good "common sense" thrown in, the chances are very good that the employer will benefit, the student will benefit and the the school will graduate a student with a much better and broader education. In summarizing, let us again look at the elements discussed in a one-two-three fashion:

1. From the curricula included in the co-op program, identify potential employment opportunities.

2. Contact the potential employers, and through discussions, establish the objectives and the mutual benefits of a good co-op program.

3. Once the program is agreed upon, place students by attempting to match the employers needs with the students who are interested in those needs.

4. Maintain good communications so that the student's educational and career interests are enhanced as a result of meeting the employer's needs.

The fourth item above perhaps may be considered the heart of the cooperative education process. In other words, when the employer's needs are satisfactorily met in the student's chosen profession, the mutual benefits to the student, to the employer, and to the school are realized.

Dr. John V. Hamme is Associate Professor of Ceramic Engineering and director of the Cooperative Engineering Education Program at N.C. State University in Raleigh, N.C. He received the B.S. and PhD degrees in Geological Engineering and Ceramic Engineering respectively at N.C. State University and the M.S. degree in Metallurgical Engineering at the University of Utah in Salt Lake City, Utah. He served in the Navy in World War II in electronics, has had 13 years of industrial experience, and since 1958 has been with N.C. State University in research, teaching, and cooperative education. He is a member of several honor societies and professional societies.

DON'T FORGET

1978 FRONTIERS IN EDUCATION CONFERENCE
UNIVERSITY OF FLORIDA
BUENNA VISTA, DUTCH INN, FLORIDA
OCTOBER, 1978

1979 FRONTIERS IN EDUCATION CONFERENCE
MCMASTER UNIVERSITY
NIAGRA FALLS
OCTOBER, 1979

SESSION D

San Diego

COOPERATIVE EDUCATION DIVISION
INTERNATIONAL DIVISION
NEWCOMERS BREAKFAST

Robert L. Heyborne
Dean, School of Engineering
University of the Pacific
Stockton, California

At this meeting, the Cooperative Education Division will hold its annual business meeting and conduct the necessary business required to meet the needs of the membership and to keep the organization viable. Some of the activities that will be conducted are the dissemination of awards, summaries of the projects that are being conducted by the Division, and the general housekeeping business required of the Division. In addition, however, it is an opportunity for those people who are interested in cooperative education to discuss informally with their colleagues some of the problems, successes, and failures that they are having at their particular institutions and within their own companies.

Although this is primarily a business meeting of the Cooperative Education Division, it is open to all participants of the conference, and we earnestly invite you to participate if you so desire. We would be happy to have you attend and learn more about the Cooperative Education Division, its goals and objectives, and how it might help meet your needs whether you work in industry or at a university.

Robert L. Heyborne is Dean and Professor of Electrical Engineering at University of the Pacific in Stockton, CA. He holds the Ph.D. in Electrical Engineering from Stanford University and has more than thirteen years of teaching experience, plus approximately ten years of industrial experience.

Dr. Heyborne's American Society For Engineering Education activities include service as Chairman of the Pacific Southwest Section 1975-76, Chairman of the Rocky Mountain Section 1968-69, Chairman-Elect of the Cooperative Education Division 1976-77, Member of the Board of Directors of the Relations With Industry Division 1974-77, Member of the Board of Direotors of the Cooperative Education Division 1973-present. He is also a member of the Institute of Electrical and Electronic Engineers (IEEE), American Geophysical Union (AGU), International Scientific Radio Union (URSI), Sigma Xi, Sigma Tau, and Phi Kappa Phi. He has received numerous awards for excellence in engineering teaching, and in 1972 was named the "Engineer of the Year" by the Joint Council of the Professional Engineering Societies of the San Joaquin Vallye.

SOLICITATION FOR PAPERS
FOR
IEEE TRANSACTIONS ON EDUCATION

The scope of Transactions is:

Educational methods, educational technology, educational materials, and educational development programs, as well as, the history of technology, the impact of evolving research, and the active exchange of ideas on issues pertinent to electrical engineering education.

See the inside back cover of any issue for manuscript format requirements.

Send manuscripts to:

Demetrius T. Paris, Editor
or
Thomas K. Gaylord, Associate Editor
School of Electrical Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

SESSION E

CONTINUING ENGINEERING STUDIES DIVISION SPECIAL INTEREST GROUP CAREER MANAGEMENT

Donald B. Miller
Manager of Human Resources
IBM General Products Division
San Jose, California

In our era of pervasive and rapid change, it has become increasingly evident that managing one's several careers is a life long task. Because of an explosion of opportunities and a reduction in the need to work, just to support life, it is now possible to increase our psychological income from work. Career Management includes career and life planning activities as well as the management of experiences and the design of meaningful jobs. Career management is thus an important and growing field.

In engineering the need for understanding how to plan, organize and manage one's career is even greater than for other professionals. This is true both because of the pace of technological change and the potential for individual career shifts. Career changes in engineering are closely tied to continuing education and life long learning. Education is often the vehicle for change. Understanding career management both at the college level and for the working adult has thus become a Continuing Engineering Studies Special Interest Group Activity.

The group was launched first as a part of the activity directed at personalizing continuing study. At the Orlando CIEC meeting it became a separate activity because of the broad interest. At Orlando there was an overflow interest in the career workshop sessions. At that session the tie-in between education and careers was discussed from several perspectives.

At this CIEC meeting the Career Management group will provide the attendee the opportunity to personally experience using some of the tools for career assessment and planning. For example, small groups will work out life lines, write scripts for a day in the future, analyze their strengths and weaknesses, and work on balancing their lives between work and other activities. The session will also include a program for those who would like to understand the impact of secondary education on the selection of an engineering career.

Special interest groups are a way of bringing together those with common challenges for a vital exchange on specific topics. The vitality of a special interest group depends on participation by those who share the interest.

Join the CAREERS group both to gain help in managing your own life for greater success and to learn how you can help others to improve their lives and careers.

DONALD B. MILLER

Don began his professional career with a B.S. in mechanical engineering from the University of Rochester. Later he earned an M.B.A. at Columbia. At Columbia he was assistant to the dean of engineering. Joining IBM in 1952, his many assignments have included general management of development laboratories, engineering education, personnel research and director of personnel.

A member of ASME, SAM, IEEE, ASTD, and ASEE, he has has carried on extensive professional activities. He is on the board of CES and is a fellow of the Society for Advancement of Management.

He is the author of a book, Personal Vitality, and a workbook recently published by Addison-Wesley.

CONTINUING ENGINEERING STUDIES DIVISION SPECIAL INTEREST GROUP INTERNATIONAL CONTINUING EDUCATION

John P. Klus
Department of Engineering & Applied Science
University of Wisconsin - Extension
Madison, Wisconsin

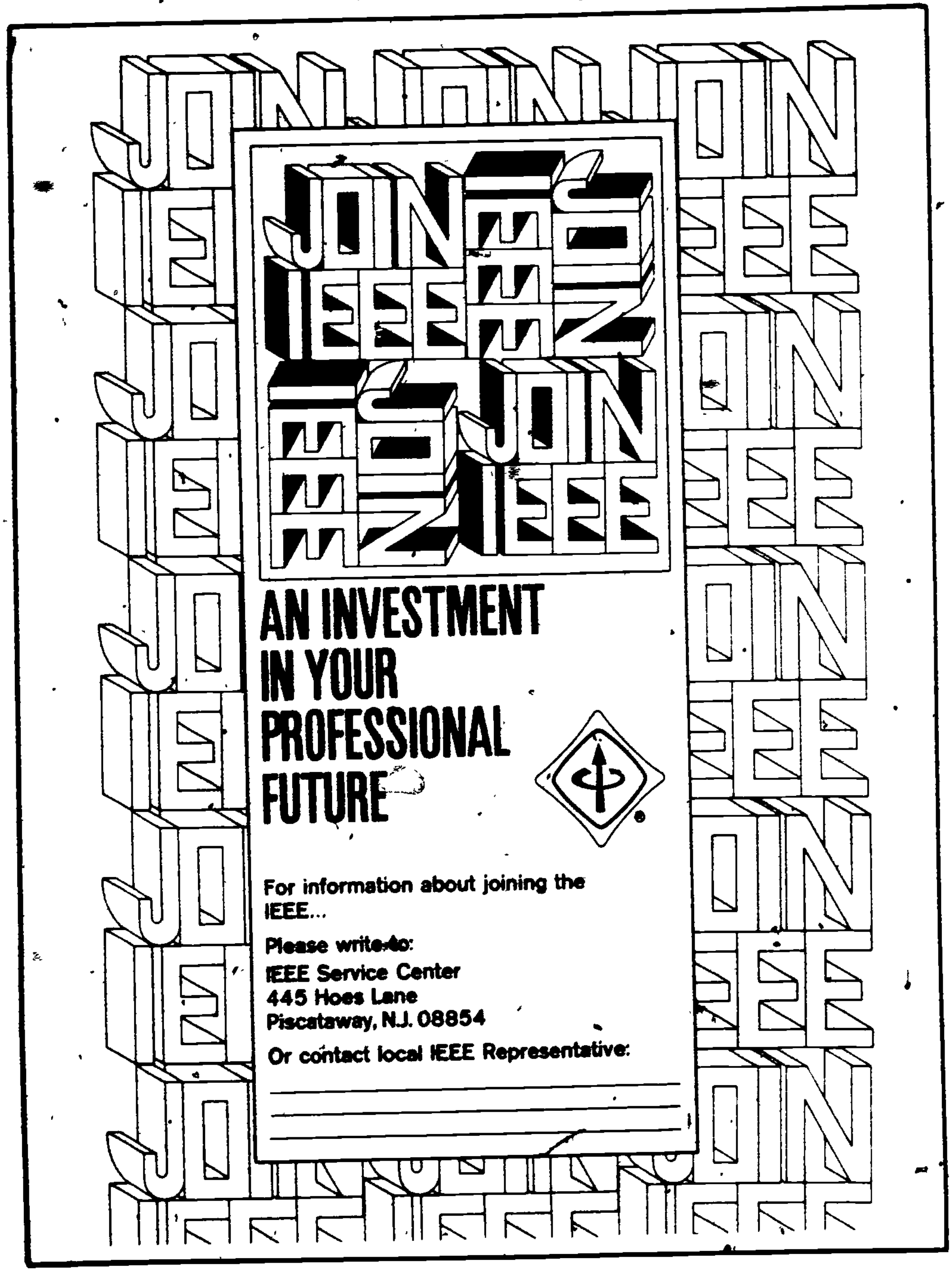
The Continuing Engineering Studies and International Divisions of the American Society for Engineering Education, along with the University of Mexico and UNESCO, are sponsoring an International Conference on continuing education for the professions. The conference will be directed primarily toward people in industry, government and universities who are responsible for developing continuing education programs in engineering and science. Those in technical education and related areas should also find the conference of interest. The host institution will be the University of Mexico, Mexico City. April 25-27, 1979 are the scheduled dates.

Participants will be continuing education directors in business, industry, government installations, and universities who develop, promote and conduct continuing education programs. With the conference location in Mexico City, an international mix of directors is expected. Promotion of the conference has been through ASEE, UNESCO, UPADI, PAHO, and the University of Mexico. Inquiries have been received from Africa, Europe, South America, Asia, and the Middle East.

Presentations will be made by persons working in the field. The first day will consist of four addresses in the areas of adult learning, motivation, program development, and marketing programs. The second day will be spent in group discussions. Special interest groups of directors from universities, from professional societies, from industry and/or government will each collaborate on program ideas, need analyses, costs, enrollment patterns, instructors, learning evaluations, and others. The third day will be an exploration of unique continuing education programs from around the world.

The UNESCO International Working Group on Continuing Education of Engineers and Technicians, which is a co-sponsor of the conference, has also joined forces with the CES Division of ASEE in publishing information on research and articles in continuing engineering education. Among ASEE channels, it takes the form of a column in the quarterly ASEE/CES division newsletter. Internationally the material is gathered into a small newsletter that is currently being distributed to 200 individuals in 69 countries. The newsletter gets even wider circulation by the newsletter recipients, and working group members, who are encouraged to pass it along to other interested parties. Content consists of abstracts of Ph.D. dissertations, government and university related research, publication articles, monographs, hardbacks, conference proceedings, and international articles in continuing engineering education and related areas. Subscribers are requested to provide input, and many have done so. The December 1977 issue of Articles & Research in Continuing Engineering Studies is the fourth one which has been mailed internationally.

John P. Klus...Chairman, Department of Engineering, University of Wisconsin--Extension since 1967. Professor of Civil Engineering. Degrees from Michigan Technological University and Ph.D., University of Wisconsin. Fulbright scholar 1966-67 for teaching and research in Finland. Chairman current UNESCO International Working Group on Continuing Education of Engineers. Member ASCE, ASEE, APWA, AAAS, Wi Acad of Sciences, Arts and Letters, NSPE and WSPE. National and international lecturer. Author of 40 technical and continuing education papers and publications; most recently: co-author "Engineers Involved in Continuing Education--A Survey Analysis" (An ASEE Monograph, 1975); editorial director of "Continuing Education for Engineers--A University Program" (A UNESCO case study, 1974).


JOIN IEEE
AN INVESTMENT IN YOUR PROFESSIONAL FUTURE
For information about joining the IEEE...
Please write to:
IEEE Service Center
445 Hoes Lane
Piscataway, N.J. 08854
Or contact local IEEE Representative:

SESSION G

CONTINUING ENGINEERING STUDIES DIVISION SPECIAL INTEREST GROUP ITFS

Morris E. Nicholson
Director, Continuing Education in Engineering and Sciences
University of Minnesota
Minneapolis, Minnesota

Instructional Television Fixed Service (ITFS) is a special broadcasting system established by the Federal Communications Commission whereby a television signal is transmitted from an educational institution to fixed locations within its broadcast range. The system provides two-way audio communication between the originating institution and the receiving locations. Each institution may broadcast on four channels simultaneously.

Engineering colleges represent the largest post secondary users of ITFS. The ITFS special interest group formed spontaneously to provide a forum for discussion of topics of common interest. Topics which will be discussed at this meeting will be: ITFS vs. videotape, educational programming, student attitudes, marketing strategies.

All who operate instructional television systems are invited to attend this meeting. Those who are contemplating construction of ITFS systesm are particularly invited.

MORRIS E. NICHOLSON

Morrie has been involved in Instruction Television Fixed Service (ITFS) since 1970. His principal reponsibility is to plan the academic program for the UNiversity Industry Television for Education (UNITE) network. Since 1973 he has been Director of Continuing Education in Engineering and Science.

CASE WESTERN RESERVE UNIVERSITY'S INSTRUCTIONAL TELEVISION NETWORK (ITN)

James L. Rogers
Director, I.T.N.
Case Western Reserve University
Cleveland, Ohio

Case Western Reserve University's Instructional Television Network (ITN) began operation in the Fall of 1972. The CWRU-ITN was designed to bring graduate courses to an off-campus audience of people who are employed full time. These employees become eligible to receive credit for ITN courses when the organizations they work for become members of the ITN, and set up appropriate viewing facilities. At that time, all of our class sessions were televised live from our two specially-built classrooms. Our signal was cabled from the classrooms to the top of the highest building on campus, then microwaved to WVIZ-TV, Cleveland's PBS station, where it was retransmitted over one of our two ITFS channels. In our first semester of operation (Fall 1972) we enrolled students for a total of approximately 1040 credit hours, and our programs were received live at 8 company locations.

In the five years since we began operation, we have changed from a 100% broadcast to a 100% videotape operation. As we will see, it is more accurate to say that shipping videotapes of class sessions allows us to meet needs of our users which were not being met by live broadcasts. In the Fall of 1977, we enrolled students for a total of approximately 1300 credit hours, and our videotapes (almost exclusively 3/4" cassettes) were shipped to 30 locations. The rest of this paper will trace the steps in this change, and identify the factors which account for it.

One feature of our live broadcast operation was the provision for a direct telephone line from each receiving location back into the campus classroom. Students watching the class session could participate directly by simply picking up the telephone and talking. On the surface, this feature seems highly desirable; indeed, some would hold that it is more than desirable: that it is actually <u>necessary</u> for effective teaching. In practice, however, it turned out that it was rarely used spontaneously: the instructors who wanted feedback from their Network students had to work very hard to generate and maintain a useful level of communication. In general, the Network students seemed even more reluctant than their on-campus counterparts to interrupt the class in order to ask questions. Perhaps Network students did not want to be responsible for their company's being identified as the source of all the foolish questions. Whatever the cause, the answer-back capability simply was not used to the degree that anyone expected it would be.

A second feature of our live broadcast operation was the provision of back-up videotape in case of technical difficulties. Especially in the first year of operation, when equipment was being broken in, and personnel were learning what not to do (at both the transmitting and receiving points), we taped each class session so that we could respond to a tape request from any location. However, the same tape which can be used to see a class missed for technical reasons can be used to see a class missed for any other reasons, and we noticed a slow but steady increase in tape requests attributed to a student's missing the class because he was out of town on company business. When the number of such requests from any single location became a significant percentage of the number of classes broadcast, we would call the company's ITN Coordinator to see if they would rather receive tapes in lieu of the broadcasts. And gradually, over the 1972-77 period, more and more companies opted for the tapes.

It goes without saying that these changes would not have taken place had there not occurred at the same time noticeable improvements in tape quality, playback performance, and reductions in the cost of playback equipment. Had the industry not overcome the incompatibility problem (one manufacturer's tapes would not play on another manufacturer's deck), we would still be broadcasting live.

Not only did the early ITN member companies change over to videotape during the 1972-77 period, but most of the companies which joined the Network after our first year of operation chose videotape from the outset. As videotape playback devices became more commonplace, it became easier for a company joining the network to meet the equipment requirements for student viewing without substantial additional investment.

As the tapes became more widely used, two features connected with their use became evident. First, the stop, rewind and freeze-frame capabilities of the playback devices contribute to the students' ability to learn from videotapes, by allowing replay of any segment and freezing of any display. Second, students in the same class who view the tapes in groups help each other in clarifying and explaining points in the lectures and discussions. Interrupting an instructor's live lecture can have undesirable consequences which do not accompany interrupting a videotape of the same lecture. Furthermore, there are limits to both the number of interruptions, and to the duration of any one interruption, which an instructor can tolerate in a live class. These limits are far less stringent when a small group of students is watching a videotape. The pedagogic effectiveness of group viewing can be maximized by including in the group someone who has already been exposed to the material (and can, therefore, act as a tutor), as the Stanford University experiments with "tutored videotapes" show.

Table 1 summarizes the relative advantages of the broadcast and tape delivery media. While each case must be decided on its own merits, our member companies have opted for videotape, largely on the basis of its scheduling convenience and flexibility. For them, this one feature of videotape outweighs whatever advantages accompany the broadcast option.

The demands on an employee's time (attributable to trips, project deadlines, commitments to visitors, etc.) which make it impossible for him or her to view a regularly scheduled live broadcast, are a function, in part of the employee's level of responsibility in the organization. Since the CWRU ITN offers only graduate courses, our students are more likely to be affected by these demands than students using a service which offers, say, only undergraduate courses.

PROBLEMS	BROADCAST With Direct Telephone Back to Classroom	VIDEOTAPE PLAYBACK With Freeze-Frame Pause Control
SCHEDULE CONFLICTS		
The student is out of town (sick, occupied with visitors) and misses a class.	The student misses the class	The student views the tape when he returns to his work location.
The student is assigned to another location for an extended period of time	The student misses the class, and may have to drop the course	Copies of the class tapes are shipped to the student at his temporary location (assuming the availability there of videotape playback equipment) for the duration of his assignment.
PEDAGOGICAL DIFFICULTIES		
A student who is watching the class alone wants clarification of a point in the lecture	The student picks up the telephone and interrupts the class proceedings to ask his question	The student stops the tape, rewinds, and replays the unclear segment. If reviewing the segment does not clear up the point, the student calls the instructor at his office during scheduled "telephone hours."
A student who is watching the class in a group wants clarification of a point in the lecture	same as above	The student stops the tape, and explains his difficulty to his colleagues; the group may replay the segment together. If they cannot resolve the issue as a group, the student can call the instructor (as above).
PROCEDURAL REQUESTS		
The student wants the material held on the screen (until he can copy it, for example)	The student picks up the telephone and interrupts the class proceedings to ask the instructor to hold the material	The student pushes the PAUSE button, and the screen is "frozen" as long as the student wants to refer to it.

TABLE 1. BROADCAST-VIDEOTAPE COMPARISON

JAMES L. ROGERS

Jim is Director of the Instructional Television Network at Case Western Reserve University, where he also holds an Associate Professorship in the Department of Systems Engineering, Computer Engineering and Information Sciences. He received the BA and MA degrees from the University of Michigan, and the Ph.D. from CWRU.

Prior to joining the faculty at CWRU in 1972, Jim held positions with Burroughs, Xerox, and RCA. He is a member of ACM, AERA, and ASTD, and serves on the Materials Development Committee of AMCEE.

CONTINUING ENGINEERING STUDIES DIVISION SPECIAL INTEREST GROUP MEDIA PRODUCERS/USERS

Neal P. Jeffries, Ph.D.
Director of Education
Center for Manufacturing Technology
Cincinnati, Ohio

The Packaged Learning Group consists of a number of individuals who are interested in the production and use of packaged educational materials.

This organization has evolved from a special-interest group of videotape producers and users, and has expanded to include other forms of packaged instruction. These materials include videotapes, movies, filmstrips, slides, audio tapes, and instruction manuals.

Through the able leadership of Mr. Al Ackhoff, this group was organized, has met several times, and has grown to include many interested persons. Some of the projects carried out or supported by this group have included:

- preparation of lists of packaged learning producers
- circulation of catalogs of programs
- evaluation of programs
- study of cost-effectiveness of continuing education
- assistance in preparation of continuing education directors handbook
- publication of newsletter including listings of available programs.

In the future, the Packaged Learning Group will endeavor to help those interested in producing or using these kinds of materials to maximize their effectiveness. The group welcomes anyone interested in learning more about Packaged Learning.

B.S. - Purdue University;
M.S. - Massachusetts Institute of Technology
Engineer - Stanford University
Ph.D. - University of Cincinnati

Project Engineer - U.S. Air Force
Program Manager - General Electric Co.
Research Associate and
Associate Professor - University of Cincinnati
Manager of Education - Structural Dynamics Research Corporation
Member of ASEE, ASME, SME
Publications: Textbook, Two Patents, Several Papers
Areas of Interest: Engineering Education; Production Management; Manufacturing Processes

CALL FOR PAPERS

ANNALS OF ASEE ENGINEERING EDUCATION JOURNAL

The December issue of the Engineering Education Journal is called the ANNALS. This publication has one primary purpose, which is to attract, publish and stimulate the writing of high quality articles that are of long-lasting interest to engineering educators. Through the existence of the Annals, ASEE hopes to increase the incentive to do research in engineering education, to publish the results, and to provide a means by which the quality of the research can be judged. A more complete statement of purpose appears in Engineering Education, December, 1975, p. 227.

Articles may pertain to any aspect of engineering education, including educational research, learning, theory, teaching methods, review of ongoing projects, administration, organization, guidance, finance and technical research as it applies to education. All articles will be reviewed by experts in engineering, engineering education and appropriate allied disciplines, such as psychology, education or sociology. The criteria for selection are based on the significance of the subject to engineering education, the quality of the treatment, including the author's knowledge of past work in the area, and long-lasting value.

Articles may be of any length appropriate to the subject, but on the average are expected to be about 4,000 to 5,000 words. If a paper is accepted, the author must be prepared to submit originals of all illustrations, and submit five copies by June 15 of each year.

Editor, Annals
American Society for Engineering Education
One Dupont Circle, Suite 400
Washington, D. C. 20036

SESSION. 5

EFFECTIVE MANAGEMENT OF HUMAN RESOURCES

Robert L. Heyborne
Dean of Engineering
University of Pacific
Stockton, California

PAPER NOT
AVAILABLE
AT TIME
OF PRINTING

Robert L. Heyborne is Dean and Professor of Electrical Engineering at University of the Pacific in Stockton, CA. He holds the Ph.D. in Electrical Engineering from Stanford University and has more than thirteen years of teaching experience, plus approximately ten years of industrial experience.

Dr. Heyborne's American Society for Engineering Education activities include service as Chairman of the Pacific Southwest Section 1975-76, Chairman of the Rocky Mountain Section 1968-69, Chairman-Elect of the Cooperative Education Division 1976-77, Member of the Board of Directors of the Relations with Industry Division 1976-77, Member of the Board of Directors of the Cooperative Education Division 1973-present. He is also a member of the Institute of Electrical and Electronic Engineers (IEEE), American Geophysical Union (AGU), International Scientific Radio Union (URSI), Sigma Xi, Sigma Tau, and Phi Kappa Phi. He has received numerous awards for excellence in engineering teaching, and in 1972 was named the "Engineer of the Year" by the Joint Council of the Professional Engineering Societies of the San Joaquin Vallye

EFFECTIVE MANAGEMENT OF HUMAN RESOURCES

Dr. B. J. Shell
President
Northrop University
Inglewood, California

Dr. B. J. Shell

Dr. B. J. Shell received his Ph.D. from Michigan State University in Civil and Sanitation Engineering. He worked in private industry as Vice President for a construction firm in Arizona prior to entering the educational field.

He taught for several years at the University of Arizona. In 1966 he accepted the position of Associate Dean of Engineering at Mississippi State University. He also served as Director of the Engineering and Industrial Research Station.

From 1970 to 1973, Dr. Shell served as Dean of Engineering at California State Polytechnic University, Pomona. He also served one year as Acting Vice President for Academic Affairs.

Since 1973, he has held the position of President of Northrop University in Inglewood, California.

Dr. Shell has received numerous awards and citations from many engineering societies and organizations for his contributions to the betterment of the engineering profession.

San Diego

SESSION 6

MEET THE EXPERTS

CIEC MEET THE EXPERT SESSION OBJECTIVES

The "meet the experts" program at the College Industry Education Conference is designed to give the individual participants an opportunity to talk to some well qualified people concerning their individual problems at their institutions or industrial organizations where they are employed. The people who "volunteered" to act as experts on various phases of cooperative education, engineering technology, relations with engineering, and continuing engineering education all have had a wide experience in their particular field.

The participants of the 1978 College Industry Education Conference are encouraged to ask questions of these individuals on an individual or small group basis throughout the entire session. No formal presentations will be made. The session has deliberately been unstructured and tables with refreshments have been provided so that an informal atmosphere can prevail throughout the session. The conference participant are encouraged to go from table to table if they so desire during the time allotted to ask questions and to get information from many different sources. Even to act as "experts" themselves.

Although these experts have not been asked to write up an article concerning any ideas they have on their particular topic. We have enclosed their picture and a short biographical sketch in the proceedings so that the conference participants can recognize them throughout the conference. We encourage you to make use of these people to help solve your problems and we certainly hope that through this individual "one on one" experience at the College Industry Education Conference we are helping meet your perceived needs.

THE INSTITUTIONAL CO-OP SCENE

Willard D. Bostwick
Assistant Dean of Engineering
Purdue University at Indianapolis
Indianapolis, Indiana

Table 1

Willard D. Bostwick is Professor of Supervision and Assistant Dean of Student and Administrative Affairs at the Purdue University School of Engineering and Technology at Indianapolis. He was a member of the cooperative education faculty at Speed Scientific School, University of Louisville, from 1965 to 1976. Prior to joining the University of Louisville, Dr. Bostwick held positions with Halliburton, Illinois Division of Highways, and the Illinois Department of Labor.

Dr. Bostwick has widely diversified experience in operating and planning cooperative education programs. This includes working first-hand with voluntary and mandatory co-op programs; academic and non-academic credit programs; quarter and semester calendars; engineering and technology curricula, as well as participating in the re-organization and extablishment of new co-op programs.

He is a member of the Executive Board and Chairman-Elect of the Cooperative Education Division, ASEE, and a member of the American Institute of Industrial Engineers. Professor Bostwick received the B.S. Degree in mathematics from Northern Illinois University and a Ph.D. in educational administration from the University of Kentucky.

THE INDUSTRIAL CO-OP SCENE

Richard S. Rice
Manager, College Relations
Diamond Shamrock Corporation
Cleveland, Ohio

Table 2

Richard S. Rice is Manager of College Relations at Diamond Shamrock Corporation, a diversified chemicals, plastics, and oil and gas company with operations throughout the United States and World Headquarters in Cleveland, Ohio. He has been with Diamond Shamrock for the past 16 years and has held various management positions in the employee relations area of the company.

At present one of Mr. Rice's responsibilities is the administration of Diamond Shamrock's Plan of Cooperative Education. There are approximately 70 engineering and business students in this program. Work assignments are provided at various types of facilities throughout the country. The co-op program has been in operation for many years and is well established and highly regarded. Mr. Rice has broad experience in the planning and operation of co-op programs in business and industry.

He is a member of the Executive Board of the Cooperative Education Division, ASEE, and is a member of the Education Activities Committee of the Manufacturing Chemists Association. He received a BSBA Degree from Bowling Green State University.

THE NATIONAL CO-OP SCENE

Alvah K. Borman
Dean, Graduate Placement Services
Northeastern University
Boston, Massachusetts

Table 3

Dean Borman has been involved in the Cooperative Education community for twenty-five years. During this time he has served as Chairman of CED, a trustee of the National Commission for Cooperative Education and on numerous committees of CED, ASEE and the Cooperative Education Association. In 1970, noting a community of interest among the four original Divisions participating in the College-Industry-Education Conference, he promoted the concept of a mid-winter meeting with the Division Executive Boards, resulting in the first CIEC in 1976. He served on the CED committee that developed the criteria for ECPD accreditation of cooperative education programs in engineering and has been the editor and publisher of the CED Newsbrief since its founding in 1969. Dean Borman received a BSEE as a co-op student at Northeastern University in 1936 and an M. Ed. in 1967. He has served as a coordinator for electrical engineering students, Director of Graduate Cooperative Education and as Dean of Graduate Placement Services. His office is now responsible for the career guidance, counseling and placement assistance of all seniors, graduate students and alumni of Northeastern University.

RWI

THE PLACEMENT OF ENGINEERS

Charles A. Harkness
Director of Career Planning and Placement
San Diego State University
San Diego, California

Table 4

Has been involved for the past ten years as a career counselor, researcher, writer, and center director in college and university Career Planning and Placement Centers. Prior to that, his professional life was devoted to work in both student and industrial personnel positions. Author of CAREER COUNSELING: Dreams and Reality.

RWI

CAMPUS RECRUITING OF ENGINEERS

Marilyn Randolph
Pacific Telephone Company
Alhambra, California

Table 5

Marilyn Randolph

Southern California resident for twenty years. Graduate of UCLA, Bachelor of Arts degree in Languages, 1969 entered Pacific Telephone's Management Development Program September, 1969. Jobs held include:

- Marketing Service Consultant
- Asst. Switching Manager for Electro-Mechanical Switching Systems
- Installation Supervisor
- Personnel Manager

RWI

WOMEN IN ENGINEERING

Donna Frohreich
Engineering Administration
University of the Pacific
Stockton, California

Table 6

Donna S. Frohreich received an A.B. (with Distinction) in sociology and a M.A. in education from Stanford University. From 1968 until 1974 she was assistant professor and coordinator of programs for women in engineering at Purdue University. While at Purdue she developed an extensive plan for attracting and retaining women engineering students. She initiated the "Director of College and University Programs for Women in Engineering." In 1974 she was named Dow Outstanding Young Faculty Member from the Illinois-Indiana section of ASEE. Ms. Frohreich is currently assistant professor and coordinator of cooperative education in the School of Engineering, University of the Pacific, Stockton, California. She also coordinates the NSF "Women in Engineering" program conducted by University of California Extension, Davis. Ms. Frohreich is chairman of the RWI Women's Action Group.

GUIDANCE

Harris T. Travis and Steven R. Cheshier
Purdue University
West Lafayette, Indiana

Harris T. Travis is an Associate Professor in Mechanical Engineering Technology and serves as an administrative assistant of minority affairs to the Dean of the School of Technology at Purdue University, W. Lafayette, Indiana. He received the B.S. degree in Electrical Engineering from Tennessee State University in 1960, the M.S. degree in Industrial Engineering from Purdue University in 1972 and the Ph.D. degree from the University of Illinois in 1976. From 1960 to 1972 he worked at the U.S. Naval Avionics Facility in Indianapolis Indiana. During this period he served in several capacities; as an engineer, project engineer, staff consultant and supervisor. He is a member of ASEE, Phi Delta Kappa and a Danforth Associate.

Table 7

DR. STEPHEN R. CHESHIER

Stephen R. Cheshier was born in Logan, Ohio, on February 21, 1940. He received the B.S. [illegible] in Physics from Memphis State University, the M.S.E. degree in Electrical Engineering from Purdue and the Ph.D. degree in Technical Education from the University of Illinois.

After 12 years in naval avionics, he has been on the Purdue faculty since 1971 and is currently Professor and Head of the Electrical Engineering Technology Department at Purdue.

RECRUITMENT OF ENGINEERS AND TECHNOLOGISTS

Richard J. Ungrodt
Vice President, Academic Affairs
Milwaukee School of Engineering
Milwaukee, Wisconsin

Table 8

Richard J. Ungrodt is Vice President for Academic Affairs at the Milwaukee School of Engineering where he has served for 31 years as teacher, department chairman, and administrator.

Current activities in ASEE include Long Range Planning Committee, Projects Board, and Committee on Accreditation Processes. Previously served as Chairman of TCC and related committees. 1972 recipient of James H. McGraw Award.

Currently serving as Director for ECPD representing the Society of Manufacturing Engineers.

Serving ECPD on the Executive Review Steering Committee, the Accreditation Planning Committee, and the Special Task Force on Allied Engineering Professions.

President, Milwaukee Chapter, Wisconsin Society of Professional Engineers.

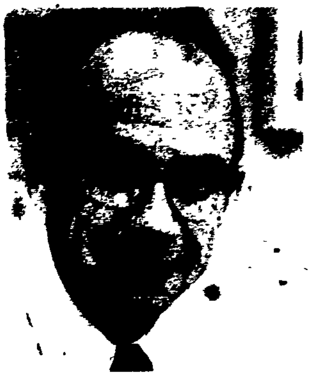
Advisor to the University of Petroleum and Minerals in Saudi Arabia.

ADMINISTRATION OF E. T. PROGRAMS

Lyman L. Francis
Professor, Engineering Technology
University of Missouri-Rolla
Rolla, Missouri

Ronald J. Young
Provost
Wentworth Institute
Boston Massachusetts

Table 9



LYMAN L. FRANCIS

Professor of Engineering Technology and Director of Engineering Technology at the University of Missouri - Rolla. Past Chairman of the Engineering Technology Committee of the Engineers' Council for Professional Development, Society of Manufacturing Engineers representative to ECPD Board of Directors. Chairman ECPD Council. Member of ASEE, SME and ASME.

Ronald J. Young, a Mechanical Engineer, has advanced over the years from Instructor to Provost at Wentworth Institute of Technology in Boston, Massachusetts. His industrial experience includes Marine and Mechanical Engineering, consulting and editing. He has been active in the Profession by presenting papers, writing articles and as a panelist. Among his professional society affiliations are the American Society of Mechanical Engineers, the American Society for Engineering Education and the Society of Plastics Engineers. He is a member of Pi Tau Sigma, Tau Beta Pi and Sigma Xi.

CONTINUING EDUCATION PROGRAMS IN INDUSTRY

Howard R. Shelton
Sandia Laboratories
Albuquerque, New Mexico

Table 10

Mr. Shelton is currently head of the University Programs and Management Training Division, Sandia Laboratories, and is responsible for developing programs of continuing education for engineers and scientists at Sandia Laboratories through university related programs and specially-developed in-house programs. He is the Sandia Laboratories' representative to the American Society for Engineering Education and served as national chairman for the Continuing Engineering Studies Division, 1973-74, and has been active in the division activities for the past 10 years.

Mr. Shelton was co-chairman of the Engineering Foundation Conference, "Maintaining Professional and Technical Competence of the Older Engineer--Engineering and Psychological Aspect," held in Maine, 1973, and a co-editor of the ASEE monograph on the same subject.

He was co-chairman of the 5th Annual Continuing Engineering Studies Division meeting held in Albuquerque, New Mexico in 1970.

UNIVERSITY CONTINUING EDUCATION PROGRAMS

Charles S. Elliott
Wayne State University
Detroit, Michigan

Table 11

Chuck Elliott is currently involved in Continuing Engineering Education programs, off-campus credit extension programs, conferences and seminars, minority student programs and liaison with industry. His Ph.D. degree is from Michigan State University and BME from General Motors Institute. He has been North Central Section Representative for the Continuing Engineering Studies Division of ASEE and is currently Vice-Chairman (Chairman-Elect) of the North Central Section, a member of the National Publications Committee of ASEE and Chairman of the Member Education Council of the Engineering Society of Detroit.

INDIVIDUALIZED CE PROGRAMING

Dean Griffith
Visiting Alumni Professor of Engineering
College of Engineering
Clemson University
Clemson, South Carolina

Table 12

Dean E. Griffith is Alumni Visiting Professor of Engineering at Clemson University, on leave from The University of Texas at Austin, where he is Director of Continuing Engineering Studies. Dean is a director of the Texas Association for Community Service and Continuing Education, a professional member of the National University Extension Association and a charter member of the Continuing Education for the Professions Section, NUEA. Dean has served on the National Continuing Education Committee of the American Institute of Chemical Engineers, on the Projects Board, ASEE, and in various positions for the Continuing Engineering Studies Division, ASEE including a member of the Board of Directors, and Chairman of the CES Task Forces. Dean is chairman of the Continuing Personalized Engineering Education Special Interest Group and is a member of the Long Range Planning Committee, ASEE. Dean's personal interests are reflected in his Clemson project "Increasing the Margins of Excellence in the External Master of Engineering Program."

OPPORTUNITIES IN INTERNATIONAL ENGINEERING EDUCATION

Merton R. Barry
Director, Engineering Foreign Programs
University of Wisconsin
Madison, Wisconsin

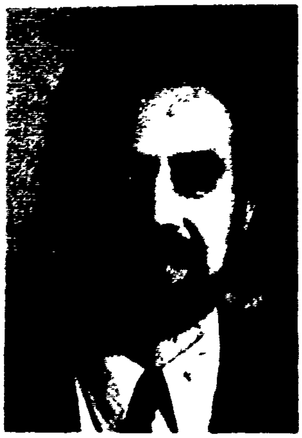
Table 13

Merton R. Barry, Professor, Department of General Engineering, and (1960 to present) Director, International Engineering Programs, University of Wisconsin-Madison. B.S. and M.S., University of Wisconsin. Post-graduate study in Switzerland and the Netherlands (Fulbright). Active in ASEE since 1955. Has served ASEE as Chairman, International Committee and International Division of ASEE, and is currently Chairman, Joint Committee on International Activities (JCIA); Secretary-Treasurer of Council for Public and Specialized Services; and as a member of the World Congress 1975 Steering Committee. He is a member of U.S.Nat'l Committee for IAESTE; U.S.National Committee for UPADI and the UPADI Education Committee; founding member of WFEO Committee on Engineering Education 1970-74. Member of NAS/NAE Panel on the Role of U.S. Engineering Schools in Technical Assistance. Professor Barry is currently a member of the U.S. National Commission for UNESCO and member of the UNESCO Advisory Panel on Engineering and Technological Education.

ACCREDITATION IN THE INTERNATIONAL SCENE

David Reyes-Guerra
Executive Director
Engineers' Council for Professional Development
United Engineering Center
New York, New York

Table 14



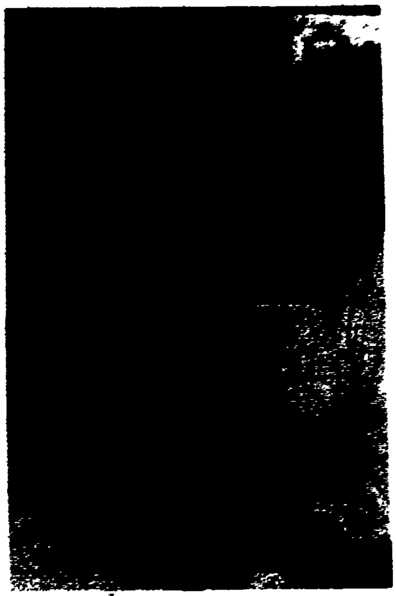
DAVID R. REYES-GUERRA

David R. Reyes-Guerra is the Executive Director of the Engineers' Council for Professional Development. He is a civil engineer with industrial experience both in the U.S. and the international scene. Prior to joining ECPD, he was a faculty member at the University of Illinois. He is a graduate of the Citadel and Yale University.. He is active in international education and serves as a consultant in management, engineering education, and professional practice both here and abroad.

INTERNATIONAL COLLABORATION RESEARCH

Maurice L. Albertson
C. E. Department, Colorado State University
Fort Collins, Colorado

Table 15



Maurice Lee Albertson is a Professor of Engineering at Colorado State University and a registered professional engineer in Colorado. Co-author of Fluid Mechanics For Engineers he has thirty years experience in fluid mechanics, hydraulic engineering, water resources research, and international development engineering. Recipient of the J. C. Stevens Award, Croes Medal, and Emil Hilgard Prize from the American Society For Civil Engineers. Since 1959 he has been the coordinator for the United States contribution to Asian Institute of Technology in Bangkok, Thailand. He has been a consultant for several AID projects, UNESCO programs and received the 1970 Centennial Professor of Engineering Award from Colorado State University.

DON'T FORGET

1978 ASEE ANNUAL CONFERENCE

UNIVERSITY OF BRITISH COLUMBIA
JUNE 19-22, 1978
VANCOUVER, B.C., CANADA

1979 ASEE ANNUAL CONFERENCE

LOUISIANA STATE UNIVERSITY
JUNE 25-29, 1979
BATON ROUGE, LOUISIANA

CONTINUING ENGINEERING STUDIES DIVISION INTERNATIONAL DIVISION LUNCHEON

Raymond J. Page
Director, Continuing Engineering Education
General Motors Institute
Flint, Michigan

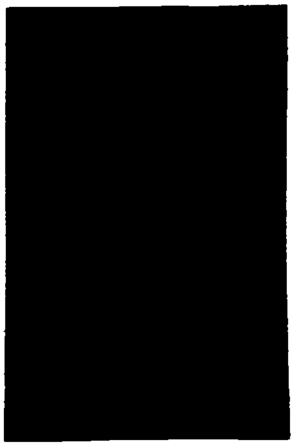
The Continuing Engineering Studies Division of ASEE invites all of the participants of the College Industry Education Conference who are interested in Continuing Education to attend this luncheon. This session will allow people to meet formally and discuss some of their problems and renew acquaintances with people who have similar jobs.

At this particular meeting also, the awards for the CES Division will be distributed for the 1976 year. Morrie Nicholson, Chairman of the CES Division Awards Committee, will have several people up for recognition at this time.

Anyone who is attending the conference is encouraged to participate in this session and we think you will find it very informative to learn what is going on in continuing engineering studies at the various engineering schools throughout the United States.

Raymond J. Page received his BSME and MSIE degrees from Purdue University. His industrial employment has been with Sylvania Electric Company, National Cash Register Company and National Gypsum Company. He has taught at SUNY at Buffalo, Cornell University and General Motors Institute where he is currently Director of Continuing Engineering Education. In this position, he is responsible for providing technical programs to General Motors Units.

He has been active in professional society activities for several years. He was a member of the ASME Policy Board Education and served as the National Chairman of it's Continuing Education Committee. His ASME offices also include several at the section and regional level and a term as Vice President. He has been active in the CES Division of ASEE since it's formation and is currently Chairman.



ANNOUNCING
AN INTERNATIONAL CONFERENCE ON
CONTINUING ENGINEERING EDUCATION
APRIL 25—27, 1979
UNIVERSITY OF MEXICO
MEXICO CITY

The Continuing Engineering Studies and International Division of the ASEE, along with the University of Mexico and UNESCO, are pleased to announce an International Conference on Continuing Education to be held in Mexico City, April 25-27, 1979 for industrial and university personnel interested in continuing professional development in engineering. Those in technical education and related areas would also find the conference of interest. MARK YOUR CALENDAR!

Topics to be discussed include needs analysis, adult learning, marketing and advertising programs, participant motivation, program costing, unique programs around the world, and others. Speakers have been contacted and will be coming from industrial, government, and educational agencies throughout the world. If you would like to receive a final program please contact John Klus, General Chairman, 432 North Lake Street, University of Wisconsin, Madison, Wisconsin 53706.

COOPERATIVE EDUCATION DIVISION BUSINESS LUNCHEON

The Cooperative Education Division of the ASEE will hold their annual business luncheon during this session. Various nominations, and election of officers of the division will be held.

Anyone who is interested in cooperative education or would like to know more about cooperative education should plan to attend this luncheon. It will be an informally operated luncheon and will allow participation from the audience on the various problems facing the cooperative education division will be discussed. You are encouraged to participate if you would like to know more about cooperative education.

ROBERT L. HEYBORNE

Robert L. Heyborne is Dean and Professor of Electrical Engineering at University of the Pacific in Stockton, CA. He holds the Ph.D. in Electrical Engineering from Stanford University and has more than ten years of industrial experience in addition to his teaching. Dr. Heyborn's American Society for Engineering Education Activities include service as Chairman of the Pacific Southwest Section, Chairman of the Rocky Mountain Section, three years as a Board member of the RWI Division, and five years as a Board member of the CED Division. He is a member of the ASEE Accreditation Processes Committee. Dr. Heyborne is a past chairman of the California Engineering Liaison Committee, a member of the IEEE, American Geophysical Union, International Scientific Radio Union, Sigma Xi, Sigma Tau, and Phi Kappa Phi. He has received numerous awards for excellence in engineering teaching, and in 1972 was named the "Engineer of the Year" by the Joint Council of the Professional Engineering Societies of the San Joaquin Valley.

CALL FOR PAPERS

1978 Conference on

Frontiers in Education

Dutch Inn, Lake Buena Vista, Florida
October 23 - 25, 1978

Hosted By Colleges of Engineering of
University of Florida
Florida Institute of Technology
Florida Technological University
University of South Florida

The Education Group of the IEEE and the Educational Research and Methods Division of the ASEE, with the participation of the Colleges of Engineering of central Florida, are pleased to announce the 1978 Conference on Frontiers in Education, to be held October 23-25, 1978, at the Dutch Inn, Lake Buena Vista, Florida. The name of the Conference is the theme of the Conference, Frontiers in Education. The purpose is to bring together persons concerned with education in schools, in colleges and universities, and in industry and government to discuss new developments and new directions in engineering and other post-secondary technical education.

Papers are invited from a wide range of areas including, but not necessarily limited to, those listed below

- Engineering for Non-Engineers
- Engineering and Society
- Pre-Engineering Studies
- Guidance and Counseling
- Continuing Education for Engineers
- Off-Campus Instruction
- The Role of the Teacher
- Graduate Research
- Design of Learning Experience
- Technology in Education
- Computers in Education
- New Methods in Education
- Evaluation of Education
- Student Self-Appraisal
- Grades and Grading
- Cost Effectiveness in Education
- Management Science/Techniques in Education
- Frontiers in Graduate Education
- Community College-University 2+2 Articulation
- Laboratory Education
- Role of Consortia in Education

One of the basic purposes of this Conference is to provide maximum opportunity for personal involvement and interaction, as opposed to passive listening to lectures. Proposals for workshops, panel discussions, and other types of interactive sessions are invited.

Authors wishing to present papers should send a synopsis (typically 200 to 500 words) describing the scope of the paper to:

Program Chairman
Professor Andrew Revay
Program Chairman, FIE '78
Department of Electrical Engineering
Florida Institute of Technology
Melbourne, Florida 32901

General Chairman
Gene Chenette
Professor, General Chairman
Department of Electrical Chairman
University of Florida
Gainesville, Florida 32611

Deadline for submission of synopses is January 15, 1978. Speakers will be notified of acceptance by March 15, 1978. Final drafts will be due June 15, 1978, and will be published in the Conference Proceedings. Persons wishing to propose workshops, panel discussions, or other special sessions should also contact Professor Revay no later than January 15, 1978.

SESSION 7.1

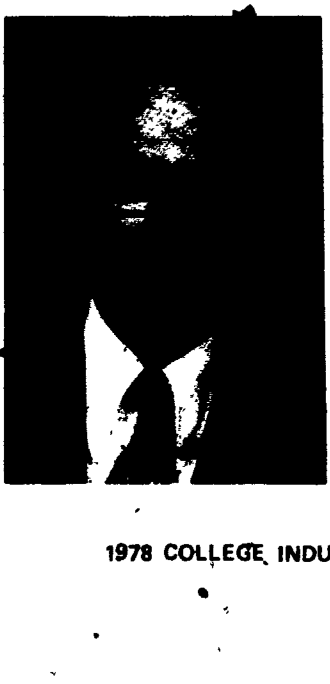
HOW DO CO-OP EXPERIENCES COMPLEMENT ENGINEERING CURRICULUM

Cliff S. Barton
Assistant Dean of Engineering
Brigham Young University
Provo, Utah

The pro's and con's of how or even whether co-op experience complement curricula have been debated for years by the employer, the faculty, and the student. Cooperative education is purported to be student oriented. It exists to serve the student. Of course, the employer would also like to say that his interests, both current and down the road a few years, are very well served. He believes that strongly enough to lay out supporting dollars in significant quantities. The faculty would argue the virtues of the program as their efforts to teach are augmented by industrial experiences had by motivated students.

A noted educator once said, "when cooperative education is treated as a basic concept for relating theory to practice in education, and when flexible arrangement and varied procedures are evolved, rather than a rigid set of operations, the resulting program is more likely to become a very successful one."

Our speakers in this session will present new views based on new data with national and international flavor. The principle and program of cooperative education knows no borders or boundaries. Engineering and technology, the social and economic impact, is not confined to the United States. There is a need for all of us to share views and information. As an outcome of interchange with our speakers, we should all have a better understanding of how co-op experiences complement curricula.



Cliff S. Barton is Assistant to the Dean in the College of Engineering Sciences and Technology at Brigham Young University, Provo, Utah. He is in charge of developing Industrial Relations which includes Cooperative Education programs. He is also chairman of the University Cooperative Education Committee which develops policies and procedures for campus operation.

He has served as chairman of the Department of Civil Engineering for several years. He is a member of several national societies and has been national President of the Society for Experimental Stress Analysis. He has been on the faculty of Rensselaer Polytechnic Institute where he also received his PhD in Engineering Mechanics. He has published numerous papers and has been an employee of, as well as a consultant to several industries.

HOW DO CO-OP EXPERIENCES COMPLEMENT ACADEMIC STUDIES

June Moore
Assistant Coordinator, Cooperative Engineering Programs
University of Tennessee
Knoxville, Tennessee

The sources of information for this paper are from interviews with co-op students, faculty, and employers who are correspondents in the University of Tennessee Cooperative Engineering Program. Approximately one hundred current co-op students were asked the title question. Faculty members were asked the question, "What is the degree of competency in engineering skills which the faculty hope the engineering graduate comprehends?" Co-op employers were asked the question, "Does the engineering curriculum at the co-op level satisfy the needs of industry?"

All of the students who discussed the subject have completed the co-op work experience. The students are ready to commence the senior year. Almost without exception, their ages are in the early twenties. I have chosen to present the student's opinion, because the co-op is the missing component at association meetings; student views are not readily available to CIEC participants. Also, co-op experiences are fresh, and can lend a unique viewpoint to the subject under consideration.

A general statement which needs to be made is that all of the students interviewed agreed that the question is, "How do the co-op experiences..." and not, "If the co-op experiences...." Without exception, all of the students interviewed agreed that the co-op work experiences were beneficial in the classroom. There were none who would not have retraced his or her steps through co-op education. The coverage of the subject matter in this paper is not intended to be a comprehensive study. The most frequently expressed views of the three groups are offered simply to stimulate thought.

Student Viewpoint

Many students stated that the theory which is taught in the classroom is employed primarily when the work assignment is within a research and development area. Students who have been placed in production or manufacturing areas feel that seldom, if ever, do they need theoretical material. This is one of the most interesting points revealed from the interviews. It is a significant observation, as it clearly indicates which students will more often find a correlation between work experience and the academics.

Problems an engineering student must solve in the classroom generally have one answer which may be obtained from the back of the book. Engineering problems on the job, however, may have many answers. Therefore, the work experience is a far reaching experience which adds dimension to a course. A student is able because of the work experience to comprehend unstated factors which are pertinent to, and which develop, the book problem. For the co-op this situation is a decided advantage over non-co-op classmates.

Co-op students become acquainted with the necessary business and legal aspects of the engineering profession. Co-ops learn how economics, inventories, schedules, environmental impact studies, contract negotiations, leases, and chains of command, to name only a few, play in the professional engineer's life. The necessity of selling one's ideas, not only to other engineers, but to finance and business representatives, administrative people, et cetera, is a rude awakening to some co-op students. Discovering the total sphere of engineering caused some co-ops to seek out courses in legalistics, written skills, business administration, and in the humanities. The "need to know" increased interest in academic courses for the co-op.

An incentive to study was a benefit which was repeated over and over by co-ops. Having worked on a project which incorporated in it the aspects of an upcoming class delighted the student. Most co-ops expressed an eagerness to schedule courses which have a direct bearing upon the work assignments. The course work is made easier by "the doing of the thing," especially computer related courses. The student often times has had computer training at work far and above that of academic requirements. Being introduced to a course subject at work allows the student to determine the "meat" of the course, and the student is able to weed out relatively unessential aspects. Study, therefore, is accomplished in an efficient manner.

There was for some students a lack of continuity of course material due to the alternation schedule; however, that drawback was overshadowed by the fact that the alternation allows the student to return to school with a fresh mind. Almost all of the students mentioned this fact. Several students indicated that they would have dropped out of school, if not for the co-op program. One student in particular, stated that he had dropped in and out of college until the co-op program was introduced to him. Now that the work periods are completed, he hopes to endure school through the senior year to obtain the degree. School is that disagreeable to him.

The necessity of dealing on his own with problems and challenges encountered at work contributed to the student's assertiveness and self-confidence in the classroom. Thus, the ability of the student to generate a rapport with the professor was enhanced — a decided advantage. The student learned at work how to approach "professionals." One student in the last work period was given a challenging project of solving a production dilemma. The solution which the student would devise would be utilized. The apprehension of the responsibility placed upon his shoulders caused him to want to check his findings thoroughly before submitting the plan to his supervisor. The student telephoned from the work site to his professors on campus, in all contacting four of them, to check out his proposed solution. The response he received and the interest generated by the professors for the co-op were distinct advantages for the student when he returned to campus. The incident not only made the professors aware of the calibre of the student, but served to gain faculty support for the co-op program.

The co-op believes himself to be a better student than he would have been otherwise. Studies indicate that this is true. He has learned to organize his thoughts. He has found at work the absolute necessity to think. Important to him, also, is the learned-at-work ability to attack a problem in a logical, orderly manner. The student is then able to attack course work with the same strategy. Study and comprehension, the student says, come easier with that approach.

Co-ops feel that they are ahead of the game. Work experience introduces equipment, procedures, processes, analyses, and a view of the state of the art which is ahead of that offered in the classroom. The hands-on experience is far reaching. Students generally, have to crowd around one piece of equipment in the school laboratory in order to observe it; it is necessary to share lab space with classmates. The co-op at work, however, has a work station to himself, and he will have ample opportunity to gain skill in the use of many devices. Industry will have the latest in engineering tools and equipment. Educational institutions simply cannot afford to completely stock the laboratory. The co-op student fully appreciates the opportunity to observe and to use the latest sophisticated engineering tools. A non-co-op may never have the experience of becoming acquainted with such devices while a student.

The last most commonly expressed work experience complement to the academics was a reinforcement of a fact that has long been identified: a co-op can define career goals.

Faculty Viewpoint

A large number of co-ops expressed the view that the classroom had no direct correlation with the realities of the work experience. This was somewhat disturbing, and prompted the question to the faculty about the purpose of the engineering curriculum. The answer could perhaps explain the attitude of the students on this crucial point, or at least offer an explanation for it.

Problems which confront the engineer are new problems of the most demanding nature brought about by an ever changing world. The faculty is concerned with teaching students to solve problems using an engineering approach. This approach means using engineering skills and techniques, and applying engineering logic and reasoning to obtain an engineering result. The courses which are taught are specifically designed to have the broadest application. A specific engineering job cannot be taught to the student. There is no feasible way to determine the engineering problems which the student will face in his career. Creativity, logic, and scientific reasoning together with engineering skills, practices, and tools are the attributes and techniques which the educator is pledged to develop within the student. The engineering curriculum is predicated upon the fact that a college education only prepares the engineer to learn and adapt. The ability to creatively apply engineering practices will ultimately determine the quality of the engineering education achieved by the student.

However broad or general the foregoing statement may be, it is the crux of the purpose behind an engineering curriculum. The curriculum is not designed, however, to acknowledge, or deal with, the practical engineering experience gained by a seasoned co-op. This fact would account for the co-op having some difficulty with correlating work experience and the classroom.

Other considerations which influence the development of an engineering curriculum should perhaps be stated here, although they are not to the point of this writer's inquiry. However, they do restrict the faculty in placing all desirable course work in the curriculum. The academic administration must schedule courses which will be completed within a definite time period. Credit hours required for a degree is a competitive number. Schools try to stay within a reasonable range of one another in courseload. Students simply will not enroll in a college which has significantly higher requirements for graduation than some similar school. There is an emphasis on preparing the student for graduate school. This fact has a strong influence upon curriculum development. The faculty also want to incorporate job flexibility into the schedule to allow the student as wide a job market as possible. It goes without saying that the guidelines of the Engineering Council for Professional Development are foremost. All of the foregoing considerations restrict the administration in developing a curriculum specific enough to please the individual professor or the individual student. There is an on-going debate among the academicians as to the effectiveness of the curriculum.

Employer Viewpoint

In attempting to answer the question put to the faculty as to the purpose of the curriculum, one is led naturally to consider whether the co-op student is adequately prepared for work assignments by the typical engineering coursework. Discussions with a number of U.T. co-op employers revealed that most employers need students to have completed the introductory engineering courses before successfully using the student in engineering related co-op assignments. Some math, basic statics, graphics, and perhaps chemistry are the minimum classroom work usually required., Some computer knowledge is of increasing importance to employers. The success of a co-op program for an employer depends almost entirely upon the ability to adapt work assignments appropriate to the level of the student, and the enthusiastic willingness to work with and develop the young student's skills.

Industry participates in cooperative education to secure "hand trained" graduates. Of equal importance to them is the fact that they are contributing to the excellence of engineering education, and many employers hire co-ops in greater numbers than they can reasonably be expected to hire as graduates.

Summary

The co-op student enthusiastically endorses cooperative education. The opportunity to gain practical knowledge of his profession and to develop professional traits and attitudes during the school years is fully appreciated. He does not by the end of the junior year realize coursework, generally, to have a significant correlation to the work experience. He will find, however, that the senior year will deal with many specific skills with which he has become acquainted on his work assignments.

The engineering administration must develop an engineering curriculum which will address the needs of the entire engineering student body. The curriculum is not geared specifically in the early years to recognize the practical engineering skills developing in the co-op through the progressive work assignments. This situation causes the co-op student to have a unique advantage over the non-co-op which the faculty clearly recognize.

The co-op employer's conscientious selection of assignments gives the student the opportunity to comprehend broad applications of his education, and allows the co-op to benefit an employer at graduation with highly developed pratical engineering skills.

The results of the survey confirms that the student, the educator and the employer participate in cooperative education because it is both self-serving, and at the same time mutually contributory to all three participants.

JUNE Q. MOORE

Attended the University of Tennessee, 1950-52

Employment:

The University of Tennessee
Engineering Experiment Station, 1960-67
Secretary

Office of the Dean of Engineering, 1967-74
College Bookkeeper

Cooperative Engineering Program, 1974-present
Assistant Coordinator

Memberships:

American Society for Engineering Education
Tennessee Cooperative Education Association

THE STUDENT, THE PROFESSOR AND INDUSTRY — ALL WIN IN THIS EXPERIENCE

CEDRSEE

RWI

San Diego

Santiago Chuck
Dean of Engineering
Monterrey Institute of Technology
Monterrey, Mexico

The experiential learning program to be described is concerned with an institutional effort that has been going on for some years aimed at coupling the university's role and that of the production and service sector with the expectancy of increasing the quality of the teaching-learning process and of the performance of graduates in industry.

One important point to keep in mind is that this program has evolved in a media with characteristics which, in some cases, may prevent its indiscriminated transfer to other ones. Nevertheless, it is hoped that the immense majority of the comments may find an echo.

The Engineering Practice School (EPS) at the Instituto Tecnológico de Monterrey is an educational method in which a group of 8 to 12 students, under the advise of one or more professors, intern themselves in a manufacturing or service industry to define, solve problems and, when possible, implement solutions to projects of mutual interest to the industry and to the group, resulting in improvements in processes, products and/or services.

IDENTIFICATION OF NEEDS:

It is felt that one of the reasons the program has continued to operate is due to the proper identification of needs. Following is a representative list of these needs:

Institutional needs:

Output indices which pretend to measure the quality of the educational process are very scarce.

There are too few innovative methods aimed at developing social and professional skills in students and professors.

The educational process must relate itself to the productive and service sectors.

Upgrading the image that graduates and professors have in society is a continuous process.

Students' needs:

Graduates should be able to do engineering work immediately upon graduation and also have the capability of going on to graduate work.

Students are extremely eager for "real world" experience.

Graduates should be able to become researchers and university professors; besides being engineers.

Professors' needs:

A planned effort to improve the teaching process must consider abilities developed in engineering practice.

There is a strong desire to evaluate oneself with respect to the ability to perform engineering practice.

The main activity is teaching, thus the lack of sufficient research must be compensated.

The faculty is predominantly young, mostly with graduate work experience and hardly no industrial experience.

Industries' needs:

Production or service activities predominate greatly over development, and this, over research.

Production technology predominates significantly over engineering technology.

Engineering "know-how" is brought in from abroad thus resulting in a weak engineering infrastructure.

Continuing education efforts are limited.

Most good engineers have become or are becoming managers.

There are always more problems that can be solved.

Once having developed a feeling for the areas where improvements are needed, it was felt that a corresponding feeling should be developed with respect to a view of the university's role in the future.

PROSPECTIVE:

It appears as though the rate of change of things will continue to form part of the conditions under which evolution will keep on taking place, thus shadowing the boundaries between the different stages of the process.

So it is felt that the university will be called upon to integrate itself, to a greater degree, to the working environment; to catalyze the integration of technological, economical, political and societal efforts, harmoniously.

> It will thus become increasingly difficult to contain persons in an embryonic stage; to isolate this human energy from more involvement, from more active integration to societal struggles; to the shaping of society.
>
> The need for personal satisfaction will be a greater one; to contribute, to achieve, to be rewarded.
>
> Another challenge to be met lies in society's influence on technology which will be felt strongly through the types and amounts of products and services which can be marketed in a complicated array of value systems.

With this general view of what the future could look like, it appears logical to present the steps being taken at the moment to move from the present situation to the future one.

GENERAL OBJECTIVES:

The general objectives may be classified as process objectives, those that extend beyond the experience period, and as product objectives, those which are terminal.

In the process category there are the learning objective and the development objective. In the product one there is the service objective.

Process:

Learning objective: To obtain solutions, that meet engineering standards, to problems imbedded in a working environment, exercising social and professional skills.

Development objective: To develop the ability to manage the learning process while obtaining solutions to problems in a "real world" environment.

Product:

Service objective: To obtain client satisfaction via the proposed solutions to the stated problems.

To reach these objectives there exist institutional policies and procedures which thread the routes.

POLICIES AND PROCEDURES:

The policies refer to students, professors and industry; the procedures to recruitment, selection, training, operation and evaluation.

Student

recruitment: publicity, personal contact, EPS image, academic credits.

selection: academic performance, skills, semester level.

training: types of problems, know the professor, the industry and the group.

operation: working norms.

evaluation: solution, skill performance.

Professor

recruitment: personal desire, persuasion, rewards.

selection: academic performance (student rating and quality of extension work), personal development program, institutional objectives.

training: group management, problem definition, solution planning, reporting, integration of experience to the classroom.

operation: working norms, deadlines, closure.

evaluation: skill development, client satisfaction.

Industry

recruitment: personal promotion, EPS image.

selection: previous EPS experience, interest shown, types of problems presented, reputation.

training: problem statement, interaction with the professor, interaction with the student, contract statements.

operation: working space, support resources (economic, material, human), information exchange.

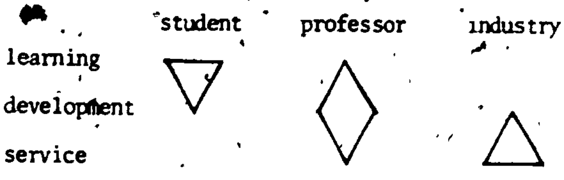
evaluation: degree and quality of support, destination given to the proposed solutions, general attitude towards the program.

In order to insure that the program stays in the right track and is accomplished at the right time, there are priorities and programs.

PRIORITIES AND PROGRAMS:

The priorities are looked upon from the point of view of the student, the professor and the industry with respect to objectives, activities and time.

Objective Priorities:



Program Priorities:

		student	professor	industry
	willing client			o
	willing professor		o	
	willing students	o		
n_{-2}	stated problems		o	o
n_{-1}	group integration	o	o	
n_0	execution	o	o	o
n_1	results	o	o	o
n_2	closure		o	o
	carry-over		o	

The learning objective predominates in the student, the development one in the professor and the service one in industry.

The execution activity must start at a given point in time which sets minimum times for group integration and this one in turn for the statement of the problems. The final results must be reported at a given time and there is a limit to closure. The elapsed time between execution and results is 6 weeks.

Functions and responsibilities are required in order to implement the program, thus a certain degree of organization is needed.

ORGANIZATION:

Functions and responsibilities must be performed by the students, by the professor, by industry and by the administration.

Student

The student must perform the following functions:

- Do a diagnosis to identify the client's real problem.
- Seek, locate, and analyze information relevant to the problem.
- Manage his activities to obtain results taking into account existing time and resource limitations.
- Analyze, create and evaluate alternative solutions to the problems.
- Prepare and present written and oral reports.
- Sell his ideas via the proposed solutions.

It is expected that the student, while performing the above functions, develop and apply social and professional skills such as:

Social skills;

1. discipline and order,
2. self confidence,
3. responsibility,
4. decision making,
5. work capacity,
6. human behavior awareness,
7. creativity and innovation.

Professional skills;

a. engineering knowledge,
b. engineering judgement,
c. acceptance of challenge and new situations,
d. analysis, synthesis and evaluation,
e. economic criteria.

For example, to perform the function of analyzing, creating and evaluating alternative solutions to the problem he must develop and apply mainly 2, 3, 4, 5, 6, 7, a, b, c, d, e. All of these functions must be performed within an ethical framework.

Professor -

The professor should do the following:

- Promote the sale of the EPS.
- Submit himself to the training program.
- Define, jointly with the industry, the project to be worked on.
- Advise the students on the definition of the problems.
- Integrate the working group.
- Design, jointly with the industry, the work program.
- Manage the activities leading towards obtaining results.
- Advise on partial reports and edit the final one.
- Evaluate the students.
- Advise on the implementation of the proposed solutions.
- Integrate the experience to the classroom.
- Follow up activities with industry

It is understood that while performing the above functions the professor must put in practice the same social and professional skills as do the students.

Industry -

The industry must:

- Define, jointly with the professor, the project to be worked on.
- Contract the problems to be solved.
- Accept a work program and name their representative.
- Provide an induction program for the student and the professor.
- Provide resource support and information.
- Evaluate the partial reports.
- Decide on the proposed solutions.

- Associate dean for research -

The associate dean for research is in charge of the overall planning, coordination, operation and control.

The specific functions are:

- Organizational planning, promotion and publicity.
- Proposal writing and contracts.
- Student insurance, registration and payment.
- Organize the training program.
- Design the budget.
- Supervise the accounting.
- Visit the groups periodically.
- Provide support services (copies, paper, etc.)
- Expedite receipt collection from industry.
- Expedite professor's payments.
- Follow-up activities with industry.

Department chairman -

The department chairman is directly responsible for the performance of each professor with respect to his own development, to the service rendered to the student and to the service rendered to the industry. In particular, the functions are:

- Service planning and promotion.
- Planning the training program.
- Project definition.
- Know the project's evolution.
- Know the project's results.
- Professor evaluation.
- Follow-up activities with industry.
- Follow-up activities with professors.

Curriculum directors -

The curriculum directors are responsible for the activities related directly with the students, such as:

- Academic planning.
- Student recruitment and selection.
- Group integration.
- Project selection.
- Know the project's results.
- Follow-up activities with industry.
- Follow-up activities with students.

The administrative models for the operation of an EPS vary according to the professor's experience and availability, the number of EPSs contracted and the institutional objectives. Six models have been put into operation. The models are:

1. One professor and one EPS; recommended when:
   a. The professor has directed an EPS before.
   b. The professor has over 2 years academic experience.
   c. The professor has experience in direction and/or execution of projects,
2. Two professors and one EPS; recommended when:
   a. Two professors desire to participate half of the time simultaneously, and
      i. the two work under close and coordinated collaboration,
      ii. at least one professor possesses the characteristics mentioned in Model 1,
      iii. the two are responsible for all of the projects of the EPS.
   b. Two professors desire to participate one during the first half of the period and the other during the latter part, and
      i. the two possess the characteristics mentioned in Model 1,
      ii. there is a week between periods when both work simultaneously,
      iii. the preparation and presentation of the reports are the responsibility of both.
3. Two professors and two EPS's in which the first are interchangeable; recommended when:
   a. one professor meets the requirements of Model 1,
   b. both professors show ability for mutual collaboration,
   c. both professors are responsible for both EPSs.
4. One professor and a graduate student manage one EPS; recommended when the professor is Model 1 type and the student is an outstanding one.
5. One professor manages "n" professors who in turn manage "n" EPSs; recommended when the one professor is of Model 1 type. The coordinating professor advises the inexperienced professors and supervises that quality standards are met. Each of the professors is responsible for the report of his respective EPS.
6. Three professors and two EPSs; recommended when at least one professor possesses the characteristics of Model 1.
   In this case, the three professors are responsible for both EPS's.

RESULTS:

During the 10 years this program has been in operation, 80 EPSs have been held in manufacturing and service industries in Mexico and one in Guatemala. These have been in Architecture, Civil, Mechanical, Chemical, Electrical and Industrial Engineering.

The following table shows data for the last 5 summers:

Year	No. of EPS	No. of Students	% of Graduates
73	6	70	26
74	6	71	26
75	10	124	35
76	14	150	32
77	23	246	50

Three fourths of the EPSs have been held during this period and also the greatest impact on graduates has ocurred here. The number of professors that have participated exceed the number of EPSs held in any particular period by no more than three.

Type of proyects:

The types of projects that have been worked on vary greatly in nature, difficulty, degree of creativity and innovation required and implementation characteristics. A sample of these projects are:

- design of civic, recreational, residential and tourist developments;
- analysis and design of elements and structures;
- mechanical analysis of elements in a system;
- design of an automatic conveyor;
- process optimization;
- waste recovery;
- computer interface design;
- simulation of a control system via a digital computer;
- localization of new hospitals;
- reassignment of users to clinics;
- teller's cash limits;
- optimization model of financial investment in a bank;
- production process planning and control;
- optimization of product mix, transport routes;
- engineering economy studies.

In the order of 50 percent of the projects have been concerned with production, optimization and engineering economy problems.

Learning objective:

The accomplishment of the learning objective is based on unstructured opinions from students.

They have stated living the experience of:

- relating and unrelating theory to practice;
- living tomorrow now;
- human interaction in practice;
- defining a real problem;
- obtaining relevant information;
- solving a real problem;
- getting to know myself;
- doing engineering work;
- applying my innovation ability;
- not being afraid of the "real world";
- meeting a challenge and reacting positively to it;
- valuing experience.

Some insatisfactions have also been mentioned such as too short a time to solve the problems and the lack of complete knowledge as to what the industry does with the proposed solutions.

It can be concluded that solutions are being obtained to "real problems"; they are meeting engineering standards (both of these based on the knowledge that solutions are being implemented) and the students become aware of the skills needed in engineering practice. Also, rather than developing skills, it is a measure of the effectiveness of the learning process of the engineering education service; it is a performance index.

Development objective:

The measure of success in the attainment of the development objective is based primarily on the professor's and also on the department chairman's opinion. Professors have said they experienced:

- becoming aware of the abilities of our future graduates;
- observing industrial people change positively their ideas with respect to academicians;
- relating to people in the industrial environment;
- solving engineering problems in the "real world";
- exercising managerial abilities;
- relating theory to practice;
- becoming aware of the importance of human relations;
- feeling closer to the students;
- a positive change in activity;
- the demands the industrial environment makes on engineers.

Department chairmen have said they:

- observe professors more self-confident;
- see them more motivated towards their work;
- perceive a greater acceptance of challenge and new situations;

- have increased their capacity for decision making.

Within the whole context of this experience, professors have felt some of their expectancies were not met, such as:

- some projects do not turn out as challenging as they first appeared to be;
- there is limited access to upper level management thus having to rely on a chain impact of the work performed;
- it is hard to correctly estimate the time table;
- there is an inherent limitation imposed by the time span to get to the bottom of each problem.

It has been concluded that the learning process is being managed effectively, judged by the student's opinion and the degree of learning the professor obtains. The proposed solutions to the problems are being implemented, judged by the continuing contact with industry and by the consulting activities that have resulted.

Service objective:

Clients have manifested, in various ways, their feelings with respect to the program. In general, the positive ones have been quite clear, such as:

- the problems were solved to our satisfaction;
- we managed to recruit personnel;
- it was an economical service compared to the results obtained;
- problems were approached which otherwise would require a great programming effort.

Others have stated that they have had the opportunity to:

- familiarize the student with the company's products;
- familiarize the engineers in industry with new techniques, methods and knowledge;
- collaborate with the institute.

There have been three cases in which a certain degree of insatisfaction has been perceived but, unfortunately, it has not been possible to determine if it was due to the results obtained, to the way the program was operated or to the professor's conduct. In one of these cases, it took six years before another EPS was held in that same industry. Two had been held there previously.

The conclusions after these years of experience are that clients have implemented, in an overwhelming majority, the proposed solutions. Old clients clearly prevail over new ones. Some EPSs are contracted with one year in advance and there is a growing pressure by industry to run the program during the semester. In general, the requests for service exceed the offer of EPSs and this has occurred even in years of economic struggle.

Secondary results:

Other secondary effects have ocurred. Certain myths that have found their roots in academia in our environment have sort of dried up, such as:

- young professors are in academia because they cannot do engineering work;
- industry will never provide access to important problems;
- engineering graduates have quite limited ability to do engineering work;
- in order to work on industrial problems as a consultant one must be an expert (have many years of experience).

FUTURE:

In order for the university to integrate itself to the working environment to a greater degree, certain changes are visualized.

- The types of problems will tend to go from engineering to development to research (EDR) with increasing economical, political and societal impacts.
- A greater balance between manufacturing and service industries will find its way into the program.
- More teams with multidisciplinary characteristics will emerge, not being composed all of engineers.
- Increasing time will be devoted to this type of learning in the curriculum.
- 80% of the graduates and also of the engineering faculty who experience this activity should be the goal.
- The EPSs will increasingly be held in a greater variety of geographically located industrial centers.
- An increase in simulated experiential learning emanating from authentic involvement activities will find its way into the classroom via case studies.
- There will be an increased involvement in solution implementation by students and professors through greater extension of time devoted to this activity.
- There will also be an increased involvement in solution implementation through consulting activities of professors.
- University industries where students and professors participate directly will be created.

SANTIAGO E. CHUCK

At the Instituto Tecnológico de Monterrey

Dean of Engineering and Architecture 1975-

Project Director for Off-Monterrey Campuses in Central Mexico 1973-1975

Professor and Chairman Chemical Engineering 1967-1973

M.S. Gas Engineering, Illinois Institute of Technology 1966

B.S. Petroleum and Natural Gas Engineering A & I University 1963

INTERNATIONAL EXCHANGE COOPERATIVE EDUCATION, EDUCATION FOR TOMORROW — THE CHALLENGE FOR TODAY

William R. Smith
Professor
Illinois Institute of Technology
Chicago, Illinois

Herman Schneider in 1906 at the University of Cincinnati began a program which made real life experience the laboratory wherein students could apply their learning to activities which reinforced their education. They learned by doing. Today the real life world into which our students go is one using highly sophisticated technology. To identify the change from the time of Herman Schneider, one must move from the horse and buggy to the SST. In communication, we change from telegram and written documents to satellite TV which puts action world-wide into our living rooms. We see events through our eyes and interpret them from within our cultural perspective. Other peoples do likewise from their cultural reality. The result is like unto the tale of the seven blind men reporting upon the reality of an elephant from their observations. Can we in cooperative education provide sight for today's 'blind' men?

Ortega y Gasset in "Revolt of the Masses" foresaw the problems in change in culture with the coming of mass communication, mass consumption, mass production, mass entertainment, mass education and was concerned with its impact on culture through the levelling of society to the least common denominator. He did not concern himself with the problems of communication, the misunderstanding which would come with the shrinkage of the world in time and distance, as he did not foresee the impact of television and air transportation at the speed of sound. He did concern himself with the problem which society would face in providing a system to produce the creative, innovative individuals capable of leading society forward. We seem to have succeeded in the areas of technology. Today the press is highlighting the lack of similar success in communicative skills. The ethical fabric of our society is likewise being questioned. What can industry and academe do to help remedy these deficiencies? Can Cooperative Education provide the system required to answer this need?

Concern about change and rate of change was focused by "Future Shock". Just as plans were being implemented to assist in handling this problem, energy and resource scarcity may have slowed rate of change or redirected the impact of "Future Shock".

Leaders of the industrial complex are looking at the societal responsibilities of the private sector. Reginald H. Jones[1], Chairman and Chief Executive Officer, General Electric Company stated "Real strategic planning involves a careful, analytical examination of all the major factors that enter into the business process - and the external factors are probably of greater importance than the traditional internal factors. Social obstacles, political constraints, and competitive counterpressures must be anticipated. Issues must be surfaced. Alternative futures must be imaginatively constructed. Alternative plans must be prepared to match the contingencies. And hard choices must be made, because investments made today will determine the character of the enterprise for years to come."

Educators are examining the content of curricula to improve the education of future graduates. Can Cooperative Education provide some program modification to help in meeting the needs of the industrial and trading society which is rapidly developing at the international level?

One system is proposed and identified by the acronym IECEP - International Exchange Cooperative Education Program. The concept is one which is cooperative in the traditional sense of Industry, Education, Student. It is additionally cooperative in that program success will require cooperation between educational institutions, cooperation between operations within the business organization, and cooperation between governments.

The guidelines[2] of ECPD (Appendix A) will be used to define the professional level of this program and will influence the design and implementation of IECEP (Chart 1).

This treatise deals with the organizational structure of IECEP, its program elements, the time requirements, and the scheduling of the program elements. Some potential benefits to each party of the traditional coop triangle beyond the usual benefits will be considered as well as responsibilities and possible problems. Finally, an assessment of costs and return on investment will be examined.

IECEP was conceived as a follow-on of the program initiated by the Office of Cooperative Education at Illinois Institute of Technology and initially funded by a coop expansion grant from the U.S. Office of Education, Department of Health, Education and Welfare. This program known as 'Early Identification of Minorities with Potential for Success in Engineering' but popularly shortened to 'The IIT Early Identification Program'.[3]

The success of this program has been dependent upon a total delivery system operating through an eighteen month period. The purpose is to make the high school student aware of a challenging opportunity, to generate an awareness of the effort which is required for success, to attain a motivational commitment to complete the program, and to show alternative paths to achievement. The identification of candidates occurs during the fifth semester of high school. Initial indoctrination occurs during three Saturdays of the sixth semester of high school. Engineering principles are explained. Small teams then are assigned a mission to design, build, and test an object using the engineering principles which they had learned. During a seven to nine week summer course, selected students learn survival skills, engineering design, and develop a strong motivation base using small group dynamics. The Saturdays during the senior year of high school are used to reinforce the students in mathematics education in areas which had not previously adequately been covered in high school. Individuals admitted to Illinois Institute of Technology then went into cooperative education or received scholarships with summer internships included for work experience. It is the participation in all elements of the program with tracking of the individual throughout by a representative of the IIT staff which has made the program successful.

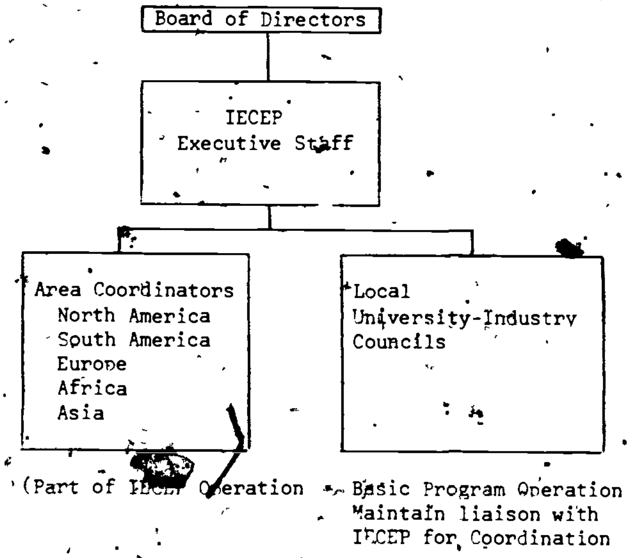
A recent development in the private sector of U.S. industry has been the structuring of companies so that the presidents or managers of divisions or product lines have become responsible for performance world-wide. This structure has continued on down to the production, engineering, and marketing managers under these general managers in that all manufacturing plants world-wide come under the production manager. Likewise, marketing and engineering functions are world-wide in operation. Examples of companies having this international structure are Continental Group, Eaton Corporation and Caterpillar Tractor Company as well as smaller organizations such as Danly Machine Company, Illinois Tool Works and Woodward Governor.

These companies are mentioned because they participate in cooperative education and have an internal structure which can facilitate the concept of IECEP. Many companies are headquartered in the United States but there are a number of operations here which have headquarters in other countries so that this program will work for other countries as well. Future managers, particulary in technically sophisticated capital intensive organizations, will be first good engineers, next good financial managers, and finally people-culturally-sensitive. IECEP will provide items one and three and the experience in coop should provide knowledge in the management of money matters.

The need for work permits by foreign nationals and the difficulty attendant with the obtaining of work permits, indicated the need for a unified development among two or more schools and several industries in order to effectively present a national need and obtain Federal backing for such an innovative program. The organization of IECEP in Chart 1 illustrates such a unified development.

Membership Categories
- Universities
- Industrial Organizations Public & Private
- Booster and Service Organizations

IECEP Incorporated Not-for-profit



ORGANIZATION CHART - CHART 1

An assumption has been made that major initial success can most easily be achieved in technologically oriented universities located in major urban industrial centers in such universities as Illinois Institute of Technology. Participation of other interested universities is invited and development will proceed as rapidly as the program can be implemented starting small and growing with experience. An organization to operate IECEP is shown on Chart 1. The anticipated input and responsibilities of each class of membership along with the internal structure and responsibilities is delineated in Appendix B.

PROGRAM ELEMENTS RELATED TO TIME REQUIREMENTS

Saturday Program	Summer Program	Work Time mos.	School Credit Hours	Time Scale	Program Elements	Description of Program Elements
				Fall	a	Identification and initial appointment
3 Sat.				Spring	b	High school 6th semester-Basic engineering project
	6 weeks			Summer	c	Engrg. project, motivational reinforcement, Career survival skills
				Fall	d	Senior year high school reinforcementtutoring in mathematics
				Spring		
		3 mo		Summer	e	Industrial selection and assignment in pre-coop work assignment
			17 hrs	Fall		
			17 hrs	Spring		
		3 mo		Summer		
			17 hrs	Fall		
		5 mo	3 hrs	Spring		
			9 hrs	Summer		
Foreign Student Saturday Seminars	12 mos.	4 mo	3 hrs	Fall	f	50 Saturday seminars with foreign students learning about foreign cultures and possible problems and adjustments required in another land.
			17 hrs	Spring		
				Summer	g	Foreign assignment for fifteen months to include both industrial work and academic experience in order to gain in depth an understanding of the foreign culture to which the student is sent.
		8. mo		Fall		
			6 hrs	Spring		
		3 mo		Summer		38 Saturday seminar sessions with another group of foreign nationals helping them to understand the U.S. culture
			17 hrs	Fall	h_1	
		5 mo	3 hrs	Spring		
			9 hrs	Summer	h_2	24 Saturday sessions with a third group of foreign nationals which will complete an acquaintanceship with from thirty to sixty individuals
			17 hrs	Fall		

CHART 2

The program elements through which a student will progress from early identification in the fifth semester of high school through to graduating from college are shown. An accompanying time scale is shown in Chart 2. Any particular foreign language interests of the candidate can be identified during the selection process. An initial determination of the particular engineering discipline which the candidate will pursue can be made during the summer between the junior and senior year of high school. Program elements are described and amplified in Appendix C.

A projected implementation schedule is given in Chart 3. The various participating universities will have different rotational schedules. Some colleges operate on semesters whereas others operate on quarters. The specifics of each institutional program will require some modification of Chart 2 as well as Chart 3. These variations must be known in order to present an understandable program to foreign schools and foreign governments. One representative should speak for IECEP when there are negotiations with the federal government, the United Nations bodies and other organizations which are functioning within some areas common to the various divisions of the IECEP structure.

GOALS PROJECTED FOR FIRST PROGRAM SEQUENCE

Time Frame	Minimum Goal
May 1978	10 Schools
September 1978	10 Industries at each School
February 1979	120 Candidates at each School
June 1979	60 Students in each Program
June 1980	40 each Pre-Co-op Employees
June 1981	30 Selectees in Competition
June 1983	10 US Students in Foreign 10 Foreign Students in US
December 1985	10 US Students Graduate 10 Foreign Students Graduate

IMPLEMENTATION SCHEDULE - CHART 3

A full time staff will be required during the initial stages of development to provide for funding and to insure information services such as keeping records of all program participants, publication of periodic reports and newsletters to all participants. Specific information will be needed by all members and by financial donors. The staff must provide the feed-back needed for a successful program. Evaluation of programs at the individual schools must be made and good development ideas should be shared with other universities.

A verbal survey by the author indicates that a number of competent individuals active in cooperative education, both from industry and from education who are about to retire or have recently retired, are interested in working in this program for a nominal retainer plus expenses. Overhead should be kept at a minimum under these circumstances. It appears that the program can succeed with an effective bootstrap operation.

The impact of IECEP when fully operational, must be considered. As students enter this program, what will be the impact on the image of the typical "introverted engineer whose interests are in things and physical phenomena"? What changes must be made in course presentation and in curriculum to meet the needs of this new sophisticated technical student who is equally interested in the ethical, societal, and cultural impact of his action within his profession?

On a broader base, is society ready for a Global Citizen? Can society afford not to refine its human resources to provide more than a geographically limited specific product oriented specialist? R. C. Krone[4], Corporate Vice President, Personnel, McDonnell Douglas, observed "Personnel staffs have had to serve companies that were growing and divesting, diversifying and consolidating, going overseas, and facing threats to their home markets, often all at the same time. The average company work force has become more diverse in terms of cultural background, interests, aspirations, and expectations." He later continues, "We have set up very detailed, carefully designed inventory control systems for our raw materials, parts and processes, etc. But in the past, we have not paid much attention to the one asset most vital to us - our personnel. I believe those days are past because of the strengthened awareness now of the value of the human resources of our enterprise."

One may question the cost of such a program as IECEP. A recent figure of the Welfare Budget was quoted as $5[illegible],000,000,000. What expenditure is too much to support an organization dedicated to the development of human resources prepared to meet the future needs. What amount should be spent to prepare the human resource to provide jobs for many now on welfare?

IECEP is proposed as an answer for Reginald H. Jones in his address, Meeting the Future Unsurprised. "Managers of the future will have to feel comfortable in the world of ideas, well-read, articulate, and capable of relating their business responsibilities to the wider stream of human experience". "Business management today is in need of thoughtful, analytical, and creative academic research to guide its efforts in adapting to a world economy whose shape is at present only dimly seen."

International exchange cooperative education - a system of education designed to prepare the technical leaders of tomorrow. The challenge today is to commit today for education for tomorrow.

APPENDIX A

Criteria for Coop Education Program

Cooperative education is many things to many people. The definition which is used in this discussion is that recommended by ASEE-CED for use as a basis for evaluation of coop programs during accredition inspections by ECPD. The criteria reported by Alvah Borman are listed:

1. The institution should, in an official publication, identify the cooperative education program and the requirements which must be fulfilled by the students who enter and complete the program.
2. The institution must maintain a formalized alternation of periods of full-time work experiences of approximately equal length during the alternation phase.
3. The program must include at least one year of institution-supervised work experiences in several industrial periods for engineering and engineering technology programs for the baccalaurate degree and six months for the associate degree.
4. Admission of students to cooperative education programs must be the responsibility of the

educational institution.

5. The student must be enrolled in the co-op program during the periods of employment and evidence of cooperative education participation, progress, and employer evaluation of the student must be a matter of permanent institutional record.

6. There should be a productive academic relationship between the faculty of the college and the group supervising the experience periods of the co-op student. This is usually interpreted as meaning that coordinators should have faculty appointments and participate in academic affairs.

7. The institution should conduct an orientation of students prior to placement of the student in industry.

8. Work assignments should be related to academic and career goals.

9. Provision should be made for progressively more responsible positions and increase in quality of work experiences.

10. Work experiences should be coordinated with academic progress by the institution as to content, direction and quality. This involves periodic visits to employers by institutional representatives.

11. Participating employers should designate a representative to be responsible for the cooperative education program.

12. Coordinators at the education institution should keep the students informed of the evaluation of their work experiences and performance.

13. There should be evidence of marked commitment on the part of the sponsoring institution, on the part of the participating employers an on-going relationship within the cooperative education framework. The cooperative work experience period should be much more than incidental employment - it should be a part of an industrial training activity, recognized as an acceptable part of a professional employee development program.

APPENDIX B

Input and Responsibilities Which May Be of Each Class of Membership in IECEP Are Noted

A. Universities

1. Develop industrial commitment within the urban center in which the university is located.

2. Establish the initial contact with local high schools and perform the initial screening and selection of candidates for the program.

3. Coordinate and conduct the various program elements at the local level.

4. Advise IECEP headquarters staff of the name of the individual responsible for the local program.

5. Local representatives keep IECEP staff informed of local program status.

6. At time that an individual company has employed its first program participant establish liaison through IECEP headquarters with the foreign university in which student will take the foreign academic program.

B. Industry - Private and Public

1. Commit to employ a pair of students in the program of cooperative education. One student will be employed in the United States and the other member of the pair being concurrently employed at a foreign location.

2. Inform the local educational institutions and IECEP headquarters staff of the identity of the students and schools involved.

3. Select the pre-coop candidates and make final selection of the student and alternate for foreign assignment.

4. Appoint individual responsible for operation of the local coop work assignment.

C. Service and Booster Organizations

1. National headquarters will work with IECEP staff to provide and establish communication channels with local chapters of the organization.

2. Local chapters of the booster or service organization help IECEP coordinator to locate housing and community acceptance of the foreign student. Members of the local chapter can assist the student to learn of customs, history, ethics, and other cultural activities which will increase the understanding and inter-cultural communication abilities of the student.

3. Assist publicizing the IECEP programs within the local community.

D. IECEP Headquarters

1. Assist in coordination between academic institutions.

2. Provide a representative in each major geographic area who will inspect and evaluate the individual programs.

3. Coordinate travel arrangements so that individuals making overseas travel might take advantage of charter fares.

4. Evaluate program operation at individual institutions to improve quality and effectiveness of program.

5. Suggest possible solutions to problems which arise in program operation.

6. Maintain liaison with national service and booster organizations.

7. Publish periodic news bulletins on program operations.

8. Provide central liaison with U.S. Government and appropriate U.N. bodies.

9. Assist in funds development for the local university participating in IECEP.

10. Prepare program guides and standard public relations materials.

11. Assist in emergency action as needed for student assistance when in foreign experience.

12. Provide arrangements for group medical, travel, liability, etc. insurance.

13. Coordinate work permits.

14. Other responsibilities as program needs indicate.

APPENDIX C

Program Elements as Noted on Chart 2

A. Identification and initial appointment

The university, with the help of the local industrial council, will publicize the existence of the program in the high schools. Recommendations of high school teachers and counselors, applications from interested students and candidates that otherwise come to the attention of the screening committee will be reviewed for final selection.

Items which may be included in the final IECEP action are:

1. High scholarship
2. Participation in extra-curricular activities
3. Shows leadership potential
4. Has two years of mathematics and one year of science
5. Has good language skills
6. Evidence of good ethical standards
7. Evince traits of perseverance, self-discipline, intelligence, integrity, skills, steadfastness, tact, guts, etc.

Number recommended for initial appointment is twelve per company committed to the alternation of one team of exchange students.

B. Spring program is to determine the aptitude and interest of the student in engineering. It provides the school representative an opportunity to learn more about the student and help in further screening. Estimated cost is $5,000/120 candidates = $40/student.

C. The summer program between the junior and senior year of high school is to provide motivational reinforcement coupled with indoctrination into the total program concept. The summer experience is also to develop the individual commitment required for completion of the program. The design of the program is to encourage initiative, innovative thinking, budget concepts, interpersonal sensitivity. This program is the students program.
A type program of six weeks would include items such as:

1st Week

Program orientation; organization of group structure for [illegible] summer: develop an understanding of th[illegible]nference technique and the methods [illegible]e leadership; develop insight as to how one sees and interprets what one sees: begin to look at skills and interest for life-time career; determine values one has; setting goals immediate and long-range; expanding options: program evaluation by students.

2nd Week

Toastmasters sessions for appreciation of speaking skills; analyze study skills such as note taking, listening, report writing, test taking, review, etc: learn of information sources; have foreign consulate representatives speak; consider succeeding in spite of barriers; develop cultural sensitivity as "The Silent Language" Edward Hall; phone power - how to sell and answer objectives: visit industrial operations; program evaluation by students.

3rd Week

Practice interviews to develop interviewing skills; creating futures; study of international organizations and their functions; perform investigative reporting; learn more of engineering by visiting various campus engineering faculty; visiting industrial operations to learn more about engineering applications: visiting international banks and learn about national and international monetary operations; presentations from functioning engineers about their careers: program review and feed-back by students.

4th Week

Continue with the development of the knowledge of the students concerning the degree to which each one can impact his or her future growth and development - Begin practice interviews.

5th Week

An engineering project will be assigned. The first two days will be used in study of the principles which will be used. One day will be needed in the calculation and design of a project such as a recoverable rocket. One day will be used to build the object assigned. The final day will be devoted to testing the object built.

6th Week

Interviews with the companies on campus. A tentative selection of six students per company will be made but no results published. Two days will be used to prepare an exhibit to be viewed by parents on Awards Night. Some time during the six weeks, students should be tested to determine mathematics and english achievement levels. Other tests such as spatial visualization, etc. should be administered.

All students will be employed for about four or five weeks to gain insight into the business world. The selection will be mutually determined by the student and the companies.

It is recommended that the Friday before the start of the summer program, the parents of the participating students will be called in and given an orientation of the summer program. Midsummer the parents should be again assembled to receive a status report. The parents will again be together on Awards Night. The parent involvement is an important reinforcement for the student in future career development and foreign assignment or in case of failure to be selected.

D. Fourteen Saturdays during senior year of high school. These Saturday sessions will be used to provide tutoring to remove any areas of weakness in mathematics achievement.

E. Initial Summer Work Experiences. Admission to college should have been accomplished. Experience indicates that six or less of each original ten will be admitted and come to the university. All admitted students should be employed by one of the participating companies.

During the summer, about two hours in each two weeks should be used for company orientation to include information concerning the foreign operation to which the exchange coop to be selected will be assigned. By the start of the first coop work period, three students should have been chosen for each foreign assignment.

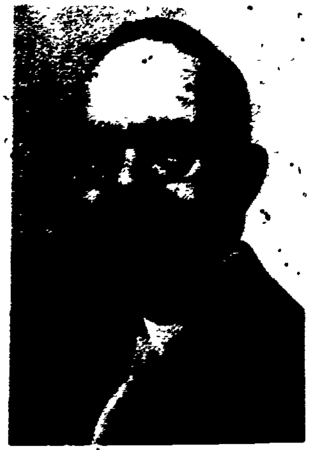
F. The selectee and alternate will begin to attend the foreign student Saturday seminars. These seminars will be run by the students with each student reporting on the home country labor laws, customs, educational system, standards making procedures, monetary system, history, governmental organization, national policy, defense system, etc. Foreign students can meet and discuss problems in adjusting to the United States culture and customs. Group plant tours may be conducted during some evenings. Individuals should be asked to speak to local Kiwanis, Rotary, and Lions Clubs. The group can attend meetings of county boards, city councils and park districts as well as be spectators in judicial proceedings to provide insight into the working of United States society.

G. Foreign Experience. The two students of the exchange team move to the other country. The initial assignment will involve eight months work, then three or four months school, followed by two or three months more of work experience, then home. Foreign cultures may have two or more strata of society with the work culture being rather markedly different from the academic culture. Therefore, both environments should be sampled for better understanding of the total culture.

H. Further seminar participation at home with a new group of foreign students for thirty six sessions and a third group of foreign nationals for twenty four weeks to complete the fifteen months will result in each exchange coop having been exposed to thirty to sixty foreign students in residence in the United States of America. In addition to these, the students will have had his many contacts overseas.

BIBLIOGRAPHY:

1. An Executive Speech Reprint, "Meeting the Future Unsurprised", Reginald H. Jones, Chairman and CEO, General Electric Company, April, 1977.
2. "Academic Accreditation of Cooperative Education," Alvah Borman, CIEC Proceedings 1977.
3. "Minorities in Engineering Programs, Second Annual Report", September 1, 1976, Illinois Institute of Technology.
4. "Changes in the Personnel Function", R. C. Krone, Corporate Vice President, Personnel, Technical Idea Exchange, September, 1977.



WILLIAM R. SMITH

W.R.Smith, BS Ch E Purdue Univ. '37, PE, Col. AUS (Ret), Logistician. Mr. Smith was with International Harvester Company 1941-60. The last four years he served as Manager of Training and Public Relations at the Farm Equipment Research and Engineering Center. In 1960 he became Dir. of Coop. Educ. at IIT and in 1966 also became responsible for centralized placement. He was Executive Secretary for the Natl. Conf. on Fluid Power 1961-1976. He conceived of and in 1973 initiated the Early Identification of Minorities in Engineering at IIT. He is a member of the ANSI B-93 Committee and ISO TC-131 USTAG Committee. He is on the Board of Directors of several small businesses. He is one of the founders of the Illinois Wisconsin Cooperative Education Council, helped to organize the Chicago Government College Relations Council, and is active in placement activities. He is a member of ASEE, MCPA, and IGPA.

SESSION 7.2

DEVELOPMENTS AND TRENDS IN FOUR-YEAR ENGINEERING TECHNOLOGY PROGRAMS

Samuel L. Pritchett
Head, Mechanical Engineering Technology
Purdue University
West Lafayette, Indiana

Four nationally known leaders in Engineering Technology Education will give a fifteen minute talk that will present the facts and figures to support the developments and show the trends in Engineering Technology Education in their region of the United States. To insure a common structure and content of both the paper and the presentation each presentor has surveyed those educational institutions in his region that offer one or more Bachelor of Engineering Technology programs. The questionnaire was divided into five major areas of concern: administration, funding, faculty, students, and student placement and follow-up.

Each speaker will give a fifteen minute presentation; after which the session chairman will mediate a panel to answer questions from the audience.

SAMUEL L. PRITCHETT

Sam is Professor and Head of the Department of Mechanical Engineering Technology at Purdue University. Sam joined the Purdue faculty in 1962 as Assistant Professor of Technical and Applied Arts in the School of Industrial Engineering. When the School of Technology was formed in 1964, Sam was appointed the Lafayette Section Chairman of the Department of Mechanical Engineering Technology, and in 1974 was appointed Head of the Department. Sam's technical interests are in fluid power and heat power and has been most active in the fluid power movement since 1964. Sam received a B.S. from Indiana State University in 1949 and an M.S. from Indiana University in 1951. He belongs to the Fluid Power Society and the American Society of Mechanical Engineers as well as several other professional and technical societies.

DEVELOPMENTS AND TRENDS IN FOUR-YEAR ENGINEERING TECHNOLOGY PROGRAMS IN THE WESTERN STATES

Winston D. Purvine
President Emeritus
Oregon Institute of Technology
Klammath Falls, Oregon

Introduction

Twenty-three four-year Engineering Technology programs were identified in the Western Region Colleges and Universities. States of location were Arizona, California, Colorado, Montana, New Mexico, Oklahoma, Oregon, Texas and Utah.

A detailed ten-page questionnaire was mailed to the 23 institutions in August, 1977. By the closing date of October 3 a total of 19 survey forms had been submitted for a gratifying return of over 82%. This unusually high response is presumed to be a reflection of the interest in Engineering Technology by educators in this field and by the engineering deans involved.

Engineering Technology educators responded in an optimistic manner to inquiries concerning future trends. A large majority anticipate enrollment to increase and placement demand to exceed bachelor graduates. They also reported placement in discipline-related positions at above 90 percent.

Four institutions reported plans to offer a Masters Degree in Engineering Technology without specifying a time schedule. Reasons for considering the programs of service varied, apparently reflecting local/regional differences.

The well-known disinclination of industry to honor educator definitions of technician, technologist and engineer was displayed. An average of 50 percent of the bachelor graduates (technologists) were found to have job titles including the noun "engineer." This negative correlation between the employer and the educator appears to be a clear trend.

Administrative Features and Programs

The returns were studied to determine if there was an administrative differentiation possible to show any significant result in program characteristics. It appeared that administrative structure differences produce no detectable trend in programs of the Western region. Nine programs were in (c) a school of engineering or (b) a school of engineering and technology. In these two structures little real difference seems to exist so we have combined them. There were ten programs as (a) separate school of technology or (e) an institution of technology only. While there are some apparent administrative differences, these did not appear to affect placement, graduate salaries, or future program expectations in a significant way (non-computer analysis).

Table 1. Administrative Structure

"How are your major technology programs structured administratively?"

	Responses
a. Part of a Separate School of Technology	7
b. Part of a School of Engineering and Technology	5
c. Part of a School of Engineering	4
d. Part of a School of Science or Applied Science	0
e. Other Technology Institution	3
Total Return	19

(a and e = 10 b and c = 9.)

There were four queries related to the interface between Engineering and Engineering Technology. The first revealed that 6 technology programs shared faculty with the engineering programs while 13 did not share. Facilities sharing was in effect between 10 engineering technology programs and engineering programs. When asked if it is desirable to share faculty, 11 responded affirmatively, while 14 felt the sharing of facilities was desirable.

The 2 + 2 Engineering Technology program with an Associate Degree awarded in the overall bachelor's schedule was found in 10 institutions. Two had a variation of the 2 + 2 program. Seven offered a 4-year program that did not include an Associate Degree as an integral part. Analysis of the program characteristics failed to show any correlation between program nature as 2 + 2 or straight four and differences in graduate salaries, placement or other factors.

On the subject of accreditation, ECPD approval of Engineering Technology was shown to be valued. Seventeen of the responding institutions had such accreditation. The other two responded that they desired ECPD accreditation.

Enrollment was reported by 17 of the 19 institutional programs. Students enrolled in 1976-77 totalled 8045 and graduates totalled 1475. Table 2 records the enrollment and graduate figures for 17 programs. In this usage a program is the total offering of an institution. The discipline instruction is shown in total for all reporting.

Table 2. Graduates and Enrollment 1976-77

Technology	Graduates	Enrollment
Electronics	669	3403
Electrical	28	231
Computer/System	16	116
Civil (and Survey)	82	586
Civil Structural	3	28
Construction	70	187
Mechanical	154	579
Manufacturing	93	508
Mechanical Power	23	147
Mechanical Design	15	118
Air Conditioning	25	70
Metallurgical	1	20
Industrial	2	14
Welding	14	57
Design (and Graphics)	22	337
Aeronautical	14	90
Fire Protection & Safety	18	174
General	151	834
Petroleum	10	134
*Miscellaneous	65	412
	1475	8045

*Bio Medical, Solar, Radiation-Nuclear and Environmental

Table 3 indicates the range of courses including required laboratories. The span ranges from below 20% to the 81 to 100% grouping.

Table 3. Required Laboratories in Courses

"Approximately what percentage of your engineering technology courses include required laboratories?"

	Range	Responses
a.	0 to 20%	1
b.	21 to 40%	3
c.	41 to 60%	1
d.	61 to 80%	9
e.	81 to 100%	5
	Total	19

Coop programs were covered: Fourteen institutions have coop. Thirteen give academic credit to students on coop. None of the institutions made coop mandatory for their students. The percentage of program students enrolled in coop ranged from 1 to 95%. The average percentage enrolled was 4 with 3 percent the median.

Few issues have raised more discussion than that of the place calculus should occupy in engineering technology. All nineteen institutions stated the use in their programs as shown in Table 4.

Table 4. Use of Calculus in Engineering Technology

	Number
a. Not required and not utilized	0
b. Required but seldom utilized	8
c. Not required but needed	0
d. Required and frequently utilized	11
Total	19

A question was directed to offering a technically-oriented Masters Degree. It was phrased "do you have, or plan to have." Four institutions affirmed plans to do so in the future. The need it will be designed to fill was listed as follows:

1. Upgrade technologists in industry.
2. Add additional interdisciplinary expertise plus additional work in the major field.
3. Computer aided manufacturing.
4. Upgrade community college teachers.

On the subject of industrial advisory committee use, 14 indicated use and 5 stated they had no such committee. The rating supplied by the 14 users appears in Table 5.

Table 5. Effectiveness Rating of Advisory Committees

"If Yes, rate their effectiveness in each of the following areas by circling a descriptor."

	Very Effective	Effective	Ineffective	Not Involved
a. Curriculum planning	0	11	0	1
b. Providing loans or scholarships	1	5	3	3
c. Providing Coop stations	0	4	4	2
d. Placement of graduates	5	7	0	0
e. Recruiting students	0	4	3	5
f. Providing equipment	2	4	4	2
g. Providing field trips or training materials	6	4	2	0
h. Providing employment for faculty	0	7	4	1

Funding

The question of financial support brought responses that were unrelated to either the type of institution as to public or private or the kind of structure in administration. Twelve replied that a recurring line in the annual budget provided for capital equipment. Yet the "one-shot non-recurring" money was reported to average 64% of capital equipment purchases but the median percentage was 90. One explanation for this is tight budgeting of equipment funds with equipment purchases being made from unexpended account balances late in the budget period. That is to say that budget balancing is one feature of practice in management of equipment outlays. Only 5 responded that the capital equipment was annually depreciated with replacement monies provided. It is regrettable that this realistic management tool is so little used but gratifying that as many as 5 have achieved this goal.

All 19 programs reported that they have funds for student assistants as paper graders, tutors, lab attendants, etc. The adequacy of such funding was not provided. Also, all 19 have a budget allocation for faculty travel. Both of these areas are difficult to assess. What is one man's adequacy is either too low or too high to some others.

The controversial point of funding equity between Engineering Technology and Engineering counterparts was included in the questionnaire. Only 15 of the 19 respondents commented. Twelve felt they received equitable funding in engineering technology. There were three who said "No." We can presume that some of the educators not responding felt a lack of comparable information.

Engineering Technology Faculty Characteristics

The first area of investigation was that of opinion of minimum educational background for ET faculty. Table 6 records the results.

Table 6. Minimum Educational Background for ET Faculty

Degree	Number
a. Ph.D.	0
b. M.S.	12
c. B.S.	6
d. A.A.S.	1
Total	19

The questionnaire asked "Do you feel that it will continue to be desirable in the future to have engineers as technology teachers?" Eighteen answered in the affirmative. The same number would have no hesitation in hiring a qualified technology graduate as a faculty member.

Less positive were the responses on professional licensure with 11 agreeing licensure was important for a technology teacher. Fifteen were positive that licensure should not be a requirement. All 19 returns gave answers on these issues.

Professional development for faculty is being required by 17 of the 19 respondents. The use of achievements in professional development is more varied as appears in Table 6 and Table 7.

Table 6. Professional Development is Required for the Following (in 17 Institutions)

Use	Number
Promotion	13
Tenure	9
Pay Raises	15

Table 7. Required Professional Development

Form		Number Using
Academic Training		13
Degree Oriented	11	
Non-Degree Oriented	5	
Industrial Work Experience		16
Summers	14	
During School Year	6	
Publishing Articles or Textbooks		6
Consulting		10
Participating in Conferences or Workshops		10
Other (Depends on Individuals)		1

Twelve programs provide paid sabbatical leaves for professional development. There are 10 allowing unpaid leaves of absence for the purpose. Only three use faculty swaps. The various provisions for professional development illustrate the concern for faculty improvement as a general attitude.

"All things considered (e.g. backgrounds, teaching loads, salaries, and promotions) do you feel that your technology faculty members are treated as fairly as engineering faculty members?" was asked. Fourteen responded "Yes" and 3 said "No."

Teaching loads were a subject of concern that brought 19 responses. University programs seemed somewhat inclined to provide lighter loads. Table 8 displays the findings on loads.

Table 8. Typical Teaching Load

(Each institution to use its own scale factor, lecture to lab)

Loads	Number
a. 12 contact hours or less	4
b. 13-16 contact hours	9
c. 17 or more contact hours	6

The interpretation of lab hours ratio to lecture hours was next requested. The range of answers shows the lack of uniformity in Table 9.

Table 9. Lab Hours in Teaching Loads

"In establishing teaching loads how do you weight labs?"

Weight	Responses
a. Same as lectures	2
b. One and one-half hours equivalent to one lecture hour	6
c. Two lab hours equivalent to one lecture hour	10
d. Less than one lab hour equivalent to one lecture hour	0
Other--three lab hours to one lecture hour	1
Total	19

Tenure appeared to be provided in 17 of the 19 respondent programs. The average percentage of temporary as opposed to tenure track was 19 with the median 15 percent. Three programs reported no "temporary" faculty. When the focus was shifted to "desirable percentage of temporary" the average preferred was 15 and the median 10 percent.

The respondents were next directed to the area of faculty recruitment. Six found it difficult to recruit temporary faculty while 13 did not. As to the recruitment of permanent faculty 5 felt it difficult and 14 did not. The problems encountered are set forth in Table 10 below.

Table 10. Hiring Problem Rankings

"Rank the following hiring problems as you have experienced them in hiring new faculty."

	Major Problem	Some Problem	No Problem
1. Candidates salary requirements	7	9	3
2. Finding candidates with correct academic background	4	8	7
3. Finding candidates with correct industrial experience	6	9	4
4. Finding candidates with a technology orientation	6	9	4
5. Candidate does not like geographic location	0	0	19

Student Characteristics

Qualifying scores were requested and produced inconclusive results since no pattern emerged. The second inquiry on student admissions was two pronged. The first resulted in the estimate that an average of 56 percent met engineering college entrance requirements, with the median at 40 percent. The second showed an average of 16 percent, a median of 10 percent, of technology students as transfers from an engineering program. Fourteen percent of headcount students are listed as part-time.

Average age of students in engineering technology was 23 years. Program enrollment of women averaged 4 percent. Minorities enrolled averaged 12 percent.

Recruiting, Retention, Placement and Follow-Up

Of all students enrolled, 69 percent were from the state of location with 31 percent out-of-state and international combined.

The "future trend expected" in enrollment showed the optimism of engineering technology educators. Five anticipated a "great increase" in the next decade. Twelve expected "some increase" a total of 17 looking for enrollment increase of some dimension. One each marked "no change" and "some decrease." There were no takers in the "great decrease" category.

The overall four-year retention rate in ET programs was estimated with the average 66 and the median 70 percent. This lead to the "discipline-related placements." Average percentage of 91 with the median at 95 percent shows the high placement in discipline-related employment. Generally, we can say that placement is an indicator of the ET program effectiveness. Not that improvement isn't needed, but such placement records are consistent with basic goals held for engineering technology. The number and percentage of placement is fine and these are reinforced by the salary levels reported. Table 11 records average placement salaries of $12,742 per annum. Starting salaries for new graduates range from $8000 to $19,000.

Table 11. ET Graduaduate Starting Salaries

Average Starting Salary	Number Reported
$10,000	1
11,000	1
11,400	1
12,000	5
12,200	1
12,900	1
13,000	3
13,200	1
13,800	1
14,000	1
14,400	1
14,700	1
15,500	1
average 12,742	Total 19
median 12,900	

The survey form asked "About what percentage of your ET graduates have 'engineer' in their first job title?" Comments range from "too many" and 2 percent to 95 percent. The average was 50 percent and the median 55 percent. This highlights an issue of controversial nature. Educators have supplied program objectives and differentiated titles for graduates and advised recruiters. Business and industry have generally paid little attention. Various internal considerations dictate the employer policy on payroll titles. The trend in consulting firms has been otherwise due to professional staff considerations.

The optimism exhibited by ET educators when addressing future enrollment trends can be based on the graduate placement situation. Experience shows that good placement leads to increased enrollment. In Table 12 the supply and demand picture is shown. There is a close correlation between future enrollment prediction and this picture.

Table 12. Placement Situation

"Check the descriptor that best describes your placement situation."

a.	Supply of grads much less than demand	10
b.	Supply of grads a little less than demand	6
c.	Supply and demand are about equal	2
d.	Supply of grads slightly exceeds demand	1
e.	Supply of grads greatly exceeds demand	0
	Total	19

In the placement effort, 18 programs state they have a formalized placement process and 17 report a formalized follow-up procedure. There are program improvement benefits from a full follow-up program and 17 of 19 utilizing this device is evidence of a good trend.

Alumni participation is a common need in college and university management, and shows up as a specific ET need as only 7 programs report active involvement by alumni. Activity seems basic to securing alumni donations as, also, seven receive such favor.

Summary

Engineering technology educators view their placement of graduates and probable enrollment expansion as evidences of success. The favorable situation in these two program areas are grounds for optimism. There are differences in administration and other organizational program aspects, but none of these seem to influence the success indicators. Various kinds of institutions and various program approaches seem to have little effect. The common ingredient--program quality--can only be judged in the area of instruction conforming to the technologist position needs of each program's placement area. Here, again, placement is the gauge to this aspect of EFFECTIVE MANAGEMENT OF HUMAN RESOURCES.

APPENDIX

Bachelor of Engineering Technology Programs by State and School, 1975-76; Western Region

(All institutions were sent questionnaire; asterisk denotes reply.)

State	Institution	City
Arizona	Arizona State Univ.	Tempe
	*Devry Institute	Phoenix
	*Northern Arizona University	Flagstaff
California	California Maritime Academy	Vallejo
	*California State Poly	Pomona
	*California Poly State University	San Luis Obispo
	*Cogswell Poly College	San Francisco
	*Northrup University	Inglewood
Colorado	*Colorado Tech. Coll.	Manitou Springs
	*Metropolitan State College	Denver
	*University of Southern Colorado	Pueblo
Montana	*Montana State Univ.	Bozeman
New Mexico	*New Mexico State University	Las Cruces
Oklahoma	*Oklahoma State University	Stillwater
Oregon	*Oregon Institute of Technology	Klamath Falls
	*Oregon State Univ.	Corvallis
Texas	*Devry Institute	Dallas
	Lamar University	Lamar University Station
	*Le Tourneau College	Longview
	Texas Tech. Univ.	Lubbock
	*University of Houston	Houston
Utah	*Brigham Young Univ.	Provo
	*Weber State College	Ogden

Founder and President of Oregon Institute of Technology 1947-1976 and is now President Emeritus. The institution was named Oregon Technical Institute until 1973. After four years in private industry joined Oregon State Department of Education in 1936. Served as Assistant State Supervisor and State Supervisor of Trade and Industrial Education to 1947. Very active in ECPD Engineering Technology accreditation and committees, ending with Chairman Region VII Engineering Technology in October, 1977. Was active in regional accreditation with the Higher Commission of the Northwest Association of Secondary and Higher Schools. Served in ASEE as Vice President and Chairman, Technical College Council and on many committees.

DEVELOPMENTS AND TRENDS IN FOUR-YEAR ENGINEERING TECHNOLOGY PROGRAMS IN THE EASTERN STATES

William F. King
Dean of Engineering Technology
Lincoln College, Northeastern University
Boston, Massachussets

Introduction

The data summarized herein is drawn from the replies of 13 Eastern institutions having a combined enrollment of 3173 students in eight technology curricula. These breakdown as follows: Electrical 1369, Mechanical 839, Civil 459, Construction 200, Environmental 147, Manufacturing 55, Biomedical 54, Industrial 50. Questionaires were mailed to 24 institutions.

Although some of the individual responses to specific questions in our survey may be surprising, on the whole, the status of the Engineering Technology programs is typical of all undergraduate career oriented programs.

There seems to be little doubt that the technology graduates are gaining acceptance in industry. The availability of technology programs provide a viable alternative for students who are technically oriented but who are not willing or unable to undertake the previously existing curricula in mathematics and physics or engineering. In most institutions, the freshman year of the technology program can serve as an excellent preparation for entering conventional science or engineering programs with the credits earned for freshman English or Liberal arts courses directly transferrable.

Administrative Features

About half of the programs are administered as separate Schools of Technology with the other half as part of Schools of Engineering. As might be expected, the Technology programs which are administered as a part of a School of Engineering share their faculty with the Engineering programs. The same proportion share laboratory equipment and facilities. Similarly, those respondents who currently share faculty and facilities believe it is desirable while the others do not.

About half of the programs are on the "two plus two" format and half are currently 4 year programs. The majority of the programs are ECPD accredited, and those which are not feel that accreditation would be desirable.

None of the schools responding have, or plan to have programs leading to a technically oriented master's degree.

Three curricula details were solicited. These related to the percentage of courses which include required laboratories; the extent to which calculus is utilized; and whether the programs include cooperative work.

On the average, about half of the engineering technology courses given by the schools responding, included required laboratories. One school reported under 20% and one over 80%. One fourth of the technology curricula utilize co-operative work. All of the institutions having coop give academic credit for the work experience; however, co-operative work is mandatory in only 2 of the 13 schools reporting.

Calculus is required in all of the programs and all but one response indicated that the calculus was utilized frequently in their course work.

The final question relating to administrative features and programs concerned the use of industrial advisory committees. Eighty per cent of the schools have such committees and find them to be most useful in curriculum planning, graduate placement and providing field trips or training materials. The industrial advisory committees were least effective in providing financial assistance.

The responses to the four questions regarding funding indicate that the engineering technology programs are treated similarly both as compared to each other and to other programs in the same institution.

Twenty per cent of the programs have no recurring budget line item for capital equipment or faculty travel. Only one reply considered laboratory capital equipment adequately funded and only one other reply felt that the technology program was not funded on a basis comparable to the engineering counterpart.

Engineering Technology Faculty Characteristics

In regard to faculty characteristics, nearly all of the respondents agreed that technology faculty should have a Master of Science degree combined with several years of industrial experience. Two thirds of the responses indicated that professional licensure was important but should not be required. Two of the responses indicated reservations regarding utilizing technology graduates in faculty assignments and two did not think that continuing professional development was important. Most of the others would require continuing professional development for promotion, tenure and pay increases.

The types of continuing professional development most preferred were conferences and workshops, industrial work experience, consulting and academic training (in that order). Most institutions encourage professional development by means of paid sabbatical leaves. Unpaid leaves of absences and faculty swaps were also vehicles for development. Only one respondent felt that technology faculty were not treated as fairly as engineering faculty members in general.

Typical teaching loads were reported to be 12 hours or less, with four schools reporting 13 to 16 hours. Laboratory assignments were weighted among the several institutions such that the average ratio was 1 1/2 hours lab is considered equal to 1 hour of lecture.

About half of the administrators reported difficulty in hiring temporary faculty, this is, faculty who would not ultimately be considered for tenure. Only one third reported difficulty in recruiting permanent faculty.

The major problem areas in hiring new faculty center around salary requirements and finding candidates with a technology orientation. There are some problems in finding candidates with correct industrial experience but practically no problem in connection with geographic location.

Student Characteristics

According to the results of the survey, the average qualifying SAT math score is 500 and the average qualifying SAT verbal score is 450, with a low of 400 in both cases and highs of 575 in math and 480 verbal. Using data from institutions which supplied both enrollment data and SAT scores, the weighted average student scores were 526 math and 466 verbal.

Correlating these data was the information concerning the percentage of students who would meet criteria for entrance into engineering B.S. programs. ~~Three~~ of the eight schools who responded to this question indicated that over 80% of their engineering technology freshman would have entered B.S. programs had they chosen to do so.

The volume of transfer students averages about 14% of the student body except for schools which operate an upper division only. About 20% of technology students are part time with a low of zero in three schools and a high of 66% in one school. The average age of technology students is nominal for four-year programs given a high school graduation age of 18; although one school reported an average age of 28. This incidentally, was not the school which reported the highest percentage of part-time students. Females and minorities constitutes approximately 10% of the engineering technology student body.

Recruiting, Retention, Placement and Follow-up

A high percentage (82%) of the technology students reside in the states in which they are studying, although no data was available regarding the breakdown between dormitory and commuting students. Most respondents expect a modest increase in enrollments over the next ten years. Four years retention rates averaged 69% and 84% of the graduates are able to find program related positions. The average salary of four-year graduates is estimated to be $14,000 per year with a high of $18,000 and a low of $11,000. Sixty-one percent of the engineering technology graduates have "engineer" in their first job title.

Almost all of the reporting institutions have formalized placement processes and two thirds have a formal follow-up process. The majority of responses indicate that the supply of graduates is about equal or slightly less than the demand. No one felt that the supply greatly exceeded the demand. About half of technology program alumni participate in ongoing departmental activities and more than half contribute to alumni fund raising.

Summary

Regardless of how they were originally conceived, Engineering Technology curricula appear to be meeting a need both at the input and output sides of the process. In addition, they provide another vehicle for transmitting the fundamental benefits of an undergraduate college experience. All too frequently, students and faculty, too, overlook the general growth and development aspects of earning the first degree. We become so concerned about the intimate details of programs that we forget the broader long range goals intrinsic to the process.

The successful student must learn how to learn in order to cope with the side diversity of teaching styles. He must develop the self-discipline required to function in a relatively unsupervised setting. And, of course, we hope he acquires some skills that relate to his field of specialization.

Speaking from personal experience, the greatest confusion exists not between engineering and engineering technology but between engineering and industrial technology. The historical basis for the industrial technology degree varies, but there are very few industrial technology programs which even come close to the typical engineering technologies in terms of analytical level and technical content. Also, it is more difficult to contrast engineering and engineering technology programs where the engineering students have been exposed to co-operative work experience, particularly if an attempt is being made to highlight the applied science emphasis of the technology curriculum.

Judging from discussions with on-campus recruiters, it is clear that the awareness of industry regarding technology graduates is increasing. However, it is equally clear that it will be some time before typical job specifications will include the technology graduate in his proper place.

WILLIAM F. KING, Director of Lincoln College and Associate Dean of Engineering is responsible for both day and evening programs offered by Lincoln College. He received his B.S. and M.S. degrees in Electrical Engineering from Northeastern University and has been a member of the faculty since 1961. He is a registered professional engineer and has had industrial experience with RCA; AVCO, and Minneapolis Honeywell. His service at Northeastern includes teaching and administrative appointments in the Department of Electrical Engineering and he was an Associate Dean of Faculty prior to his present appointment. Dean King is the father of six children and enjoys photography, music, and amateur radio as hobbies.

DEVELOPMENTS AND TRENDS IN FOUR-YEAR ENGINEERING TECHNOLOGY PROGRAMS IN THE SOUTHEASTERN STATES

Walter O. Carlson
Executive Director/Dean
Southern Technical Institute
Marietta, Georgia

Introduction

Twenty-three colleges and universities in ten southern states identified as offering four-year engineering technology programs were surveyed. The institutions were located in the states of Alabama, Florida, Georgia, Kentucky, Louisiana, North Carolina, South Carolina, Tennessee, Virginia and West Virginia, Appendix A. Equivalent full-time (EFT) enrollments ranged from 45 to 1687 with a median and average of 240 and 314 respectively.

Eighteen institutions, 78%, responded to a detailed ten-page questionnaire. The responses represented the status of the programs as of August 1977. The high percentage of return for a lengthy questionnaire, and several letters which accompanied the returns, are interpreted as demonstrating the great interest on the part of engineering technology educators in various key questions related to their programs.

In the presentation of the results of the questionnaire which follows, no attempt was made to statistically analyze the data in detail by considering such factors as administrative structure, total and major enrollments, major fields, and whether the financial support was private or public. A cursory examination of the data collected did not reveal any significant trends.

Administrative Features and Programs

There are in the southern region a variety of administrative structures as shown in Table 1. There is no consistency in designating the units within an institution offering the four-year engineering technology programs. In compiling these data, "college" and "division" are used synonymously with the designation "school." At ten institutions which offer both engineering and engineering technology on the same campus, the engineering technology programs are either in the School of Engineering (c) or the School of Engineering and Technology (b). Five others are a part of a separate School of Technology (a) and one is a separate institution (e).

Table 1. Administrative Structure

		Responses
a.	Part of a Separate School of Technology	5
b.	Part of School of Engineering and Technology	2
c.	Part of a School of Engineering	8
d.	Part of a School of Science or Applied Science	2
e.	Separate Institution	1

There were four questions related to the sharing of faculty and facilities (laboratories, equipment, etc.) between engineering and engineering technology programs. Of ten institutions which offer both programs, eight share faculty and all ten share facilities. One engineering technology program is planning to share to a limited extent faculty and facilities with engineering programs on other campuses. The one primarily engineering technology institution shares faculty and facilities in one program with its related engineering institution. Nine responses indicated that it is desirable to share faculty and eleven felt that it was desirable to share facilities.

The nature of the technology programs vary among the eighteen institutions. Eight institutions offer only a four-year program which does not include an associate degree as an integral part. Seven institutions which teach all four years, offer 2 + 2 programs and three others offer only the last two years.

ECPD accreditation of engineering technology programs was apparently of importance to most institutions with ten institutions responding that their major programs were ECPD accredited and six others reported a desire to have their programs accredited. Two respondents indicated that they were not interested in ECPD accreditation.

All institutions responding provided data on EFT enrollments and baccalaureate degrees conferred for 1976-77. As shown in Table 2, the total enrollment was 5,863 and 1,120 degrees were conferred. Enrollments and degrees in industrial technology reported are not included. Electrical and electronics engineering technology programs have by far the highest enrollments. There were no indications, however, that for these programs or any others that the supply of graduates meet the needs of industry. In contrast to engineering programs, the specialized nature of many engineering technology programs has resulted in a wide range of programs offered.

Table 2. Graduates and EFT Enrollments 1976-77

Technology	EFT Enrollment	BS Degrees Conferred
Aircraft	48	12
Apparel	29	1
Architectural	498	51
Broadcast	16	-
Civil	834	131
Computer/Computer Systems	154	27
Construction	298	46
Electrical/Electronics	1867	234
Environmental	110	10
Forest Products	13	2
Industrial	347	55
Industrial Safety	10	2
Land Surveying	25	7
Materials Joining	20	5
Manufacturing	87	15
Mechanical	839	185
Mechanical Drafting & Design	162	19
Mining	104	-
Operations	94	23
Printing	42	2
Textile	66	4
Programs and/or Degrees Not Designated*	200	289
Totals	5,863	1,120

*Some programs and/or degrees are not designated

The percentage of engineering technology courses which include laboratories span a wide range of percentages for the responding institutions from less than 21% to over 80% as shown in Table 3 The responses indicate that laboratory experience is generally considered to be of importance in engineering technology programs.

Table 3. Required Laboratories in Engineering Technology Courses

Range, Percentage of Courses		Responses
a	0 to 20	1
b.	21 to 40	4
c.	41 to 60	4
d.	61 to 80	6
e.	81 to 100	3
	Total	18

While the percentage of engineering technology students participating in coop programs is relatively low, twelve of the respondents offer such programs and eight of the twelve give academic credit. One institution requires all students to coop, while for the others participation varies from less than 1% to a maximum of 10%. Although the respondents were not queried on percentages of enrolled students employed full-time, several reported a relatively high percentage.

Calculus is required by all but one responding institution; however the frequency of utilization apparently varies with a majority finding it is frequently used. The responses are shown in Table 4.

Table 4. Usefulness of Calculus in ET Programs

	Responses
a. Not required and not utilized	0
b. Required, but seldom utilized	5
c. Not required, but needed	1
d. Required and frequently used	12
Total	18

Three institutions have or plan to have technically oriented master's degree programs in technology. The other fifteen have made no plans at this time. The needs to be fulfilled by existing or planned programs are

1. Provide specialized technologists for water treatment, environmental technology, urban systems planning and construction management.
2. Junior and senior college technology teaching.
3. Industrial and government positions.

Industrial advisory committees are utilized by over eighty percent of the institutions. Only three do not utilize committees; however, one is planning a committee in the near future. Table 5 gives measures of the effectiveness of the committees in nine areas of interest.

	Very Effective	Effective	Ineffective	Not Involved
a. Curriculum planning	3	10	1	0
b. Providing loans or scholarships	1	3	6	3
c Providing Coop Stations	2	8	1	2
d. Placement of graduates	4	7	2	1
e. Recruiting students	0	9	4	1
f. Providing equipment	3	5	4	2
g Providing field trips or training materials	5	7	0	2
h. Providing employment for Faculty	0	4	6	4

Funding

Financial support for all of higher education is a major concern today. The questionnaire did not attempt to make a detailed survey of financial matters of interest to engineering technology administrators, but rather asked general nonquantitative questions. No attempt was made to correlate responses as to whether the institution is private or public; nor the administrative structure.

Only three of the responding programs do not receive a recurring annual budget for capital equipment. In only two cases is capital equipment depreciated with annual replacement monies provided. The average and medial capital equipment purchases funded from "one-shot nonrecurring money" is approximately 40%.

The programs of the eighteen responding, reported that no funds are provided for student assistants and one did not have a budget allocation for faculty travel. For fifteen programs which are a part of or could make a comparison with engineering programs, nine felt that their programs were funded equitable with their engineering couterparts, considering the difference in missions and considering the number of students involved.

Engineering Technology Faculty Characteristics

Fifteen respondents felt that the minimum educational background for ET faculty should be the masters degree; however, two would consider the bachelors degree plus extensive, applicable industrial experience. One indicated that approximately half the faculty should possess the doctorate, but should be industry oriented. Three respondents accept the bachelors degree as a minimum requirement.

It is interesting to note that twelve respondents indicated that it will be desirable in the future to continue to have engineers as technology teachers. Three did not agree; one indicated that it depends on several factors including education; and one indicated that a BET graduate with an MS in engineering may be acceptable. Seventeen respondents would not hesitate in hiring a qualified technology graduate as a faculty member, but one indicated that in addition a degree in engineering would be desirable.

While fourteen of eighteen respondents feel that professional licensure is important for technology teachers, only four feel that licensure should be a requirement. Industrial experience is an important requirement for technology teachers as shown in Table 6.

Table 6. Industrial Experience Expected for Technology Faculty

Years	Responses
a. None	0
b. One Year	1
c. Several Years	13
d. Five or More Years	4
Total	18

Eleven respondents indicated that they require continuing professional development for technology faculty, and seven do not. For those having the requirement, its uses are given in Table 7.

Table 7. Uses of Continuing Professional Development

Use	Responses
Promotion	12
Tenure	9
Pay Raises	9
Continuation	4
None of the Above	5

Professional development takes on a number of forms as shown in Table 8. Individual institutions utilize a variety of forms for faculty development.

Table 8. Forms of Required Experience

Form		Number Using
Academic Training		10
Degree Oriented	6	
Nondegree Oriented	8	
Industrial Work Experience		13
Summers	11	
During School Year	7	
Publishing Article or Textbook		6
Consulting		9
Participating in Conferences and Workshops		16
Public Service		1

Fourteen of the eighteen respondents encourage faculty updating through one or more of the provisions shown in Table 9.

Table 9. Mechanisms for Encouraging Faculty Updating

Mechanisms	Responses
Raid sabbatical leaves	10
Unpaid leaves of absence	8
Faculty exchanges	4
Reduced teaching loads	1

Considering all things (e.g. backgrounds, teaching loads, salaries and promotion), thirteen of sixteen respondents feel that their technology faculty members are treated as fairly as engineering faculty members.

Teaching loads with weighting laboratory hours in comparison with lecture hours are of continual faculty interest. Typical equivalent loads vary widely as shown in Table 10. Scale factors for the conversion of laboratory hours to equivalent lecture hours were left to the discretion of the respondents. In Table 11 the wide variation in weighting of laboratory teaching are shown for seventeen respondents. It is noteworthy that two of the six institutions designating a full-time teaching load of 12 or less equivalent hours, weigh laboratory hours the same as lecture hours.

Table 10. Typical Faculty Teaching Loads

Equivalent Contact Hours	Number
12 or less	6
13 - 16	9
17 or more	3
Total	18

Table 11. Weight of Labs in Establishing Teaching Loads

Weight	Responses
Same as lectures	4
One and one-half hours equivalent to one lecture hour	5
Two hours equivalent to one lecture hour	8
Total	17

Eight of seventeen respondents have from ten to fifty percent of their faculty on temporary, nontenure tracks. Eleven of fourteen respondents think that it is desirable to have from five to fifty percent (median 20 percent median) of their faculty on a nontenure track.

Difficulty in recruiting temporary faculty is experienced by nine respondents, while seven have no problems. In a similar fashion for permanent faculty, ten have difficulties while seven do not. Some of the problems and the degree of these problems encountered in hiring new faculty are shown in Table 12. Problems with respect to salary, academic background, industrial experience, and technology orientation are encountered by most institutions, while geographic location in most cases is no problem.

Table 12. Problems Experienced in Hiring Faculty

Problem	Major	Some	No
Candidate's salary requirement	7	7	4
Finding candidates with current academic background	2	12	4
Finding candidates with correct industrial experience	6	11	1
Finding candidates with a technology orientation	5	8	5
Candidate does not like geographic location	0	2	16

Student Characteristics

An attempt was made to obtain quantitative data (SAT scores, ACT scores, high school rank and grade point index) on beginning technology freshmen, but the responses were fragmentary and no useful information was obtained.

The approximate percentage of technology freshmen who would meet engineering entrance requirement was estimated by fourteen respondents to vary widely from eight to one hundred percent, with a median of fifty percent. Fourteen respondents reported transfers from engineering programs. Estimates of transfers varied from five to twenty-five percent, with a median of 6 percent. Four indicated no transfers.

Most programs have part-time students enrolled as estimated in Table 13.

Table 13. Part-time Enrollment by Headcount

Percentage	Responses
0	3
1	1
5	5
10	3
20	1
30	4
80	1
Total	18

It was estimated that the average age of students in programs as reported by eighteen respondents varied from 19 to 30, with a median of 23. All but one program reported female enrollments varying from two to ten percent, with a median of three percent. Four programs have minority enrollments of 40, 50, 80, and 95%. Of the other fourteen, one program reported no minorities, while for the others the percentage ranged from two to ten percent, with a median of five percent.

Recruiting, Retention, Placement and Follow-Up

In the south in all but one special purpose program with only five percent state residents, the percentage of state residents varied from 65 to 98%, with a median of 90%. All respondents were bullish on the prospects of increasing enrollments over the next decade. Seven project a great increase and eleven project some increase.

There was no significant difference in retention rates between the three programs offering only the last two years; median 75%, and a median of 70% for fifteen programs offering all four years.

A very high percentage of ET graduates, median 95%, have discipline-related placements at or near graduation. In one case the percentage was at a low of 10% and in the maximum case, it was 100%. A high percentage of ET graduates have "engineer" in their first job title. The range is from 10 to 90% with a median of 70%.

The optimistic outlook for future increasing engineering technology enrollments is to a great extent predicated on existing demands by industry for graduates. Six respondents report that the supply of graduates is much less than demand, ten report that the supply is a little less than demand, and only two report that supply and demand are about equal. In no case was the supply reported to exceed the demand.

Starting salaries for four-year engineering technology graduates reflect the demand exceeding supply. Reported salaries ranged from $8,500 to $25,000 per annum during 1976-77, with a median average starting salary of $13,200. In Table 14 minimum, average and maximum starting salaries are tabulated. Although overall averages are given for each of the three categories, they are not weighted.

Table 14. BET Graduate Annual Starting Salaries 1976-77

	Minimum Salary	No	Average Salary	No.	Maximum Salary	No.
	$ 8,500	1	$10,000	2	$13,000	1
	9,400	1	11,500	2	13,500	1
	9,500	1	12,000	2	14,000	1
	9,600	1	12,500	1	14,700	1
	10,000	4	13,000	1	15,500	1
	10,800	1	13,100	1	15,600	1
	11,000	3	13,400	1	15,900	1
	11,400	1	13,500	1	16,000	2
	11,500	1	13,700	1	17,000	3
	12,000	3	14,000	1	17,800	1
			14,200	1		
			14,500	1	18,000	1
			15,000	2	19,000	2
			16,000	1	25,000	1
Average	10,865		13,050		16,706	
Median	10,800		13,250		16,000	

All but two responding institutions have a formalized placement process. Ten have a formalized follow-up procedure for their graduates, while eight do not. As many alumni groups participate in ongoing departmental activities as those who do not. Alumni donate money for only six schools, while for eleven they do not. This would be expected because engineering technology programs are relatively new, and it takes a long time to develop alumni interest in donating money to schools from which they have graduated.

Summary

Engineering technology educators have demonstrated that they are very much interested in the present and future status of their educational programs. While, in some respects, distinct differences exist in programs, the similarities far outweigh the differences. An optimism prevails for the future based on the fact the demand for graduates exceeds the supply, and that it is expected that the demand will continue into the foreseeable future. This also demonstrates that the graduates and employers of these graduates are well served by existing programs.

Significant differences do exist in administrative structures; however there is no evidence that this is a significant factor in the results achieved. A wide variety of degree programs are offered, but they best serve the students and industry in the community in which the institution is located. There is also a wide variation from institution to institution in defining equivalent teaching loads and the extent to which calculus is used in technical courses.

Distinct similarities and strengths exist in that laboratory experience is an essential component of engineering technology programs, faculty have had and continue to maintain appropriate industrial experience, and that needs of employers are continually evaluated as inputs toward program improvement.

It is felt that the results of this survey of four-year engineering technology education in the south, together with similar surveys from other sections of the country, will provide faculty and administrators with useful information in future program planning.

APPENDIX A

Bachelor of Engineering Technology Programs by State and Institution, Southern Region, 1976-77. (All listed institutions were sent questionnaires; an asterisk denotes no response.)

State	Institution	City
Alabama	Alabama A & M	Normal
	*University of Alabama	University
Florida	Embry Riddle	Daytona Bch.
	*Florida A & M	Tallahassee
	Florida International U.	Miami
	Florida Tech. Inst.	Orlando
	Univ. of Florida	Gainesville
	*Univ. of South Florida	Hillsborough
Georgia	Georgia Southern	Statesboro
	Savannah State	Savannah
	Southern Technical Institute	Marietta
Kentucky	Western Kentucky	Bowling Green
Louisiana	Louisiana Tech	Tech Station
	Southern A & M	Baton Rouge
North Carolina	University of North Carolina at C.	Charlotte
South Carolina	Clemson	Clemson
	*South Carolina State	Orangeburg
Tennessee	Memphis State	Memphis
	University of Tennessee	Martin
Virginia	Old Dominion Univ.	Norfolk
	*Virginia Polytechnic Institute	Blacksburg
West Virginia	Bluefield State	Bluefield
	Fairmont	Fairmont

WALTER O. CARLSON

Dr. Carlson received his B.Aero.E. and his MS and Ph D in Mechanical Engineering from the University of Minnesota. He is a registered engineer and has worked for the Radio Corporation of America, General Electric and McDonnell Aircraft Corp. and has consulted with other companies. Dr Carlson is a member of the Policy Board, Education of the American Society of Mechanical Engineers, a member of the Board of Directors of the Engineers' Council for Professional Devlopment, member of the Long Range Planning Committee and Vice chairman of the Technical College Council for the American Society of Engineering Education, ad hoc visitor for ECPD and the Southern Association of Colleges and Schools. Dr. Carlson joined the School of Mechanical Engineering at Georgia Tech as professor in 1962 and became Dean of Southern Technical Institute in 1971, became Executive Director/Dean in 1976.

DEVELOPMENTS AND TRENDS IN FOUR-YEAR ENGINEERING TECHNOLOGY PROGRAMS IN THE MIDWESTERN STATES

Steven R. Cheshier
Head, Electrical Technology
Purdue University
West Lafayette, Indiana

Introduction

Twenty-five schools from the midwestern region of the U.S. were chosen from John Alden's 1975-76 survey which appeared in the April, 1977, issue of "Engineering Education." This represents, (according to Alden's survey) all of the four year engineering technology programs in the region that had any graduates that year (1975-76). These schools were located in the states of Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Ohio and Wisconsin. All offered four year bachelor's degree programs in engineering technology and each reported having graduated 4 year students during the reporting year. Ohio led the list with seven schools, followed by Indiana and Michigan with four each. The schools surveyed are listed in the appendix.

A detailed questionnaire containing over 50 questions was prepared by a panel of technology leaders from around the country. Items for inclusion were carefully discussed and modified so that the data gathered would be meaningful and relevant.

Twenty-one of the twenty-five schools responded (84%) indicating that the technology leaders responding felt this to be a worthwhile endeavor. The questionnaire was mailed during the busy start up weeks of the fall semester which makes the response even more gratifying.

Most of the respondents were Deans or Directors of Technology programs rather than Heads of specific departments.

I. Administrative Features and Programs

The first part of the questionnaire (about 20 questions) dealt with administrative features and program descriptions.

Table 1. Administrative Structure

"How are your major technology programs structured administratively?"

	N	% total
a. Part of a separate School of Technology	7	33%
b. Part of a School of Engineering and Technology	4	19
c. Part of a School of Engineering	4	19
d. Part of a School of Science or Applied Science	4	19
e. Other (College of Industry, Dept. in Liberal Arts University)	2	10

Thus about half of the programs were either in Schools of Technology or Schools of Engineering and Technology.

Only about a fifth were departments within Schools of Engineering. (One program within a School of Engineering indicated that a change of structure was being considered.)

Several questions were asked concerning interfacing with engineering. Nearly half (10/21 or 48%) said that their technology programs share faculty with engineering. Fifty-five percent (11/20) felt that such sharing is desirable. About two-thirds (14/21 or 67%) indicated that they share physical facilities with engineering, while 90% (18/20) said that sharing facilities is desirable. Several voluntary comments were made in these areas. On the issue of sharing faculty, one said "under no conditions," while several others said that under certain conditions (e.g., the faculty member being aware of the differences in program objectives) sharing would be desirable.

When asked the nature of their technology programs, 62% (13/21) replied that their's is a 2 + 2 program where they teach all four years. Another 24% (5/21) are operating four year programs that do not include an associate's degree. Two schools (9%) have upper division programs only and one school had a 3 + 1 structure.

About half of the schools surveyed (11/21 or 52%) said that their major technology programs are ECPD accredited. Of those that were not accredited 70% (7/10) replied that they desire accreditation.

It was not fully determined why the 3 schools do not desire to seek accreditation, although one school indicated that the criteria are not relevant to technology programs.

Enrollment was reported for 19 specific four year program categories. Students enrolled in 1976-77 totalled 5197 while there were 1597 graduates.

Table 2. Graduates and Enrollment 1976-77

Program	Graduates	Enrollment
Electronic	1075	2454
Mechanical	167	810
Electrical	150	789
Civil	34	173
Manufacturing	34	128
Automotive	8	97

Program	Graduates	Enrollment
Computer	15	84
Aviation	7	84
Electro-Mechanical	20	80
Construction	7	50
Mechanical Design	10	40
Fire Science	1	25
General/Undecided	55(General)	316
Miscellaneous*	14	67
	1597	5197

*Industrial, Environmental, Food Science, Production Management, Architectural and Biomedical

One school, with programs in Electrical, Mechanical, Architectural, Biomedical and Manufacturing did not report numbers.

It is interesting to pull out the three major categories from Table 2: Electrical (including Electronics and half of the Electro-Mechanical), Mechanical (including Manufacturing, Production Management, Mechanical Design and half of the Electro-Mechanical), and Civil (including Architectural and Construction).

Table 3. Collapsed Major Program Categories

Program	Graduates	Enrollment
Electrical & Kindred	1235(77% of total)	3283(63% of total)
Mechanical & Kindred	222(14% of total)	1036(20% of total)
Civil & Kindred	43(3% of total)	238(5% of total)
	94% of total	88% of total

Thus, in the Midwest, nearly two-thirds of the enrollment and three fourths of the graduates are in Electricity/Electronics.

It may be significant that 79% of the Electronics graduates and 65% of the Electronics enrollment were reported by Bell and Howell Schools.

Table 4 deals with the utilization of labs in engineering technology programs.

Table 4. Required Laboratories in Courses

"Approximately what percentage of your engineering technology courses include required laboratories?"

Range	Responses
a. 0 to 20%	2 (9%)
b. 21 to 40%	3 (14%)
c. 41 to 60%	4 (19%)
d. 61 to 80%	3 (14%)
e. 81 to 100%	9 (44%)
	21

Thus nearly half require labs in over 80% of their courses.

Co-op programs were dealt with in a series of several questions.

Nearly half of the schools (10/21) or 48% have Co-op programs. About the same number of schools (9/17 or 53%) grant academic credit for Co-op. When asked what percentage of their students were participating in Co-op, the range of responses was from 0% to 15% with an average overall response of 7%. None of the schools indicated that their Co-op program is mandatory.

All of the schools are requiring calculus although 38% said that it is seldom utilized. The remaining 62% (13/21) replied that calculus is not only required but is frequently utilized.

Master's Degrees in Engineering Technology are receiving a great deal of publicity in the literature. 14 percent (3/21) of the schools either have, or are planning, a technically oriented Master's Degree. The three schools were Western Michigan University, Bradley University and Southern Illinois University (Carbondale). The needs expressed had to do with technical upgrading of industrial personnel or management preparation.

The remainder of Part One of the questionnaire dealt with industrial advisory committees. Just over half of the schools (12/21 or 57%) use an advisory committee.

Table 5. Effectiveness Rating of Advisory Committees

"Rate their effectiveness in each of the following areas by circling a descriptor."

	Very Effective	Effective	Ineffective	Not Involved
a. Curriculum planning	0	8	2	1
b. Providing loans or scholarships	1	0	1	9
c. Providing Co-op stations	0	3	4	4
d. Placement of grads	0	6	2	3
e. Recruiting students	1	1	5	4
f. Providing equipment	0	3	6	2
g. Providing field trips or training materials	3	5	1	2
h. Providing employment for faculty	0	5	3	3

The only two areas in which advisory committees seem to be quite helpful are curriculum planning and providing field trips or training materials. They seem to be somewhat effective in the areas of student placement and faculty employment.

II. Funding

Six questions dealt with the area of funding. Sixty percent of the schools (12/20) indicated that they receive a recurring line in their annual budgets for capital equipment (capital equipment meaning items over $100 in cost and intended most often for lab use).

Only 15% replied that their lab equipment is depreciated annually with updating money being provided. This is a major difference between equipment purchases in industry and in universities. Apparently in universities, equipment once purchased is intended to last forever. It is encouraging that three schools (the 15%) are implementing the "living lab" concept.

When asked "What percentage of your capital equipment purchases (items over $100) have been funded from one-shot, non-recurring money?", the average percentage reported was 67%.

Surprisingly, all schools reported that they have funds for student assistants as well as for faculty travel. It was not determined if these funds are adequate but there rarely is enough money in any category of university funding so the answer to that may be guessed.

After considering all of the variables, 69% (11/16) said that they feel they are funded as equitably as their counterparts in engineering.

The information gathered in these funding questions seemed to present a positive picture of technology funding, with the only negative area being the provision of monies for the replacement of outdated equipment.

III. Faculty Characteristics

The respondents were asked "What should be the minimum educational background for ET faculty?" Table 6 summarizes the results:

Table 6. Minimum Educational Background for ET Faculty

	Degree	Responses
a.	Ph.D.	0% (0)
b.	M.S.	80% (16)
c.	B.S.	15% (3)
d.	A.A.S.	5% (1)

Ninety percent (19/21) held the view that it will continue to be desirable in the future to have engineers as technology teachers, although the same 90% said they would have no hesitation in hiring a qualified technology graduate as a faculty member. (One said, "if he had a good degree.")

Professional licensure has been hotly debated around the country and one aspect of the issue brought a split response among educators. When asked if they felt that licensure is important for a technology teacher, 48% (10/21) said "yes". Thus just over half felt that it is not important. When asked if it should be a requirement for a technology teacher, only 5% (1/21) said that it should be.

Technology programs are frequently distinguished from engineering programs in that they require industrial experience (often in lieu of a Ph.D.) of their faculties. None of the respondents felt that less than several years of industrial experience would be appropriate. Sixty-seven percent (14/21) said "several years," while 33% (7/21) said "five years or more" was the correct amount of experience.

The area of professional development for faculty members illicited some interesting responses. Nearly two-thirds (62% of 13/21) replied that they are requiring continuing professional development for their technology faculties.

Of the schools requiring development, 92% require it for promotion, 62% for tenure and 69% for merit pay raises.

When asked "What form does the required experience take?", the responses were varied. Table 7 summarizes them:

Table 7. Required Professional Development

Form		Number Using
Academic Training		62% (8)
Degree oriented	50% (4)	
Non-degree oriented	50% (4)	
Industrial Work Experience		92% (12)
Summers	75% (8)	
During School Year	25% (2)	
Publishing Articles or Textbooks		38% (5)
Consulting		54% (7)
Participating in Conferences or Workshops		62% (8)
Other		8% (1)

Paid sabbatical leaves were provided as a vehicle for updating by 65% of the schools while unpaid leaves of absence were available in 45% of the schools. One school pays only the difference between the academic and industrial salary. Ten percent utilize faculty swaps as an updating method. (Several others said they were going to try swaps.)

When asked "All things considered (e.g., backgrounds, teaching loads, salaries and promotions) do you feel that your technology faculty members are treated as fairly as engineering faculty members?", 71% (12/17) replied "yes." This closely parallels the response given to the question about the equities of funding between the two types of programs.

Teaching loads are always a subject of interest to faculty members. Teaching loads (with labs scaled to their appropriate lecture equivalents) varied quite a lot. A full time teaching load was 12 contact hours or less for 32% (6/19) of the respondents. Another 42% (8/19) indicated that their loads were between 13 and 16 contact hours per week. Finally, 26% (5/19) had teaching loads of 17 or more contact hours.

Only 9% (2/21) weighted labs the same as lectures in determining teaching loads. Labs were weighted one and one half lab hours to one lecture hour by 24% (5/21), and a full 67% (14/21) counted two lab hours as equivalent to one lecture hour.

When asked what percentage of the technology faculty were temporary (not tenure track), the respondents said about 18% (range 0-100%, median 7%). When asked what percentage is desirable, they replied about the same - 17% (range 0-70%, median 10%).

Just over half (58% or 11/19) replied that they find it difficult to recruit temporary faculty.

A slightly greater number (65% or 13/20) found it hard to recruit permanent faculty members. When asked what the recruitment problems were, it appears that the greatest problem (by a small margin) was finding candidates with relevant industrial experience. The least significant problem was selling candidates on the geographic area. Table 8 tabulates the responses:

Table 8. Hiring Problem Rankings

	Major Problem	Some Problem	No Problem
1. Candidates salary requirements	38%	38%	24%
2. Finding candidates with correct academic backgrounds	29%	52%	19%
3. Finding candidates with correct industrial experience	48%	48%	4%
4. Finding candidates with a technology orientation	43%	48%	9%
5. Candidate does not like your geographic location	5%	33%	62%

IV. Student Characteristics

Very little information was gathered about qualifying score averages for beginning technology freshmen. The averages reported were: SAT Math = 538, SAT Verbal = 438, ACT = 20, High School Rank = 69th percentile, and High School Grade Point Index = 2.8/4.0. The number of respondents providing these test data varied from 2 to 6 schools.

The technology respondents stated that about 54% (range 10-100%, median 40%) of their freshmen would meet engineering entrance requirements and that 19% (range 1-75%, median 10%) had transferred into their programs from engineering.

There are apparently a large number of evening programs in the region since the schools reported that 24% (range 0-90%, median 10%) of their student headcount is part-time. The average age of the technology student was reported to be 22. Only 4% (range 0-10%, median 4%) were reported to be females and 8% (range 0-25%, median 5%) minorities. There obviously is a lot of work to be done in this area.

V. Recruiting, Retention, Placement and Follow-up

A full 80% (range 25-100%, median 90%) of the students were reported to be from the home state of the institution. It would appear that technology students have more regional allegiances than do engineering students.

Projected enrollment trends paint a bright picture for the future of technology. Twenty-four percent (5/21) feel that there will be a "great increase" in technology enrollments in the next decade. A full 62% (13/21) believe that there will be "some increase." Only 9% (2/21) indicated "no change" anticipated, while 5% (1/21) foresee "some decrease" in enrollments. No one sees a "great decrease."

Retention of students is always an important consideration. With greater competition for students occurring because of the declining birth rate, retention will become even more important. The respondents reported that they are averaging about 52% (range 20-90%, median 40%) retention (overall 4 year rate for beginners continuing through to graduation).

Eighty-six percent (range 5-100%, median 90%) of the graduates were reported to have discipline related placements at or near graduation. This is a major strength of technology programs.

The starting salaries reported for the 4 year ET graduates were also very encouraging.

Table 9. ET Graduate Starting Salaries

	Average Reported	Median Reported
a. Salary per year	$13,600	$14,000
	(range $10,000-16,000)	
b. Minimum annual salary	11,600	12,000
	(range $8,000-13,000)	
c. Maximum annual salary	17,300	16,600
	(range $13,000-24,000)	

When asked "What percentage of your ET graduates have 'engineer' in their first job title?", the average was 55% (range 0-90%, median 60%). This is not surprising since industry and academia use the title 'engineer' quite differently.

The placement situation appeared to be very healthy. Ninety-five percent of the respondents said that the demand for graduates equals or exceeds the supply. Table 10 tabulates the responses:

Table 10. Placement Situation

	Responses
a. Supply of grads is much less than demand	25% (5)
b. Supply of grads is a little less than demand	40% (8)
c. Supply and demand are about equal	30% (6)
d. Supply of grads slightly exceeds demand	5% (1)
e. Supply of grads greatly exceeds demand	0% (0)

Part of the reason for the successful placement reported must be that 90% (19/21) have a formalized placement process. Formalized follow-up procedures were also used by 90% (19/21) of the schools.

Alumni seemed to be exerting minimal influence on technology programs (at least in a formal way). Only 20% (4/20) of the schools said that their alumni actively participate in some way in ongoing departmental activities. Finally, 22% (4/18) said that their alumni typically contribute money to their programs.

Summary

It is clear from these data that engineering technology programs throughout the Midwest are enjoying success. Strong areas reported included funding for equipment, student help and travel; faculty qualifications, student quality, anticipated program growth, and placement and salaries of graduates. Possible weak areas reported were the licensing requirement disagreement, the ineffectiveness of industrial advisory committees, the difficulty in recruiting faculty, the lack of females and minorities, the moderately low retention of students, the lack of alumni involvement, the frequent application of the title "engineer" to technologists by industry, and the fact that only about half of the programs were accredited. In spite of these weaknesses, the overall picture reported is indeed a healthy one.

Appendix

Bachelor of Engineering Technology Programs Surveyed (by State and School, 1977, Midwestern Region)

State	Institution	City
Illinois	Bradley University	Peoria
	DeVry Institute	Chicago
	Southern Illinois U.	Carbondale
Indiana	(*)Indiana University-Purdue University	Fort Wayne
	Indiana University-Purdue University	Indianapolis
	Purdue University	W. Lafayette
	(*)Purdue University	Calumet
Kansas	Kansas State University	Manhatten
	Wichita State University	Wichita
Michigan	Andrews University	Berrien Springs
	Lake Superior St. Col.	Sault St. Marie
	Wayne State University	Detroit
	Western Michigan U.	Kalamazoo
Minnesota	Southwest State U.	Marshall
	St. Cloud State U.	St. Cloud
Missouri	Missouri Institute of Technology	Kansas City
	Missouri Western College	St. Joseph
Ohio	Cleveland State U.	Cleveland
	Franklin University	Columbus
	Miami University	Oxford
	Ohio Institute of Tech.	Columbus
	(*)U. of Akron C&T College	Akron
	(*)University of Dayton	Dayton
	Youngstown St. U.	Youngstown
Wisconsin	Milwaukee School of Engineering	Milwaukee

*denotes non-respondents

Stephen R. Cheshier was born in Logan, Ohio, on February 21, 1940. He received the B.S. degree in Physics from Memphis State University, the M.S.E. degree in Electrical Engineering from Purdue and the Ph.D. degree in Technical Education from the University of Illinois.

From 1958 to 1970 he was involved in many levels of Naval avionics including maintenance, administration, quality control, test and evaluation, and development, primarily in the areas of electronic communications, navigation, electronic countermeasures, radar and anti-submarine warfare. He also taught 5 years in the Navy's Advanced Electronics School (Class B) at Memphis, Tennessee.

Dr. Cheshier is a member of IEEE, ASEE, Eta Kappa Nu, Sigma Pi Sigma, Phi Delta Kappa, Phi Kappa Phi, Chi Gamma Iota and Kappa Delta Pi. He is faculty sponsor and midwest coordinator for Tau Alpha Pi (Engineering Technology National Honorary). He has been on the Purdue faculty since 1971 and is currently Professor and Head of the Electrical Engineering Technology Department at Purdue.

SESSION 8.1

OPEN UNIVERSITIES — CHALLENGE FOR ENGINEERING

David R. Reyes-Guerra
Executive Director
Engineers' Council for Professional Development
United Engineering Center
New York, New York

This session opens the door for you to consider a new approach to higher education. The concept is popularly known as the "open university" or the "university without walls". Though it has existed in one form or another in the social sciences and in liberal studies it has not until recent years attempted to address engineering. These opening remarks are intended to give an overview of several aspects of the development of engineering education which are pertinent to understanding the reasons for the apparent popularity and growth of the "open university". Possible acceptance of this concept by our profession is still in the questionable future.

The process of education for the engineering profession has undergone many metamorphoses over the years. At one time one became an engineer by being apprenticed to one who already was an engineer. Engineering was learned through a hands on experience. Intuition played a very important role and theories were few. Physicists and mathematicians provided the necessary scientific and calculating know-how for the engineers to carry out their projects.

With the growth of engineering science as well as the basic sciences academicians developed within the profession. Programs of study were developed and increasingly theoretical knowledge was required to efficiently practice engineering. The engineer needed to know the why of things rather than the how. With the development of academicians engineering school were created within the universities. Eventually, the faculty in engineering integrated with other faculties. Qualifications for faculty, advancement and recognition eventually paralleled those in the rest of the university.

Slowly, field experience, such as surveying, disappeared. The one-to-one all encompassing relationship between the master (professor) and the apprentice (student) has virtually disappeared except for some limited doctoral cases--most of which are in research and theory. The requirements of residency courses and hours necessary for a degree became the same as those for the university community. Graduate programs follow the format determined by the graduate school.

The engineering profession through the accreditation process has retained the control of the requirements needed to become an engineer. However, they are tailored within the framework of an undergraduate college education.

Though engineering is credited with initiating cooperative programs, the students who choose this route must extend their education over a longer period than those who follow the regular program. Only a handful of engineering schools have an "engineering year abroad" or a "field term".

Teaching methods have become almost universal in all colleges: lectures, demonstrations, hands on laboratories. The colleges of engineering have experimented and many have adopted new teaching techniques such as video systems for lectures and demonstrations; self-paced courses including both lectures and laboratories, and live two-way video lectures. The work in extension and continuing education work has proliferated. Short courses to bring practitioners to date with new advances are becoming more and more prevalent.

Industry and professional societies have entered the field of education and offer a variety of courses. However, very few of these are accepted for credit towards a degree by the university community unless they are made a part of the particular university's extension program.

With the growth of research laboratories and the ever accelerated change in laboratory equipment many universities find themselves in serious difficulty in keeping their laboratories up to date with the demands of the profession. Industry and government--one of the major employers of engineers--provide in many instances opportunity for their employees to learn on the job with equipment and faculty taken from the industry itself. This has become almost a necessity in today's accelerating world. Especially since the equipment found in industry may be different than that found at the university.

Universities are recognizing the value of self-teaching and life time experience. In many academic areas a person is given credit for his or her knowledge and such is verified either through examination or other proof of competency. The student, therefore, is not required to take courses for which he already has the proven necessary knowledge. Proficiency examinations, placement testing, the college credit programs of the American College Testing Program and the Educational Testing Service are obtaining increased acceptance.

Correspondence courses offered world-wide by many universities for college credit have increased in popularity. A variation of these are the television courses offered through commercial and public television. New satellite communications are enabling these courses to be provided in a multi-national framework. However, up to now I know of no university which offers an accredited program in engineering that does not require at least two years of residency, demands that all laboratory experiences be obtained in a college setting and that the major option be covered at the institution granting the degree.

Several innovative educators are experimenting with new methods to educate an engineer which waive many of the residency requirements and use different combinations of experiences to cover the laboratory, design, and other course requirements. Their efforts have not yet received the acceptance of the profession or of the educators. Many of them offer, as proof of the excellence of their program, the record of professional attainment of their "graduates" in comparison to the graduates of regular programs. Most of these offerings are popular with persons already in a working environment who cannot take the time to attend college. To those individuals these programs provide a unique opportunity for access to higher education.

Whether or not these programs will be accepted by the profession remains to be seen. This session will acquaint you with the methods and success of three such "open universities".

DAVID R. REYES-GUERRA

David R. Reyes-Guerra is the Executive Director of the Engineers' Council for Professional Development. He is a civil engineer with industrial experience both in the U.S. and the international scene. Prior to joining ECPD, he was a faculty member at the University of Illinois. He is a graduate of The Citadel and Yale University. He is active in international education and serves as a consultant in management, engineering education and professional practice both here and abroad.

EMPIRE STATE COLLEGE: INDIVIDUALIZED LEARNING

Jay Gilbert
Associate Professor
Empire State College
Lower Hudson Regional Learning Center
Suffern, New York

INTRODUCTION

In recent years it has become clear that colleges and universities must find ways to be more responsive to the educational needs of individuals. Empire State College of the State University of New York represents a serious and significant effort to individualize the educational process, and to recognize the fact that learning is a lifelong activity. The college has been given a mandate to develop methods to permit the direct support of individual undergraduate study. This paper presents a brief description of the several components of the Empire State College process.

The E.S.C. process is based on the premise that an educational system must start with the needs, interests, and goals of the individual. From these, an individualized degree program can be developed for each student which can address the objectives and expectations of the college, build upon the prior learning of the student, and move the individual toward his or her stated goals.

Empire State College opened in the fall of 1971, and to date more than 12,000 students have enrolled and more than 3,000 have been graduated. The college offers B.A., B.S., B.P.S., A.A., and A.S. degrees. It operates year-round and admits students monthly. It has no traditional "campus:" instead, faculty serve students from a state-wide network of over 30 locations. These include regional learning centers of 13-16 full time faculty with a variety of backgrounds, plus part time faculty and academic administrators; learning units with 1-3 full time faculty, who coordinate the work of many part time support people; and special programs designed to meet the needs of specific student audiences.

Empire State College offers no courses. Credit at E.S.C. is accrued over units of time, through a contract learning procedure. One E.S.C. credit month is equivalent to four college semester-hour credits. Associate degrees require a total of 16 months study, while Bachelor degrees require 32 months. All candidates for Bachelor degrees must spend a minimum of 8 credit-months of study at the college; 6 credit-months are required for Associates Degree.

Empire State College of S.U.N.Y. has become the first non-traditional college to be fully accredited by a regional agency (Middle States). A more complete description of the educational philosophy underlying Empire State College can be found in Engineering Education[1].

DEGREE PROGRAM

The organizing framework for study at E.S.C. is the individualized student degree program. Within this framework, prior learning is assessed and study plans are designed. The degree program is worked out between the student and a faculty member, and will reflect a response to the basic question: "Will this degree program address college objectives, as well as move the student in the direction of his or her stated goals?"

The degree program contains two sections: the concentration, which details learnings within a well-defined context; and general learning, which may support the concentration as well as provide educational, intellectual, or professional breadth. The concentration addresses those learnings normally contained within a traditional "major," but it may, unlike most "majors," be cast in broader terms or be directed in quite different ways. For example, concentrations may be designed to cover a field or area in a disciplinary, interdisciplinary, or multi-disciplinary manner. But they may also be designed around a particular theme, problem or project, or be designed to support preparation for professional practice. Similarly, general learnings in the degree program are designed to provide breadth through liberal studies. They may be addressed through disciplinary study of the arts, humanities, social sciences, natural sciences, and mathematics. However, they may also be organized around the framework of themes, problems and/or projects.

All degree program learnings, both concentration and general, are classified in two categories: those which were completed prior to enrollment, and those which are to be completed by further study. For the former, appropriate validation and documentation is assembled; the latter are carried out through contract learning.

When the degree program has been prepared (including student goal statements, prior learning documentation, and contract learning plan), it is submitted for approval to the faculty academic review committee at the student's local learning center or unit. The review process determines that the proposed degree program addresses the stated goals of the student, and conforms to all Board of Trustee general requirements for S.U.N.Y. degrees. Upon completion of the approval process, the contract learning plan constitutes the "requirements" of that individual for degree completion.

ASSESSMENT OF PRIOR LEARNING

Assessment of prior learning is an integral part of the E.S.C. process. It recognizes the fact that significant college level learning can occur outside of formal college settings, and that academic credit can be awarded for such learning.

At E.S.C. assessment of prior learning is not an independent process; it is carried out totally within the context of the degree program assembled by the individual. A student will not simply present a series of learnings and ask, "What are these worth?" Applicability and value will be determined by the educational goals of the individual. For example, a given individual with a particular professional background may express goals which include further work and advancement within that profession. Contract learning, both in concentration and general areas, would then be designed to build upon or to broaden the competencies presented as prior learning. The amount of contract study to be done to complete the degree portion of the student goals would then be determined, as a certain number of credit-months.

If the same individual with the same professional background expressed goals which included a career change, the results of assessment might be very different. The contract learning necessary to support a career change goal would be different from, and would probably take more time than that necessary to support the goal of advancement within the profession. Thus, the study time necessary for degree completion would be greater, and hence the identical set of prior learnings would not, in the context of the degree program, appear to be "worth" as much credit compared to the former case.

Validation of prior learning must satisfy two requirements: documentation that the learnings did indeed occur, and evaluation of the level of learning that resulted. Documentation and evaluation may be evidenced by the following, as appropriate: transcripts of completed college courses; certificates of completion or other evidence from proprietary institutions or organizations; written results of standardized examinations; and licenses or membership in trade or professional associations. In addition, written evaluations of products or performance may be sought from colleagues or supervisors of the student; from faculty of E.S.C. or other colleges; or from other appropriate persons of demonstrable competence. Such evaluations may describe learnings which occurred in the past, or they may discuss the results of interviews or oral examinations. In any case, the signed evaluation will include the identity and brief vita of the writer; the professional relationship, if any, of the writer to the student; a description of the content examined and/or competencies identified; a discussion of the level of resulting learning; the method of observation or examination; and the specific outcomes supporting the conclusions of the writer.

CONTRACT LEARNING

All credit-bearing academic work at E.S.C. is described and carried out using learning contracts. Their use permits the college to structure individualized study of variable time and depth. A learning contract is a written agreement, developed jointly between a student and a faculty member, which describes the nature and amount of work to be completed in a designated time. It includes

a. An initial description of the intended scope of the student's general plans;

b. The specific goals and purposes that the work is supposed to accomplish, and the time stipulated for the work;

c. A description of the learning activities to be carried out, including all resources to be developed or used;

d. The criteria which will be used to evaluate successful completion of the work or achievement of the purposes.

Learning contracts can be organized around frameworks comparable to those available for degree program design: exploration of a field or area; specific disciplinary, interdisciplinary, or multi-disciplinary study; or thematic, problem, or project-oriented study. A wide variety of learning resources can be considered including: human interactions; work and field experiences in businesses, industry, hospitals, governmental and social agencies, and public and private community organizations; packaged modular materials; college courses and laboratory work; research in libraries, museums, galleries and concert halls; and media material of all kinds.

Evaluation of the results of the learning activities can include elements which are oral, written, or performance-based; which are product or process-focussed; which are objective or subjective. The important point is that, in all cases, these elements relate directly to contract goals, and result in evidence that provides public representation of the student's accomplishment. In addition, ongoing student-faculty dialogue, which may be written into the contract as a series of checkpoints, serves as a continuing evaluation of progress during the course of the contract work.

The primary educational advantage of contract learning is the ability to involve students in the organization of their own work, and to assist them to become capable of self-directed learning. Planning a contract is, in itself, a learning experience. Students must think about their own goals, the relevance of the area being considered for study, the objectives of the college, and perhaps, the changing needs of a profession. Where curricular content is not initially prescribed, the personal involvement of the student in defining objectives and developing learning activities can help the student to develop a more organized approach to his or her own study over time. In addition, the guidelines contained in well-planned contracts provide a firm "structure" for students, enabling them to assess their own progress as they carry out the learning activities.

A more extensive discussion of contract learning can be found in reference 2.

STUDENTS

Data assembled by the E.S.C. Office of Research and Evaluation[3] indicate that the college has attracted as students individuals with a wide variety of backgrounds and interests. Their ages range from late teens to late sixties, with median age in the late thirties. Approximately two-thirds are married; work full time; live within 25 miles of their center or unit; and report "definite" learning objectives when they enroll. Most E.S.C. students have had some prior college experience, and most live in New York State. The student population is about evenly divided between men and women.

After a brief admissions orientation with a group, students normally engage in study independent of other students. They work with a mentor or with a resource person as appropriate to their contract learning activities. However, a variety of "one-time" group-study activities do occur throughout the college, designed to respond to student and faculty interest and availability. These may take the form of seminars, workshops, or residencies, and may be center-based or statewide.

E.S.C. recognizes that there are certain times when students need or desire an intermission from study, and so provides students the opportunity for temporary withdrawal. A student receives no academic penalty for withdrawing; upon re-enrolling, the expected date of completion of the current contract is merely advanced to include the withdrawal period.

The author has served as mentor to a variety of students with degree program concentrations in engineering and technical areas. These students have included a mechanical field superintendent in major construction; an analytical chemistry technician for a medium-size manufacturing company; a quality control laboratory supervisor; an assistant engineer for a county highway department; a computer system specialist; and a variety of technicians in large corporations working in the physical sciences, metallurgy and materials, and chemistry.

ROLE OF THE FACULTY MEMBER

The E.S.C. faculty are called mentors. The role of the mentor is modified somewhat from the role of a traditional college faculty member[4]. Although the elements of the job descriptions sound similar, the emphasis will be different. In each case, faculty are usually responsible for advising students, identifying and developing learning resources, developing curricula, providing instruction and evaluating outcomes. At E.S.C., however, student advisement is a major part of the job. Students usually meet with their mentors in face-to-face conferences to discuss work planned or in progress, and academic advisement occurs continually as an integral part of the student-mentor interaction. The mentor must not only assist students in assembling learning contracts that are academically sound and have clearly stated objectives and expectations, but must insure that each contract moves the student in the direction of his or her long range educational and career goals as expressed in the degree program.

It is probably not possible to describe "the" way in which a mentor works with students. At certain times, it is appropriate for the mentor to serve as the primary learning resource for students, helping to design learning contracts, suggest resources, formulate problems, answer questions, and evaluate outcomes. At other times, the mentor may serve the managerial function of bringing together the student learner with outside resource persons who can assist the mentor and student in the planning and evaluation of learning contract or degree program design activities. There appears, then, to be a spectrum of functions, with one end, perhaps, being labeled "tutor" and the other end, perhaps, being labeled "facilitator." The mentor's function may therefore be described by different points along this "spectrum" when working with different students, or with the same student at different times.

Mentors carry an assigned student load, and normally meet with students by appointment. Given the diverse E.S.C. student population, appointment times of mutual convenience are rarely regular. Mentors have met and worked with students during the day, during evenings and weekends, and at a variety of locations as necessary and appropriate.

CONCLUSION

This paper has briefly described the way in which one college has been structured to give the individual student maximum control and responsibility over his or her own education. To support individualization of learning, the college has redefined the role of the faculty member, altered perceptions of syllabus and curriculum design, and expanded recognition of where and how learning takes place.

REFERENCES

1. J. Hall, "Empire State College", Engineering Education, V. 63, No. 7, p. 496 (April 1973).

2. J. Gilbert, "Contract Learning", Presented at Annual Conference, American Society for Engineering Education, Event 2530, Ft. Collins, Colorado (June 1975).

3. T. Lehmann, "Educational Outcomes from Contract Learning at ESC", Office of Research and Evaluation, Empire State College, Saratoga Springs, New York 12866.

4. P. Bradley, "The Empire State College Mentor: An Emerging Role", Office of Research and Evaluation, Empire State College, Saratoga Springs, New York 12866.

Jay Gilbert (Ph.D., Materials Science, S.U.N.Y. at Stony Brook), worked for several years as an Associate Physicist for the I.B.M. Corporation. He has taught in a community college and was one of the founding faculty of a two year upper-division technical college. He is currently an Associate Professor and Mentor at Empire State College, where he works primarily with adults studying in the sciences, technologies and in engineering.

THE TEACHING OF TECHNOLOGY IN THE OPEN UNIVERSITY (UK)

Geoff Peters, Chairman
Systems Performance course team Open University
Milton Keynes, England
currently visiting Systems Management Center
University of Southern California

David Blackburn
Reader in Engineering Science
currently Director Open University of the United Kingdom
North American Ofice
New York, New York

SUMMARY

Since 1972 Technology courses have been offered to students of the Open University. The 60,000 students are adults studying in their spare time by means of specially written course books, television and radio programs produced jointly with the British Broadcasting Corporation as well as specially manufactured home experiments and computer exercises.

The paper charts some of the developments in course design that the authors perceive and discusses possible future problems.

The Open University

Aims and Methods

The Open University was designed to offer a full program of University level education to working adults studying at home. To do this the University has developed a range of courses each of which employs a number of instructional media. These include: text, the leading medium; television, nationally broadcast; radio; tutorials, sometimes by telephone, usually in meetings at 700 centers throughout the country; week-long summer schools, particularly for courses involving experimental work; kits for experiments to be performed at home; a nationwide computing service; a system of continuous assessment based on written work monitored by a net of tutors spread throughout the country and on computer marked multiple-choice questions; a nationwide system of proctored final examinations. The University places no educational prerequisites on its students and actively encourages those who have few or no qualifications at entry.

Students

The mean age of Open University students is about 35 years the range being from 21 to over 80. They currently progress through the University at a rate which, on average, allows them to complete the requirements for an ordinary degree in 6 years or an honors degree in 8 years. Students may work faster, and a few have completed a full honors course in 4 years, a rate of progress comparable with that asked of full-time regular students. Present estimates are that about 60 per cent of those entering the university will finally graduate. The background of students is very varied and ranges from those without any educational qualification to post doctoral researchers and teachers in Universities - including our own.

In technology courses there is a good representation of people with occupations like draftsman and computer programmers where higher education was not necessary for entry but may aid promotion. People intending to change careers or broaden their career prospects are common too. Included in this group are members of the armed forces and women intending to resume employment after raising a family.

Commencing in 1971 with 25,000 students, the University has a current enrollment of 60,000. Total registration is limited to budget, some 30,000 students being turned away each year.

Courses Offered

Courses offered by the University are administered by Faculties of which there are six: Humanities, Social Science, Education, Mathematics, Science and Technology. Between them the Faculties currently offer 113 course titles, 19 of these being administered by the Faculty of Technology and a further 12 are interfaculty course involving technology. (Those available in 1980 are shown in Appendix I).

In common with most UK institutions the Open University offers courses which are individually rather long. All are equivalent either to about 6 x 3-credit hours (called a 1 credit course) or to 3 x 3-credit hours (called a ½ credit course). The total course offering made by the university is equivalent to about 500 3-credit hour courses. Because the university is commited to replacing all courses after roughly six years of operation, the number quoted represents a steady state of the university with new courses being replaced at the rate old ones are discarded. The university will reach this state about 1982.

Each course takes 32 weeks and is available once a year beginning in February. The demands made of students are considerable. As an example an idealized week in the Foundation course in Technology would consist of a specially written course unit of about 30 to 50 pages, readings from a textbook, a 25 minute television program, a 20 minute radio program, an experiment to be conducted at home using a kit provided as part of the course or an exercise on a computer terminal located in the nearest town. In addition every 3 or 4 weeks each student has the chance to attend a local tutorial dealing with current work. Such tutorials are run by the University's 6000 part-time tutors who normally work in local universities, colleges or industry. It is to this tutor that students submit their written assignments, which are marked to schemes set by the University's course teams. In Science, Technology and Mathematics it is common also for students to answer a number of multiple choice questions which are marked by computer. All Foundation courses have a one week compulsory residential summer school about 2/3 of the way through the course, which is held at a conventional university.

Course Production

Courses are designed and developed by project groups called course teams who have a chairman--usually a senior academic specializing in the course topic who has a managerial responsibility for the production and has a leading role in editing and maintaining academic standards. The team exist for the two to three year period when the course is being designed, developed, produced and run for its first year. Course teams are staffed by full time members of the University's central academic staff, often with the addition of staff from other universities either on secondment or more usually as part time consultants advising on particular aspects. In addition to academics, a typical course team will also comprise: two or three BBC producers who will often have academic qualifications in the subject; a professional editor for all the written material; a full time tutor from among the academic staff who takes responsibility for tutorial aspects of the course; an educational technologist whose task is to keep the course team aware of developments in distance teaching methods and comment on the effectiveness of draft material. Once a course has been produced, and lessons learnt from the first year incorporated, the team is reduced in size. It then works to maintain control over academic standards by monitoring the work of part time tutors and by devising assignments, marking schemes and examinations. All courses have a final examination which is sat throughout the country at the same time, and is marked either by members of the course team or by a selected small group of tutors under course team supervision. In line with UK practice, the pass standard is set by external examiners, academics prominent in the field who are recruited from other universities. This habit of external consultation is seen as an essential feature of Open University work, much of its written course material also being sent to outside academics for criticism and evaluation.

Feedback

In addition to providing course team advisors, the Institute of Educational Technology which is a seventh "faculty" has a staff of researchers who help course teams collect data about the effectiveness of their strategy. In addition a survey research department is developing standard methods of comparing the performance of different course teams. In essence the methods are twofold. In the first case students and part time staff are asked to report on their own opinions and experiences with the material. These data which come from various forms of survey are particularly suited to highlighting unevenness and difficulty among different aspects of one particular part of a course and the length of time necessary to complete various parts. The second method involves assessing how much students have learnt. Course aims and section objectives are made the subject of assignment questions for students throughout the year and in an examination at the end. Often it is only the answers to these final examinations which throw light on the quality of the overall course design.

Teaching Technology at the Open University

How to Teach Technology

From its inception the Open University recognized that to teach remote, adult students who may have had no previous experience of advanced education would require teaching material of exceptional quality. Precedent in the field was available in the history of correspondence schools from which student dropout rates have always been disastrously high for a reason which has well been described as "The loneliness of the long distance learner". Compounding this problem, there is the need in science and technology to give students laboratory and practical experience.

The University's general response to the distance problem has been to build a sense of community through tutorials, counseling service, summer school, even by telephone discussion of work assessments. Less formally there are also a student newspaper, clubs, student representation on university government. In science and technology the specific response has been to write course material in which there is constant reference to aspects of his studies for which a student can see application at home or work. The problem of hands on experience is met by home experimental kits which may include signal generators, CRTs, sound measuring equipment or microcomputors. With such equipment students do not need do experiments, but may work on small projects in which they design, make and test their own special equipment. By using television programs to back-up some of these projects students are again made to feel a closer involvement with the people who teach them.

Trends

While it was clear from the outset that good teaching material for our students had to be more than a clear textbook presentation, the differences required were not at all clear. As a result there has been a distinct change in teaching style since 1970.

In the early days of course production considerable effort was made to analyse the essentials of each subject, and to break it down into its constituents so that each might be taught as thoroughly as possible. The result of this approach was to produce excellent individual course units, for example in production modelling or electricity and magnetism. These units taught theory well but the relationship between theory and reality was not always as clear as authors had hoped. Material of this type differed from standard texts mainly in the use of a free writing style addressed directly to the student, as if he were there face-to-face, and in an emphasis on explicit statements about the skills and understanding a student should have on completion of his study. Another early device was the use of in-text questions for students to monitor their own understanding of each point made.

Overall course integration proved difficult in the ~~early courses~~ unless they were structured so formally as to be mere textbooks. The next stage in course development was therefore the introduction of major case studies that described real examples like the electricity supply industry and which had the objective of integrating theory with its application when teaching simple electricity or thermodynamics. These studies also put a solid context behind technological skill.

A third stage in this progression was the design of courses in which case studies formed an integral part. The courses commonly start by detailing a particular situation or problem and then formal theory is introduced as and when it is necessary to understand the case studied. So, in one course students are asked whether solar cells have the potential to drive a full size power station and why it took so long for the techniques of chinese porcelain manufacture to come into use in Europe. The appropriate branches of solid-state theory, semiconductors and ceramics, are then introduced to illuminate the set problem. In a different discipline, human factors, students are given all the details of an aircraft accident. They are then provided with a methodology to analyze the accident and the human factors theory necessary to understand what might have happened.

It is, we believe, through this continuing search for styles of presentation that are comfortable for an adult student working at home--sometimes called habitability--that the University's dropout rate has been held to a reasonable level. Of the first year's intake 43% have graduated and 35% are still studying. We expect a final graduation figure of just under 60%.

The search for improved presentation and study patterns continues. A fourth and recent stage in course production has been the introduction of student project work. Starting with small structured projects that all students work through, the trend has developed to a point where in the next year or so the Faculty of Technology hopes to allow students the chance to conduct a final year project equivalent to 18 credit hours of work in a subject of their own choosing.

Plans for the project course, if course is the appropriate word, are incomplete but a pilot scheme with a small number of students will commence shortly. There are considerable problems in divising good projects in sufficient numbers, in providing suitable guidance, and in ensuring adequate assessment.

Currently it is expected that students will be provided with access to some general material on "how to do my project" and that some clearing house will be set up to link tutors and students with common interests. In the longer term we hope that students may be able to carry a subject and tutor with them from a previous course.

Ultimately all students studying primarily technology may complete a project. The scale of operations then will be formidable for we contemplate a demand for the devising, monitoring and assessing of thousands of projects each year.

Strenghts and Weaknesses

Because its structure is so different from other institutions, the Open University has a pattern of strength and weakness very different to that met elsewhere. The prime strength of the university lies in the great care that is taken in course preparation. Because a course may have many thousands of students throughout its life the resources expended may be very high. In some cases as many as 1000 staff hours may be devoted to producing material for one hour of student study; commonly over 100 hours are spent for each student hour. Even so, the cost of an Open University degree is probably only a third to a sixth of that at a conventional institution, depending on whether one includes the social value to the community of the student who remains in fulltime employment. The other great strength lies in the course teams and in the mutual criticism to which team members submit their work. Strength also arises by collaboration with other institutions over particular courses.

A different kind of strength comes from the use of broadcasts. By the use of television it is possible to present to students the views and ideas of outstanding people and also to show situations they could not expect to visit in the course of their study. The medium also allows us, especially through computer graphics, to illustrate many ideas in a way not possible with blackboard and chalk.

Finally an important strength is the commitment by staff, both full and part-time, to what is still a revolutionary idea in British education and a student group who show extraordinary tenacity in their search for a widened experience of life.

There are also weaknesses inherent in its distance learning method. Some are general, some specific to the Open University itself.

Most serious is surely the lack of contact between student and student and between student and staff. This is inevitable: to increase the contact hours to those at a conventional university would require funding well beyond what can be expected from the most beneficent government and even were the funds available working students do not have the time to travel frequently to their tutorial centors. Against the lack of contact must be put the maturity of the students. Adults seem able to maintain their firmness of purpose, even when isolated, in a way that could not be expected of the young campus-based student.

Our other big weakness arises from the size of the Open University and the complexity thought necessary in course production. The high visibility of the course material to the world at large demands exceptional standards of quality. One result is that it takes three years to design and produce a course. It is thus a very slow matter to change courses or to change the pattern of courses offered.

However others may see the balance of strength and weakness in the distance learning methods practiced at the Open University, our view is that this represents a good alternative for students who must combine their study with work. This view is confirmed by the fact that some 10% of fresh UK graduates now come from the Open University.

APPENDIX I

Titles of Technology Courses Available in 1978

Foundation Courses

The Man-Made World: A Foundation Course[1]

Second Level Courses

Introduction to Engineering Mechanics

Systems Behavior

Systems Management

Man-Made Futures: Design and Technology

Environmental Control and Public Health

Instrumentation

Food Production Systems

An Introduction to Materials

Electromagnetics and Electronics

Art and Environment

The Digital Computer

Modelling by Mathematics

Statistics: An Interdisciplinary Approach[2]

Elementary Mathematics for Science and Technology[2]

Mechanics and Applied Calculus[2]

Science and Belief: From Copernicus to Darwin[2]

Science and the Rise of Technology Since 1800[2]

Urban Development[2]

Biological Bases of Behavior[2]

Solids, Liquids and Gases[2]

Images and Information[2]

Principles of Chemical Processes[2]

Technology for Teachers[2]

Third Level Courses

Telecommunication Systems

Systems Modelling

Materials Under Stress

Systems Performance: Human Factors and Systems Failures

APPENDIX I (cont.)

Materials Processing

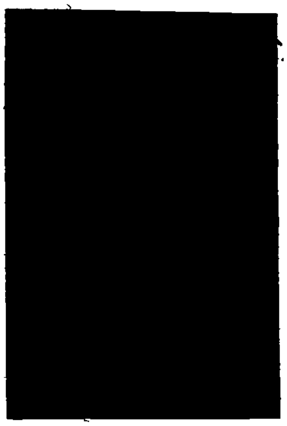
Control of Technology

People and Organizations[2]

---

1. Full credit course

2. Courses produced by other faculties with assistance from the faculty of technology



Geoff Peters has been with the systems group at the Open University since it was founded in 1971. He worked on the technical faculty's original foundation course - "The Man Made World" and has since mainly contributed to courses in the systems area. He was chairman and general editor of "Systems Performance: Human Factors and Systems Failures." - A joint technology - social science faculty course.

His recent publications include "A Systems Behavior" (Published by Harper & Row) and "Catastrophic Failures", "Systems and Failures" and "Airtraffic Control - A Man Machine System" (Published by Open University Press).

He is currently on study leave at the University of Southern California Systems Management Center.

NEW CONCEPT IN AMERICAN EDUCATION

Eugene G. Stone
President
American International Open University
St. Louis, Missouri

I. The Way It Was --- Some Background

History tells us that there are few things that can be counted upon to endure. Among those few things which can be counted upon is the fact that social organizations will change to meet the needs of society. A good deal of this change will be resisted by the present order of social organizations. The amount of resistance encountered is directly proportional to the level of perceived threat which the new idea brings with it. Something within the make-up of man causes him to cling unreasoningly to the common and familiar and to resist with vigor that which threatens the status quo. A familiar statement by John Gardner in his book Self-Renewal sums up this attitude:

> "A common strategem of those who wish to escape the swirling currents of change is to stand on high moral ground. They assert that the old way is intimately bound up in moral and spiritual considerations that will be threatened by any change.... The new thing will usually look barbarous compared to the old. The era that is being born will often look less spiritual and less laden with the deeper values. The society that has mastered the art of continuous renewal will not let such impressions distort it's judgement. It will reject the notion that nothing is morally worthy unless it has been around for a long time."

The external degree is one of those areas of education where change has been demanded by social conditions and has been greatly resisted by established organizations.

Historical Overview

A brief overview of the evolution of internal and external education will be helpful in understanding how we arrived at the present forms of education and will take a good deal of the mystery and suspicion out of the discussion.

In the United States the evolution of educational process and procedures began with the establishment of Harvard College in 1636. The process of education as established there lasted for 250 years and regarded the degree as an award given to students, all of whom completed in look-step fashion, a set of course studies pursued in the same way and in the same sequence. No leeway was given for electives or other academic alternatives. Students were, however, allowed to make use of literary societies and other external ways of enriching their education. (External, that is, to his main curriculum of study though not always external to the institution.) The curriculum was classical and religious.

In the last quarter of the nineteenth century Charles W. Eliot, the president of Harvard University, established the elective system in which students had a larger freedom of choice as to which classes they took. However, this innovation, though common-place today, took thirty years of hard-fought academic battles to establish. But, many traditionalists die hard. Six decades later Albert Jay Nock said, referring to the elective system, "The worst calamity that ever befell American education was Eliot's refusal of the presidency of a textile manufacturing company."(1)

Following the bold innovation by Eliot, other innovations appeared on the American educational scene which today seem so commonplace that we think that they have been around forever. Some of these innovations included the ideas of giving credit for courses, grouping courses into majors and minors, requiring a minimum number of credits for graduation, grade points and grade point averages, etc.(2) The result of all these changes was that American education became more and more open and more and more accessable to a larger number of individuals who wanted to commit themselves to fulltime study at an institution of higher learning. Another effect was the creation of more and more degree titles to reflect the diversity of the educational programs studied by these students. For example, in 1877 there were eleven different degree titles. Today there are approaching 2000 different degree titles used in American education.

Following World War II the large number of adults in the form of veterans and others who wanted a college education but who could not spend full time on campus led to the establishment of the extension degree programs. At first the extension degree program was merely another way of satisfying all of the requirements laid upon all other students.

Eventually, however, it was seen to be ridiculous to equate sophisticated adults with high school graduates. Adult degree programs began to be developed which recognized the maturity and sophistication of this new type of student.

The acceptance of adult degree programs did not come, however, without a good deal of criticism.

Schools of business were among the first to recognize the urgent need for a different approach to education of adults. Many business schools worked with extension divisions of their universities to establish programs specifically designed for adult learners. Most of these programs, however, still required physical attendance at the university classes. Throughout the 1960's more and more universities began to realize the need for developing programs which recognized the sophistication and learning already possessed by adults.

By 1970 a variety of schools had organized programs for individuals, primarily adults, which did not require attendance at the university at all. Since the study and learning was external to the campus the degree became known as an "external degree".

Once the thinking of educators had been opened to the possibility of new processes and procedures for learning, an avalanche of ideas came forth. Among these was the granting of degrees by institutions which were not primarily educational, such as government bureaus, business or professional associations, etc. (e.g., the U.S. Department of Agriculture Graduate School); the elimination of some or all of the admission requirements to establish open access to education; granting credit and/or degrees on the basis of evaluation of learning regardless of how acquired; teaching by non-faculty persons or part time teachers; the use of modern education aids such as TV, audio and cassette tapes, programed learning, computerized instruction, etc.; recognition and credit for informal learning and learning through experience.

As indicated by Dr. Houle, "These bold suggestions make it clear that a watershed has been reached... Proposals now being made go to the very heart of the system of higher education and call for radical changes in its structure and processes. Even in relatively conventional, and well-established situations where there is no thought of undertaking the extreme proposals just suggested, non-traditional curricula are being developed."(2)

The North Central Accrediting Association indicates that today every American university and college has at least one non-traditional program.

The historical message is clear. American education is a dynamic institution which responds, however slowly and reluctantly, to the educational needs of society. External degree programs for adults have emerged as a much needed and logical extension of American educational delivery systems. It is here to stay. It is the wave of the future.

American educational processes and procedures have not developed to their present state in a vacuum. Educational innovations from Europe have had a profound effect on American education. Most of us have heard of the Open University of Great Britain, but not all of us perhaps realize that the University of London established over 100 years ago a program which allowed their students and graduates to pursue education external to their university. In fact, the external degree approach to education has found a stronger foothold in the European countries and has been more readily accepted there than in America. Many European countries have national open universities for the benefit of their citizens.

Fer of the educational innovations in America reported above came about without vociferous criticism from some part of academia. Those individuals for whom the currents and winds of change became too strong reverted to name calling, labeling as "degree mills" those institutions who had accepted innovations too quickly and implemented them too vigorously.

Agassiz, a well-known 19th century philosopher, said that every great innovation goes through three stages. First, people say it conflicts with what they hold most holy and sacred; second, they say that it has been discovered before, it is not new; third they say that they have always believed it. In like manner, many of the staunchest critics of educational innovations have, in time, become staunch supporters of these same innovations.

<u>Studies and Reports on Non-Traditional Education</u>

During the 1970's there have been several studies which have, in some major or minor way, contributed to the understanding of non-traditional education and particularly to the external degree. The first and perhaps the most well-known and well-done was the Carnegie Commission on Non-traditional Study. Funded by the Carnegie Foundation, the Commission on Non-traditional Study was composed of 26 of the most outstanding educators in America. The findings of this commission are clearly indicated in their two books, <u>The External Degree</u> and <u>Diversity by Design</u> (Jossey-Bass, 1973).(2,3) "The fundamental recommendation of this report is clear. The oft-stated American goal of full educational opportunities should be made realistically available and feasible for all who may benefit from it whatever their condition of life. Colleges and universities would work toward the absorption of the external degree into their normal process of degree granting, instead of keeping it as an ancillary part of their total program."

While many universities have heeded the findings of the Commission on Non-traditional Study, a great number of universities have been reluctant to move in the direction of the external degree. This, in spite of the fact that separate studies by the U.S. Office of Education and the Educational Testing Service showed that over 75% of adult Americans want additional higher education and feel that the traditional university route is unable to deliver it because of barriers of time, place, cost and irrelevant courses and arbitrary requirements.

The early 1970's saw the completion of a number of studies which called for the establishment of new institutions with new processes and procedures to meet the expanding educational needs of adult Americans. A number of institutions were created to meet this need. /A few of these are discussed in the next section of this report.

II The Way It Is --- An Overview

There have been a large number of institutions created during the 1970's specifically to serve the educational needs of adults. Some were established within existing universities, others were new institutions created outside of existing schools and for the specific purpose of serving mid-career adults. A few of these will be discussed to give the reader an overview of the types of institutions external to the mainstream of education which exists in America today.

The ones to be discussed will be New York Regents External Degree Program, Empire State College, Union Graduate School and American International Open University. The first two deal only in undergraduate degrees; AIOU deals in all levels of degrees, and Union Graduate School deals at the doctoral level only.

Before embarking upon a description of the external degree as it exists today, the reader should be cautioned that attempts to equate external degrees in process, procedure or outcome with internal degrees can be a frustrating and fruitless experience. This is not to imply that one is better than the other. Each degree deals with a clientele with a different set of needs, aspirations and objectives. As in every other aspect of life mismatches can produce some unfortunate consequences. That is, an "internal" oriented sutdent in an "external" program, or an "external" student in an "internal" program would produce, at the very minimum, a sub-optimal educational experience.

The Regents External Degree Program

The Regents External Degree Program is a truly "external" degree program. It is an undergraduate program run by the New York Board of Regents which evaluates a student which it has not directly taught. It has no campus, no resident faculty and no students in the traditional sense. It publishes its requirements for the degree and awards the degree to anyone who can meet the requirements. There are no requirements for admission, residence or age, and the methods of preparation are not prescribed. The degree requirements can be satisfied in a variety of ways. No classroom attendance is required and no instruction is provided.

Within the first two years of its creation in 1971, more than 2500 people had earned Regents external degrees, and well over 7000 others were working toward that goal. The Regents External Degree Program received regional accreditation only recently with the Middle States Accrediting Association. However, since the inception of the program, they have been accredited by New York State Education Department, a nationally recognized accrediting agency.

From 1971 to date there have been over 18,000 graduates. The Regents External Degree Program operates only at the undergraduate level and does not offer engineering and other technical degrees. Anyone can use the University's services. The cost is minimal compared to residency based programs.

Empire State College

Empire State College in New York has been in existence since the turn of the decade and has issued many thousands of degrees in art, science and professional studies at the undergraduate level. Empire State bases its system of education on its advisors who help the student tailor a degree program to the specific need of the student. The student body ranges from those of traditional college age to individuals of advanced years. Each student has a "mentor" who is responsible for directing and advising him or her. Prior learning, regardless of how it was attained, is evaluated and credited.

Overseeing the student's mentor is a committee of three Empire State faculty members who review the student-mentor relationship to ensure that Empire State's standards are upheld. Overseeing the committee of three faculty members is an Office of Program Review and Assissment which acts as a final check before the granting of a degree.

Empire State University has a formally developed set of study-unit requirements that must be fulfilled by the student. Many of the study-units requirements can be met through prior learning or life experience by passing oral or written exams. Empire State's program requires a minimum of one year's study in residence in the program. A final oral examination is required by the University after all other requirements are completed. Anyone in the U. S. can attend. The cost of the program is minimal to New York state residents. It is accredited by Middle States Accrediting Association.

Union Graduate School

Union Graudate School (UGS) is an out-growth of the Union for Experimenting Colleges and Universities, a group of colleges and universities which banded together for the purpose of providing bachelor level programs for individuals who wanted to study at any of the universities and get credit at the "home" university, i.e. the university at which they were matriculated.

The UGS program is only for individuals who "clearly cannot obtain the kind of advanced training they require within any conventional doctoral program."

Participants begin by attending a four-week residential colloquium and are expected to spend two additional weeks attending "mini-colloquia" or similar meetings. During the first four-week session, the participants discuss their study plans with the staff and other students and develop a sense of goal and direction and an awareness of the steps to be taken and the effort to be required.

After the four-week Colloquium, a guidance committee is formed made up of a UGS faculty advisor, two adjunct professors who live near the student and chosen by the student subject to UGS approval, and two student peers. Following the establishment of this learning committee the candidate spends six months or more in planning the degree program at the end of which a learning contract is evolved and signed by all concerned.

A large part of the program is spent in planning and productin a "project demonstrating excellence". This project may be a traditional dissertation or any other type of project which makes a "significant contribution to our culture".

When the project demonstrating excellence is completed, the committee decides on its acceptability. When it is approved the student applies for the degree. The program requires a minimum of one year and can take a maximum of four years to complete. The total cost is about three thousand dollars per year.

Union Graduate School works only at the doctoral level, does not give credit for experience, and doew not have programs in the engineering sciences. Union Graduate School is a Candidate for accreditation with the North Central Accrediting Association.

American International Open University

American International Open University (AIOU) was created in 1972 by a group of faculty from the graduate schools of Harvard, U. Mass., University of Pittsburgh, Southern Illinois University (Edwardsville), and the Central Midwest Educational Laboratory. AIOU offers external degree programs at all levels of education from the associate to the doctorate. The overwhelming majority of the participants are at the Master's or Doctoral level and in a wide variety of fields including engineering.

Once accepted into the program, participants of AIOU enter into a planning phase or "CAPS" during which Counseling, Assessment, Planning and Screening are conducted. The CAPS activities may last several months. At its completion the student will have had his experience and prior learning evaluated and possess an approved Master Learning Plan (MLP) which will guide his learning. There is no need for participants to spend physical residency at the University or other location, but residency in the program is required for a sufficient time to plan and implement an MLP and a project. Orientation to the process is conducted via a detailed student and advisory handbook and through orientation discussions with a University coordinator.

Each participant works with advisory committees composed of two (sometimes three or more) individuals who have been screened by the University and accepted as capable of doing the advisory work. Students are requested to nominate the advisory committee members with final approval by the University. The University provides one advisory committee member.

The University also provides an Academic Council composed of individuals who are familiar with standards and requirements of the University and which give final approval regarding each of five major milestone events during the student's tenure at the University. Academic Council approval is required at these points:

1. Approval of the advisory committee.
2. Approval of competencies which the participant will be required to master.
3. Approval of the Master Learning Plan.
4. Approval of the preliminary project.
5. Approval of the final project as submitted for graduation.

After a candidates's committee has been established, the committee proceeds to define a list of competencies, i.e., statements of knowledge and ability which the candidate will be required to master. These competencies are expected to be specific and supportive of these general competencies:

DOCTORAL LEVEL COPETENCIES

* A broad understanding of the field as a totality, including a high level of understanding of the theoretical, practical, and subcategorical dimensions of that field.
* Mastery of at least one branch of knowledge and/or skill within the field of a sort that enables one to function at a high level as a specialists in that branch.
* Familiarity with research deisgn and methodology so that one can be competent consumer and critic of published research studies.
* Acquisition of skills necessary to carry out a research or action project which can produce new knowledge, insights, or tools for the benefit of others.
* A knowledge of the most effective ways of keeping up with the developments in theory and techniques within the field of specialization.

MASTER'S LEVEL COMPETENCIES

* Mastery of at least one branch of knowledge and/or skill within the field of a sort that enables one to function at a high level as a specialist in that branch.
* Familiarity with research design and methodology so that one can be a competent consumer and critic of published research studies.
* Acquisition of skills necessary to carry out a research or action project which can produce new knowledge, insight, or tools for the benefit of others.
* A knowledge of the most effective ways of keeping up with the developments in theory and techniques within the student's field of specialization.

BACHELOR LEVEL COMPETENCIES

* An indepth understanding in a field of knowledge and/or skill which enables one to function as a professional in that field.
* A familiarity with selected social and physical sciences as well as several areas of liberal arts.
* EITHER, possession of the skill and ability to carry out, with supervision, a research or action project which can benefit society and the student; OR, successful completion of an appropriate practicum.

* Knowledge of the most effective ways of keeping up with development in one's major field of interest.

When these competencies (the competency list) have been approved by the Academic Council, the candidate works with his committee providing them with documentation of his backgound and prior learning, including transcripts and other documentation. The committee's responsibility at this point is to determine which of the approved competencies are already possessed by the candidate and which are in need of further development. During this evaluation phase it is the participant's responsibility to provide to the committee whatever documentation is necessary to verify his possession of one or more of the competencies.

When the evaluation is completed the committee will have identified those competencies which are in need of further development by the candidate. At this point the committee and the participant prepare a Master Learning Plan (MLP) which defines in detail what will be done to master each of the remaining competencies, what resources are available to work with, and approximately what time schedule will be adhered to. Once the Master Learning Plan has been designed it is submitted to the Acedemic Council for final approval. If approved the committee and the participant proceed to implement the plan with frequent feedback between candidate and committee. If the Master Learning Plan is not acceptable to the Academic Council, it is returned to the advisory committee with specific suggestions which are then incorporated into the plan.

The implementation of the MLP will take as ong as necessary to adequately demonstrate mastery of the remaining competencies. The amount of time necessary depends on the work to be done. Candidates have spent as little as one trimester at the University and as long as seven trimesters. A trimester is four months.

When all competencies have been mastered to the appropriate level required for the degree being sought, the advisory committee completes the final evaluation and verification of competency possession. This final evaluation is written on presceibed forms and submitted to the academic Council for final approval. If it is approved, based on the existence of sufficient documentation and other evidence, the Academic Council will notify the advisory committee that the candidate may begin the Project phase of his program.

If the Academic Council believes one or more of the competencies are not sufficiently mastered, it will so notify the advisory committee with specific suggestions as to the candidate's next steps. The advisory committee then proceeds to work with the candidate until all the competencies are mastered at the desired level.

A project is required at all levels from the bachelor's through the doctorate with each level having its own requirements regarding the nature and significance of the project. In all cases the project must be something which is of social value and a significant contribution to the individual's profession and/or society. The project phase of the program begins with the submission to his committee of a preliminary description of a project which the candidate desires to complete.

Once the Academic Council has approved the project the candidate works on the project under the guidance of his advisory committee. When the project is completed to the satisfaction of the committee and the Academic Council, the candidate applies for graduation. Sometimes an oral defense of the project is required by the Academic Council or by the participant's advisory committee. Whether or not such a defense is required depends in large part on how closely the committee and participant worked during the implementation of the project. Some committees know intimately how the project was conceived and implemented and do not feel an oral defense is necessary. Other candidates work more independently and, in these cases, an oral defense is frequently required. The oral defense committee is composed of the advisory committee plus one member of the Academic Council in the participant's field of study. AIOU is nearing the end of a year long self-study in preparation for application for accreditation.

Evaluation of External Education

How does an individual jusge the effectiveness of an external degree educational experience? How would one judge which external degree program is the best for a particular individual? In short, how does one evaluate external learning?

External education is by no means simple to understand and evaluate. Nor is it simple to administer. In many ways, administration and evaluation of traditional "internal" education is much simpler than external education. In the first place internal education is common and well-known to most of us, having experienced it ourselves. Second, internal education has, somewhat arbitrarily and artificially, quantified learning into numbers of credits within majors and minors each of which is made up of an accumulation of credits in designated areas and in specified quantities. It is easy to count the courses and add up the credits to come up with a total. If that total equals or exceeds the total which defines the baccaluareate or other degree, and if the course distribution is acceptable, the degree is awarded. In short, internal education is focused primarily upon the "product" (knowledge) and various quantification methods to determine its relative presence.

On the other hand, external learning usually focuses upon the "process" as well as the learning outcomes of the process. But, regardless of the focus, all education, whether external or internal, is ultimately evaluated on the basis of subjective decisions by the faculty or advisor. Within external programs of learning, evaluation takes place sometimes by written examination, but more frequently by the successful completion of certain tasks. Some external programs attempt to tailor their evaluations to be easily translated into traditional terms such as credit hours. Other programs completely ignore the traditional symbols of evaluation and attempt to fashion an evaluation which is meaningful to the participant as feedback on his performance and/or to others who can reasonably be expected to be interested in the evaluation. Some external programs have chosen to explicitly detail on the transcript what the individual did during the course of his program, commenting upon what the individual knows and can do at the end of his program.

Probably no one today is more aware of the variety of non-traditional programs from traditional and non-traditional universities around the world than is Dr. John Bear. Dr. Bear, in 1974, completed an extensive study of all forms of non-traditional education with particular attention to external degree programs.(4) Dr. Bear comments that the only means by which an individual can determine the quality of the external degree experience short of experiencing the program itself is to evaluate the credentials of the individuals involved, the qualifications of the faculty, and appropriateness of the process and procedures used, and to match these against your own reasons for attending an external university and your expectations from the educational experience. Dr. Laurence J. Hollander of the New York Department of Education agrees with Dr. Bear in the need for evaluating the faculty, process, procedures and others involved in the institution prior to becoming involved in an external program. Your motto should be *caveat emptor*.

After you make your evaluation you will see that the external degree is most successfully completed by individuals who have commitment to their own learning, have established clear goals and paths to those goals, and have the drive and determination to carry on self-directed learning.

One method used by many to get an "unbiased" and "authoritative" evaluation of external degree programs is to ask a favorite professor or other member of a traditional university what they think of it. Since most traditional university faculty and school administrators do not adequately understand external education and, based upon that lack of knowledge, view the external institution as competitive with their own, the opinions of such individuals are likely to be biased or misinformed. So what is the individual left with? He is left with making his own decision based upon knowledge of himself and his goal and whatever information he can obtain about the external degree program regarding its faculty, processes and procedures.

III Accreditation -- What It Is and Isn't

A few remarks should be made regarding the myths and realities of accreditation in America.

America is the only country in the world which does not have a ministry of education. In America evaluation of education is done by a group of private organizations constituted for the specific purpose of evaluating educational programs and institutions. The number of these agencies is large. Some agencies deal only in certification for licensure to practice a profession. Other agencies deal specifically in the evaluation of institutions and programs within institutions. It is these latter two that will be discussed.

There are two levels of accreditation in America: institutional accreditation and program or professional accreditation. Institutional accreditation, i.e., accreditation based on an evaluation of the institution as a whole, is done by a group of regional accrediting associations (e.g., Western, North Central, Southern, etc.). By and large, accreditation by one regional accrediting association is accepted by all the others.

Within a university, the various colleges have their own accrediting associations. For example, engineering, business, nursing, psychology, etc., all have their own professional accrediting associations. These associations deal primarily at the bachelor's or master's degree level and focus their attention on the contents of the curriculum and other learning experiences, establishing criteria regarding the number of courses and credit given for these courses.

The conventional wisdom is that the accrediting association establishes the standards of education and evaluates in terms of these standards. From this it is reasoned that the quality of the program is the focus of the evaluation and that, therefore, accredited programs are of necessity of higher quality than non-accredited programs.

A careful evaluation of accredited and non-accredited programs will quickly indicate that this is not necessarily the case. There are schools of high and low quality in both camps. A commission appointed by the U.S. Office of Education to evaluate the effects of accreditation on undergraduate education reported in 1976(5)

> ...it seems clear that the accrediting agencies conduct "technical evaluations" concerned with measuring physical facilities, faculty size, number of library books, etc. The agencies lack adequate indices for measuring

educational quality, and to the extent that the evaluations consider non-technical aspects of curriculum and educational excellence, their considerations appear to be based on unvalidated, "personal" or "social" impressions".

The accrediting agencies and the professional associations also appear to lack the capability to undertake responsible encouragement and accreditation of non-traditional programs...

A weakness of regional accreditation is that it has, for most practical purposes, stopped making quality distinctions. That will be denied, but we believe it is true and even axiomatic...

Professional or program accrediting associations come closer to the evaluation of the quality of education than do regional accrediting associations. By establishing curriculum requirements and other degree oriented standards, the professional accrediting associations help to assure that all graduates of accredited programs have somewhat the same background and understanding of the subject matter. But even here it is difficult for the accrediting association to adequately judge the quality of the teaching and, more importantly, the quality of the learning which is going on.

The mere ability of students to pass on examination does not of itself indicate quality learning. The real evaluation of the level of quality comes when the individual faces the necessity to use what he has learned in a real life situation. Much education fails this test. Complaints from employers are commonplace today regarding the educational and professional preparation their employees did not receive from colleges and universities. What employers want are individuals that can produce. They want individuals of competence and ability as well as knowledge who can tackle real problems and find real and feasible solutions.

In order to meet this need some universities have established what is known as competency based education. In these programs competency generally means that the individual has the knowledge, ability and attitude to behave correctly in given situations and when faced with given circumstances.

For example, the McMaster University School of Medicine in Hamilton, Ontario, is a competency based university. Here learning is more in terms of developing competencies for dealing with a wide variety of problems rather than from the more traditional biosystems approach. Their approach is to involve the students with experts from the field as well as with experts from the faculty. The entire program involves them deeply in the solution of real problems, and the result is that hospitals have said that McMaster graduates "go into internship behaving like doctors while graduates from other places come into internships behaving like graduate students."

Regional accrediting associations have had a difficult time understanding non-traditional programs. Partly this was due to the fact that external programs did not fit into the evaluation procedure used by the accrediting bodies. In fact, most of the criteria evaluated by the accrediting associations is absent in the external program. These programs often have no campus, no buildings, libraries or classroom facilities. So it is impossible to calculate such numbers as faculty-student ratios, full-time faculty equivalents, hours of classroom instruction, etc.

The accrediting association's slowness in responding to the non-traditional movement in American education as well as other rigidities within their policies and procedures caused Senator Proxmire in 1975 to threaten to introduce legislation to take the accrediting power away from private institutions and establish it with the U.S. Office of Education unless some progress was forthcoming.

Since the early 1970's, regional accrediting associations have been under extreme pressure from many sides to bend to the winds of change. Caught in the middle between member institutions who resisted innovation and outside forces in the form of lawsuits by individuals and institutions demanding change as well as pressures from the U.S. Office of Education for change, the regional accrediting associations have had a traumatic experience over the last decade.

Much of the resistance to the external educational institutions from within the regional accrediting association comes from the fact that member institutions are almost entirely traditional universities who view external universities as a threat to their "standards" of education as well as to their market of traditional students. However, the fact is that the vast majority of individuals who attend external universities are not within the marketplace of traditional universities. The external student is primarily an individual who has established a place for himself in his career and has no desire to upset the applecart in order to meet the residence and other requirements of traditional universities. In other words, a clear sighted individual can see immediately that there is not competition between external institutions and traditional universities for students. As mentioned earlier, external students would be as unhappy and mismatched in an internal traditional university program as traditional students would be in an external degree program.

So far as "standards" are concerned, external learning is more demanding. The learning is practice oriented and is learned better and retained longer than traditional classroom learning.

IV The Way It Will Be -- A Forecast

External education is here to stay. Particularly at the undergraduate level, many universities have external programs today, and more are investigating and implementing such programs.

The majority of external education today goes on at the undergraduate level. Only a few schools have external programs at the graduate level. However, this is certain to change. As schools get more experience and feel more comfortable with the external degree program, you will see a larger number of institutions offering external master's and doctoral level programs. It is my prediction that by the end of the century, external education will be as commonplace at all levels from bachelor's to doctorate as is internal traditional education today.

Further, it seems clear to me that as the barriers to education come down and the openness and ease of achieving education become more prevalent, there will be a significant jump in the percentage of the population with advanced education, and with advanced degrees to certify that education, much of it from external programs. With the proliferation of education it will become increasingly necessary for employers and others in the position of evaluating another's education to focus on the individuals demonstrated competence rather than on the possession of the degree.

There will undoubtedly be a larger number of institutions designed specifically for the delivery of external education. These institutions may have their own specialized accrediting association and will resist the next wave of innovation as vigorously as the traditional schools have resisted the external movement. Such is the history of organizational evolution, and there is nothing on the horizon that indicates that it will be different next time around.

A Final Word

Ever since the first degree was conferred several hundred years ago by papal authority, there has been a gradual increase in demand for degrees, until in America at the present time, a large portion of our population is questing for a degree. Most individuals enrolled in universities and colleges are not there merely for the learning but primarily to achieve the degree. So strong is the pressure to achieve the degree that many students will literally do anything to accomplish it, as recent history has shown.

Many students view academic requirements and course assignments as merely obstacles or hurdles which they must successfully negotiate in order to eventually finish the course and be awarded the degree. Much of traditional education has become a gigantic game between professors and students. Both parties to this game know very well that the major content of courses is learned only long enough to pass the exam successfully and is never again remembered or used.

This is not to say or imply that none of traditional education is retained and useful. However, that which is constitutes the smaller portion of the pie.

A recent issue of IEEE Transactions On Education (November, 1977) contained an article by Dr. William S. Byers which showed that the majority of mathematical education for engineers beyond algebra was never or seldom used after graduation. Similar conditions exist in other schools. There is a clear need for universities to restructure their curricula in light of the needs of the users of their end products. The gap between successful performance of the university and successful performance in a career should be reduced or eliminated. In addition students should be taught how to learn, how to change with the changing society, and how to survive in a society in which rapid change is commonplace and the knowledge which they learn today will be obsolete tomorrow.

Universities must learn that the *process* of learning has become equally or perhaps more important than the *product* of learning. In large measure what is learned is less important than learning how to learn and to continue to learn throughout one's lifetime.

In many, if not most, external degree institutions, the *process* is their most important product. Participants entering these institutions are introduced to a process which facilitates their planning and implementing of the learning program. The process of defining and planning the program is equally important to the implementation of that program since it requires of the participant skills which will be called upon over and over again throughout his career as new situations demand new learning. Once the participant in an external degree program has internalized the ownership of his education and has mastered the skills of learning, he will be in command of his learning. He will no longer have to look outside to agencies and institutions to structure for him a learning experience to fit him for new career opportunities. He will have within himself the knowledge and ability to fearlessly recognize the need for change and confidently set his career goals to accomplish the change.

Once set, he knows he can achieve his goals through a deliberate process of self-directed learning. He will have the knowledge and ability to locate and utilize those human and non-human resources necessary to achieve the needed knowledge and ability.

Dr. Malcolm S. Knowles, professor of adult and community education, North Carolina State University at Raleigh, is credited by many as being the "father of adult learning." Of his many years in the adult education field, Malcolm Knowles said recently, "I have been so impressed with the joy my students have found in self-directed learning that I want to spread the gospel. My motives are the motives of the missionary - so beward. I'll try to convert you." (6) Those of us responsible for external institutions delivering self-directed learning experiences to adults share the sentiments of Dr. Knowles.

References:

(1) A. J. Kock, A Journal of These Days (New York: Morrow, 1934).

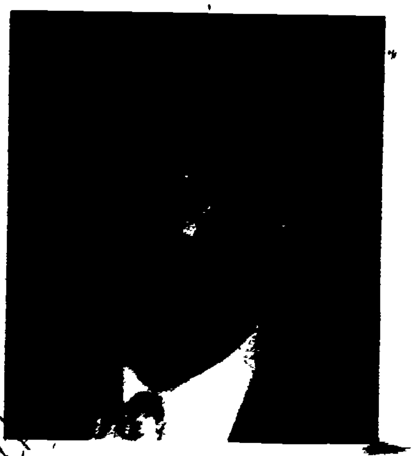
(2) C. O. Houle, The External Degree (San Francisco, Ca.: Joffey-Bass, 1973).

(3) Commission on Non-Traditional Study, Diversity by Design (Joffey-Bass, 1973).

(4) John Bear, College Degrees by Mail, (Little River: Rafton and Bear, 1975).

(5) Commission on Undergraduate Education and the Education of Teachers, Teacher Education in the United States: The Responsibility Gap, (Lincoln: University of Nebraska Press, 1976).

(6) ___________ "Talking with Malcolm Knowles: The Adult Learner Is A 'Less Neglected Species'" in Training, (Minneapolis: Lakewood Publication, 1977), P.16.



EUGENE G. STONE

Eugene G. Stone is President of American International Open University, an institution which he founded in 1972. Over the last five years Dr. Stone has developed AIOU from inception to an institution with hundreds of advisors and participants.

Born and raised in Salt Lake City, Dr. Stone received his Bachelor's (1955) and his MBA (1958) from the University of Utah. After three years of study in quantitative methods and organizational development at Washington University, Dr. Stone received his doctorate in 1973.

He has seven years experience in aerospace industry as industrial and quality engineer. From 1963 through 1973 he taught business and management science, most recently at Southern Illinois University at Edwardsville. While at SIU he participated in an experimental program designed to increase student motivation through self-directed learning.

WHAT CONSTITUTES AN EFFECTIVE COOPERATIVE EDUCATION EXPERIENCE

Laurence A. Hill
Director, Cooperative Education Program
University of the Pacific
Stockton, California

COOPERATIVE EDUCATION: A STUDENT PRESPECTIVE
This session will focus upon the factors which constitute an effective Cooperative Education Program from the student's point of view. Students from various CO-OP schools will present a discussion of those factors, which enchance and detract from a CO-OP program. Each student will give an oral presentation outlining key positive and negative components of CO-OP. Following these presentations will be a discussion of the ideas and suggestions expressed by the students. Questions from the floor will be encouraged as a part of this session. The overall purpose of the session is to identify those components of cooperative education which students perceive as valuable and enchancing as well as to identify constructive criticisms of cooperative education programs, i.e. areas which can be improved or changed to strengthen existing programs.

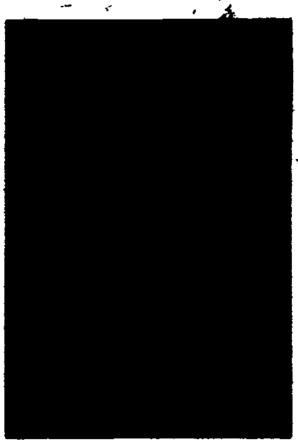
LARRY A. HILL

Larry Hill, a long time resident of California, holds the BA and MA in Political Science from the University of the Pacific. He also has done additional graduate work at the University of Stockholm, Stockholm, Sweden. Mr. Hill has served as Assistant Coordinator, Coordinator, and Director of the Cooperative Education program in the School of Engineering at U.O.P. During the academic year 1976-77 Mr. Hill was a Training Coordinator for the Western Center for Cooperative Education. He has been active in Cooperative Education serving as Chairman of the Co-op Sub-committee of the Engineering Liaison Committee. He has served on the Steering Committee which formed the California Cooperative Education Association.

PANELIST

Ms. Kerry Robertson
Co-op Student
University of the Pacific
Stockton, California

KERRY ROBERTSON



Born in Columbus, OH, Kerry Robertson now refers to Seattle, WA as her home. Strong interests in mathematics and science prompted Kerry to apply to the School of Engineering at the University of the Pacific, Stockton, CA where she was accepted with President's Honors at Entrance, and began as a civil-management engineering major in the fall of 1975. Since that time she has become involved in a number of organizations and activities, serving on the Dean's Advisory Committee, the President's Long Range Planning and Budget Committee, and as senator and freshmen student advisor for the School of Engineering. Kerry is a student member of ASCE and SWE, and has twice served as an officer within her school's chapter. Kerry is currently in her third year of the School of Engineering's five-year cooperative educational program. She completed the first of her Co-op work experience this past summer, with the Washington State Department of Highways. Her work with the planning and designing of Park and Ride Lots provided exposure to a wide variety of activities, including technical writing, surveying, cost estimating and P.R.

THE WALLS CAME TUMBLING DOWN: DISTANCE DELIVERY DISCOURSES

Isaac A. Morgulis
Associate Dean of Technoloty
Ryerson Polytechnic Institute
Toronto, Ontario, Canada

Distance delivery, non-traditional study and educational technology may resolve some of the problems that educators are or will face shortly.

Colleges and university boards which look ahead will foresee the need to change their missions to meet changing societal needs, while maintaining their academic excellence and staying solvent. Their new mission must meet the challenges of rising costs, dwindling capital funds and shifts in student populations. Such post-secondary institutions will share these desirable educational goals:

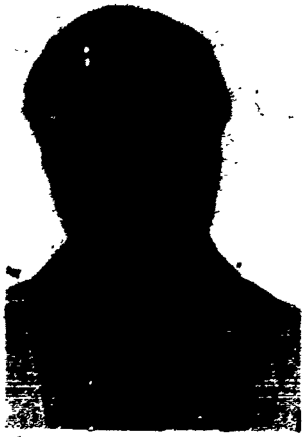
1. provide opportunities for learning without a residency requirement,
2. allow access to education for all ages from eighteen to eighty,
3. offer courses of study to meet the individual's career or life goals.
4. use educational technology to improve instruction.

This session will examine how three organizations are developing models which address these problems.

"INDIVIDUALIZATION: AN EFFECTIVE APPROACH TO OFF-CAMPUS LEARNING", described by Jay Gilbert, Empire State College, shows an approach to "distance delivery" from the viewpoint of a redesign of educational support structures. The primary intention is to give the individual student maximum control and responsibility over his or her own education. To do this, colleges must redefine the role of the faculty member, alter perceptions of syllabus and curriculum design, and expand recognition of where and how learning takes place.

In the paper, "DEGREE EDUCATION THROUGH RADIO", Margaret Norquay, Director, Ryerson Open College, Ryerson Polytechnical Institute, will deal with the realities of pioneering a new Canadian-educational venture designed to meet the needs of students who are unable to take advantage of traditional educational approaches. She will describe how Ryerson Open College uses Ryerson FM station CJRT (91.1 MHz) to offer credit and non-credit degree courses to students in their home environment.

A new learning and technology system developed jointly by ACESS Group of Community Colleges, Goldmark Communications Corporation and two other educational groups is described by Dr. Peter Goldmark in "NEW COMMUNICATION TECHNOLOGY FOR EDUCATION". The objective of the system is to provide life-long learning opportunties to adults everywhere. Dr. Goldmark will describe how the newly developed Rapid Transmission and Storage System can, through high quality compresion techniques, transmit up to 60 simultaneous low-cost, high quality programs per half hour via standard TV transmitters, satellite, cable TV or microwave systems. Dr. Goldmark will describe his experiences in working with the colleges in program preparation.



ISAAC A. MORGULIS

"Ike" joined Ryerson Polytechnical Institute in 1963 as an instructor. In 1965 he became Chairman of the Electrical Technology Department and was appointed Associate Dean in January 1970. He received his B.A.Sc. degree in Electrical Engineering and M.A.Sc. in Engineering Physics from the University of Toronto. He has held teaching positions at the University of Toronto and the University of Waterloo.

He is a past Chairman of IEEE, Toronto Section. Since joining ASEE in 1967, Ike has held many executive positions. At present, he is Vice-Chairman, ETD; Secretary-Treasurer, ERM Division; Director, TCC; Member, Membership Policy Committee; and Past Chairman, St. Lawrence Section. He is a registered professional engineer in Ontario and has held several executive positions in that association.

His industrial experience includes ten years in the domestic electronics field with EMI (England), Dominion Electrohome (Canada), and Canadian General Electric Company.

CREDIT EDUCATION BY RADIO
RYERSON'S OPEN COLLEGE

Margaret Norquay
Director, Ryerson Open College
Ryerson Polytechnical Institute
Toronto, Ontario, Canada

HISTORY

Ryerson Polytechnical Institute has a long tradition of pioneering new developments in education. Its years of experience in technical and vocational education provided the prototype for Ontario's community colleges. Ryerson's educational radio station and its continuing education division which sends correspondence courses around half the world, have both pioneered in providing education at a distance. Ryerson Open College continued in this tradition. It was the brain child of the Dean of Arts, who won the support for the experiment from the President and the Manager of CJRT-FM, the educational radio station owned by the Institute. It was designed as an experiment and was inspired by news reports about the launching of the Open University in Britain. The aim was to find out how radio with some assistance from television, could be used effectively to teach a university level course and to assess the potential market for such education.

Open College offered its first course in January 1971. The teacher and the office staff needed to carry out the project were borrowed from other Ryerson departments and housed in CJRT-FM. It was decided to offer Introductory Sociology as a first course because the subject was thought to be timely and because a tenured sociology teacher was available who had some experience writing and broadcasting for the Canadian Broadcasting Corporation. The teacher appointed was merely asked to find out how to run a credit course on radio. It was to be an experiment that could fail. Trouble over approving the course for credit was not anticipated since a tenured teacher was teaching the same course she would have given in the classroom. It was only the delivery system that was different. Public response to the first course was sufficiently positive to enable the Minister of Education to urge Ryerson to continue the experiment. From the beginning it was a stated objective of Open College to offer courses in response to community needs. Continuous contact and consultation have been maintained with a wide variety of community groups, social agencies and educational institutions so that the courses selected for development would be those for which there was some evidence of demand.

WHAT COURSES ARE OFFERED

Open College offers two kinds of courses: formal credit courses, and informal non-credit. Students registered for the formal courses do assignments, are tutored and evaluated, and get a statement of recognition or achievement at the end. Listeners may also register for the formal courses and receive the student workbook which contains a detailed outline of all the radio programs, the assignments and the required readings. However, registered listeners do no assignments and so do not receive recognition. Listeners may also register for the informal courses and receive a general outline of the material, but there is no channel of communication with the instructor.

There are two levels of credit courses. There are courses which provide a credit towards ~~a degree~~ program and there are short courses designed to fit the needs of a specific target group wishing to upgrade its skills. The latter are offered in response to specific requests from the community. University level courses must be carefully scrutinized by the relevant faculty and are then approved by Academic Council, a body which corresponds to the senate in other universities. Since most students use Open College as a point of re-entry into the post-secondary educational system, the courses selected are those likely to have transferability at other universities. Other factors which influence course selection are the adaptability of the material for radio and

• the likelihood of an enthusiastic response from the listening audience who contribute financially to the support of the radio station.

UNIVERSITY COURSES

A typical university level course will have the following components:

- an orientation, at which students meet their tutors and broadcast instructors;
- 48 one-hour radio programs (two programs a week), each broadcast three different times;
- 10 to 20 television programs, the content of which is determined by Open College but is financed and broadcast by the Ontario Educational Communications Authority;
- written assignments marked by a tutor;
- two study weekends;
- a mid-term and a final examination.

The typical student who completes a course gains enough confidence and improves his academic skills sufficiently to continue his studies by enrolling in a degree or diploma program in a college or university. Five university level credit courses have been offered to date. These include Introductory Sociology, Developmental Psychology, 20th Century Biology, The Canadian Novel and Introductory Economics.

CERTIFICATE COURSES

Certificate level courses are developed in consultation with potential students. The first such course was designed for volunteers working with disturbed children and came as a result of a request from Metro Volunteer Centre. Meetings were held with over a hundred people from the professional and volunteer staff of some 40 agencies to find out what they wanted to learn through the course. Detailed notes were taken of these meetings, a committee of potential students was struck, and a curriculum outlined. Open College took over from there and employed appropriately qualified professionals to develop and present the course. Certificate courses are of shorter duration than those at university level. They are less intensive, less costly and can be produced in less time. However they are eminently suited for upgrading when a whole degree or diploma program is not needed or required.

A typical certificate course would consist of the following components:

- an orientation as above;
- twelve to fourteen one-hour radio programs over as many weeks;
- 6 to 8 TV programs;
- weekly written assignments marked by a tutor;
- two study weekends;
- no examination, but careful evaluation on each assignment.

HOW OPEN COLLEGE WORKS

All programs in credit courses are aired at three different times each week in order to provide maximum listening opportunity for students with irregular work hours or heavy family responsibilities. The programs are also put on cassette and so are available through the library for students who miss the broadcast. The radio programs are supplemented by weekly or bi-weekly half-hour telecasts and four days of study seminars held on campus. All students are provided with a tutor who marks the assignments, the mid-term and final examinations and is available by phone if consultation is needed. Tutors meet with their students on orientation and study weekends and are expected to make detailed written comments on all assignments, so the reasons for grading are clear. This tutorial function is carefully monitored. All tutors must have a graduate degree (M.A.) in the discipline offered and are selected for their nurturing and supportive qualities.

WHO BENEFITS FROM OPEN COLLEGE COURSES

Open College students come from a wide variety of backgrounds. The age distribution and educational level of the student depends somewhat on the course. Registration is completely open, anyone can register on the payment of the required fee. If a student thinks he can do the work he can take the course. It's up to him to decide. Since he studies at home he can't hold up the other students if he is ill prepared.

The educational level of students ranges from those with grade 8 to those with post-graduate degrees who haven't studied the discipline being offered. Twenty per cent of the total student body have not gone beyond grade 12. In some courses twenty per cent have not gone further than grade 11.

The age range is from 16 to 70. However, a third of the students are between 31 to 40 years of age and nearly all the rest are in age groups of 41 to 50 and 21 to 30.

Three quarters of all students are women and there is a wide occupational range. Approximately one third of those enrolled are housewives. Nearly another one third are professionals or managers. The remaining students have included clerical and sales staff, draftsmen, nursing and teaching assistants, blue collar workers, actors, journalists, security guards and postmen.

Many of the students are people who have dropped out of the educational stream and who for some reason are unable or too intimidated to enroll in a conventional educational institution. Handicapped persons, people working irregular hours or on shifts are able to take advantage of the alternative listening hours or to use cassette tapes provided through the library system. A major finding of the Open College experience has been the knowledge that a large number of people feel inferior because they haven't earned a degree. And an equally large number have such low self-esteem that they are afraid to risk exposure in the classroom. Open College students can test themselves in private. By the time they go to a study weekend they will already have had feedback from their tutor and their confidence will have begun to build. Open College students are exciting to teach. They work very hard. They do all the required reading and most of the optional. And during the breaks at study weekend they want to talk about the books they have read. Open College students enroll because they want to, not to please their parents or because they have to put in time. Tutors and teachers working with Open College students often feel that post-secondary education is wasted on the young. Once an Open College student gets a credit for a course, he or she has a whole new self image and is ready to move on to something else.

For example, a 51-year old man who worked as a security guard took the course for volunteers working with disturbed children. He did very well in the course and became a volunteer for an agency. Six months later he enrolled in a two-year diploma course in child care at a community college. He was one of those who had thought educational doors were closed to him.

A 24-year old woman who left school at grade 10 and was considered an unrepentant drop-out by her father and husband, both of whom were teachers, secretly registered in a university credit course. She was terrified of failure but with support from her tutor she achieved an 'A', astonishing both herself and her family. And she went on to earn a B.A. in an Arts Program in a university.

Not all successful Open College students continue their formal education, but many report greater achievement in their jobs and greater satisfaction in their personal life.

For example a nurse reported her promotion to a supervisory position as a result of a better self image and greater insight into human relations gained from her courses in sociology and developmental psychology.

A 50-year old woman who took the university credit course in sociology reported that she was thereby enabled to restore communication with her daughter, a third year sociology major in a university.

PRODUCTION OF COURSE

There are several steps to be taken before a course is ready for presentation. Once the course has been decided and the outline approved by the relevant academic department, the process of selection for the production team begins. The normal production team is one or two instructors, an editor, and a producer with technical expertise. Once selected there is an initial training period to teach the instructors the necessary skills. These include the techniques of interviewing, script writing for the ear and broadcasting (speaking a script as opposed to reading it). During this period the prospective instructor has a chance to find out how much work is involved and whether he can cope with being edited. The latter usually means being told something is unclear and must be rewritten.

There is nothing occult about learning to write and speak for broadcast but the skills do have to be learned and often take a great deal of time and effort. Academics used to being the supreme authority in their classroom are not used to having their work criticized much less being made to rewrite it. Sometimes they find the training and editing process rather difficult and painful. But the process is just as painful for the Open College staff who do the work of training, editing and production.

Students in the classroom may have to put up with whatever the teacher wants to impose. But when an educational institution takes to the public air waves the teaching has to be well done. Most educational broadcast systems hire writers to rewrite what the academic produces and employ professional broadcasters to voice it. However, Open College has opted to train the teacher to write and broadcast his own material. This provides a more personal approach to students and is incomparable as an instructional development tool.

The typical one-hour program will include a pre-taped talk by the instructor enriched by interviews with experts on the specific subject being dealt with. In addition there may be some feed-back on student assignments or some live commentary on events in the news which relate to the matter being studied. The courses in sociology and economics both had commentary on the news in every program.

Since Toronto has two universities and four community colleges in addition to Ryerson Polytechnical Institute, there is no lack of academic expertise. In addition Open College tries to keep abreast of all the conferences, seminars and workshops that bring guest lecturers in from outside and makes arrangements to tape relevant interviews or talks with visiting experts. Consequently Open College courses may have interviews with twenty or thirty academics or scientists talking about their particular specialty.

For example, the current offering "Money, Power and Politics" has interviews with Kenneth Boulding, John Kenneth Galbraith, the Governor of the Bank of Canada and some fifty other economists from around the world. Radio is much more flexible than television for this purpose because one can do an interview on a portable tape recorder in a hotel room, if necessary, or even over the telephone. For television one needs a whole crew of technicians.

In addition to the radio programs, a student workbook is prepared. This contains learning objectives for each program, outlines of the material to be presented, required reading, assignments and appropriate diagrams and charts. This material provides students with the framework for making notes and makes a good substitute for the blackboard one might use in the classroom.

EVALUATION OF COURSES

All courses are carefully evaluated by the students who are asked to complete a detailed questionnaire assessing the value of each course component as an aid to learning. This evaluation includes the radio and television programs, assignments, examinations, student workbook, weekends and tutoring.

The student evaluations are carefully studied each year and improvements made whenever possible. Open College learns from its students. Three extensive course evaluations have been done by outside agencies.

The evaluation process is essential for a delivery system which is still regarded as innovative and experimental.

RELATIONSHIP OF OPEN COLLEGE TO THE COMMUNITY

From the beginning Open College was concerned to present courses of such a quality that they would merit accreditation by other academic institutions.

This goal has been largely realized, and over two hundred Open College students have been accepted and given credit at some half a dozen Ontario universities. However academics generally are suspicious of anything offered over radio and television and in the present climate of declining enrollment are concerned about job protection.

Consequently the path to accreditation even in Ryerson has been rocky. Courses have never been rejected on academic grounds only bureaucratic ones. Despite the fact that Open College serves an entirely different clientele to day school, considerable energy is needed to get around the blocks. Academics who dream of using other media than the typical classroom lecture should beware.

There are considerable advantages in providing courses over radio. In addition to the flexibility already mentioned, there is an opportunity to do a great job of public education. Open College courses rarely have more than a couple of hundred students, but the estimates of the listening audience range from ten to twenty thousand depending on the course and the season.

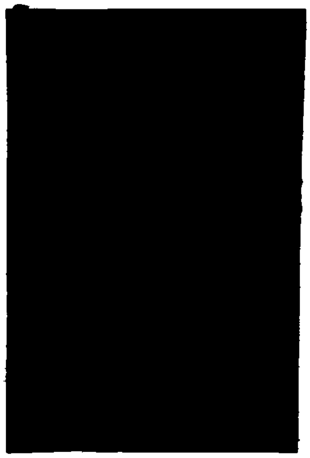
On occasions when the programs have broadcast an open line phone-in for students, the public have sometimes helped out.

For example, in the course on developmental psychology, a student phoned on air and asked the teaching psychologist a question in genetics that he was unable to answer. A leading geneticist from the University of Toronto heard the exchange, phoned Open College office next day and offered to come to a study weekend and conduct a seminar on genetics. She so enjoyed the experience she has come back every year the course has been offered.

Similarly during the sociology course a student phoned in to ask whether an obscure primitive culture from the interior desert of Australia cooked their food. The teacher did not know. But within minutes after the broadcast there was a phone call from an anthropologist who had the answer. He had spent several years studying Australian aborigines and volunteered to come and be interviewed on a subsequent program.

Open College seems to have captured the imagination of a large segment of the academic community in Metro Toronto. In the last two years some four hundred professors, scientists and writers have volunteered their services for interviews.

Open College courses have been greatly enriched and the community at large has had an opportunity to hear from some of its best minds.



MARGARET NORQUAY

Margaret Norquay has been on the faculty of the Department of Sociology at Ryerson Polytechnical Institute for ten years. She holds an M.A. from the University of Toronto.

Previous to her appointment at Ryerson she had a varied career as a community organizer and adult educator and did research, writing and broadcasting for the Canadian Broadcasting Corporation.

She pioneered credit education via radio, teaching the first course. She was subsequently seconded to Open College as Director, and later took on additional responsibilities as Program Director of the educational station that carries Open College courses, CJRT-FM.

San Diego

INDIVIDUALIZATION: AN EFFECTIVE APPROACH TO OFF-CAMPUS LEARNING

Jay Gilbert
Associate Professor
Empire State College
Lower Hudson Regional Learning Center
Suffern, New York

Colleges and universities are increasingly being faced with the need to address and serve the post-secondary educational aspirations of part-time students who are working adu[illegible] Many such adults do not live or work close [illegible] college of their choice. In addition, many [illegible] do live close to an otherwise appropriate college have difficulty matching their own schedules to those set up by the college. How, then, can a college or university respond to the educational needs of people who desire formal study, but who, for whatever reason, are unable to attend regularly scheduled classes at a campus? The purpose of this paper is to focus on this question, and to suggest a general approach to a solution. The discussion is based upon the author's four year experience at Empire State College, the alternative college of the State University of New York. Students at Empire State College are predominantly working adults, with an average age in the late thirties.

At the present time education insitutions serve almost exclusively as a source of subject-based "offerings", usually courses, that are arranged in largely preset sequences for specific majors, degrees, or other purposes. It is here proposed that institutions should, in addition to "offerings", also make available their personnel resources and physical facilities to individuals in ways that are not bound by the clock, by the calendar, or by preset or prescribed curricular guidelines. To accomplish this, a different approach to insitutional support of student learning is required. Such an approach would have the following kinds of general characteristics:

A. Planning support for overall program:
Institutions should provide support to individuals or groups of individuals, to assist in the design of comprehensive program plans which would help students to attain the educational components of their work or career goals. This process would require the active participation of each individual in the design of his or her program plan. It would imply a willingness on the part of the institution to negotiate and to arrive at plans which recognize and evaluate the educational status of each individual, and which provide for variability of topics selected for study by individuals with different goals.

B. Utilization of varied resources for learning:
A "clearinghouse" function should be developed to identify, evaluate, and publicize existing and potential resources to support learning both within the institution and within the adjacent geographical region. These might include schedules of existing and planned courses and availability of laboratory space; names of faculty and other people in the region who would be willing to serve as guides for study or to assist in project design and evaluation in their area of expertise; listings of field placement arrangements in businesses, industries, hospitals, government and social agencies, public and private community organizations, etc.; and announcements of research opportunities and available facilities in libraries, museums, galleries, and concert halls.

C. Specific plans tailored to the needs of each individual:
Institutions should help individuals or groups of individuals to carry out each portion of their overall program plans by assisting in the design and implementation of appropriate specific study plans. Such study plans should select study topics to meet specific content needs; respond to the availability of particular learning resources; address differences in learning styles between individuals; recognize the variability of time available for study; and include evaluation schemes that are challenging and appropriate to the learning.

To develop institutional procedures which can successfully incorporate the above conditions, it is necessary to redefine the roles and responsibilities of faculty members and students, alter perceptions of syllabus and curriculum design, and expand recognition of where and how learning takes place.

The primary alteration of faculty role lies with increasing involvement in the planning and advising stages of student learning. Advising can and should be considered as an ongoing process during student learning, occurring continually and over time as an integral part of faculty-student interaction. Faculty must not only assist students in assembling study plans that are academically sound, but must insure that the overall program plan will indeed move the student in the direction of his or her long range goals. The faculty member must be aware of student progress, and must be prepared to respond with recommendations and to discuss options, if students desire to alter direction during the course of their studies.

Moreover, since students may express interest in studying or working in a wide variety of areas, a faculty member may, on occasion, determine that it is inappropriate to serve as the primary instructional resource person for a specific student study plan. The faculty member must then be willing to assist the student in the selection of an appropriate available learning resource person or opportunity. This rôle of "linking" the student to appropriate resources will involve the faculty member in the "resource clearinghouse" function mentioned above. It is in fact the opinion of the author that the best "resource clearinghouse" is generated by, rather than separate from, the faculty.

The traditional basis of syllabus and curriculum design also has to be reexamined when addressing the needs of working adults. Adults seeking additional formal study usually possess a background of knowledge, skills, and experience not normally found in the traditional college-age population. Often, this background and experience may have served to clarify purposes, and to provide such adults with focussed career and professional goals. In these cases, the usually linear subject progressions found in standard curricula, and the practice of requiring all students studying in a given area to cover the identical set of topics, may be an inappropriate or insufficient institutional response. Instead, individualized program planning may offer the best way to meet the desired learning needs of adults.

An individualized comprehensive plan worked out jointly between each student and the faculty can serve as an educationally powerful learning-support system. If each individual can be assisted to specify his or her career, professional, and educational goals, and if procedures can be developed to determine present levels of proficiency in each of his or her areas of existing competence, then a plan can be assembled to provide study topics which build upon the background of the individual. The object of such study might be to deepen or to provide greater theoretical or experimental rigor to an area of primary student interest. Alternatively, or in addition, it might be used to broaden the background of someone who is already highly professionally focussed. It might also serve to enable an individual to review or to update knowledge in an area of current concern in his or her job.

Once an overall plan is agreed upon, the problem for students "at a distance" becomes one of appropriately structuring the learning that they seek to carry out. A good way for faculty and students to structure specific topics or projects of individual study, especially when regular classroom attendance is not an integral part of the learning, is to use learning contracts.[1] These are written agreements, developed jointly between the student and the faculty member, which describe the nature and amount of work to be completed in a designated time. Study can be organized to respond to specific content needs, and to time and geographical constraints for each student.

It is already a cliche, although nevertheless true, that learning occurs in many different settings and throughout life. The use of individualized learning contracts can permit students and faculty to take advantage of an extensive variety of learning resources which become available at various times and places. For example, joint agreements between faculties can permit students to have access to programs and facilities at educational institutions other than their own. In addition, and where applicable, arrangements can be made to permit students to capitalize on the array of learning resources represented by professional personnel and facilities at their work sites. In general, many resources for learning other than regular courses already exist and can be used profitably by students to assist their study.

A major educational advantage of the individualized program and study planning which makes this approach particularly suitable for adults studying primarily away from a campus, is the opportunity to actively involve students in the design and organization of their own study. It is the observation of the author that the greater the active involvement of individuals in the planning stages of their work, the greater is their stake in the eventual outcome. In addition, as students begin to take on the primary responsibility for their own study, they become more capable of self-directed learning: they begin to "learn how to learn." For faculties seeking to assist students to learn "at a distance," these factors provide a strong base for learning in any subject or field. In addition, the direct faculty-student interaction can be intellectually challenging and mutually rewarding, as students progress, develop and learn.

REFERENCE

1. J. Gilbert, "Contract Learning", Presented at Annual Conference, American Society for Engineering Education, Event 2530, Ft. Collins, Colorado (June 1975).

Jay Gilbert (Ph.D., Materials Science, S.U.N.Y. at Stony Brook), worked for several years as an Associate Physicist for the I.B.M. Corporation. He has taught in a community college and was one of the founding faculty of a two year upper-division technical college. He is currently an Associate Professor, and Mentor at Empire State College, where he works primarily with adults studying in the sciences, technologies and in engineering.

NEW COMMUNICATION TECHNOLOGY FOR EDUCATION

Peter C. Goldmark
President and Director of Research
Goldmark Communications Corporation
Stamford, Connecticut

One of the most important issues that needs everybody's immediate involvement, and particularly by educators, is the growing exhaustion of our most essential resources: Human, Earth (which includes energy), and Environment. Due to the ever-increasing rate of changes in the world around us, the traditional cycle of developing teachers to educate the next generation is too slow, and thus it is necessary for adults to learn about current issues and problems and ways to help solve them.

This paper describes the objectives of a newly formed consortium, representing the largest assembly of educational institutions which in combination with a technology-based organization have cooperated over the past three years. The objective was to meet today's critical need in education by providing life-long learning opportunities to adults everywhere, near where they live or work. Adults today are ready and eager to learn about necessary changes in our life-style resulting in fuller dependence on our own earth resources for many generations to come. Thus, in addition to career development and self-improvement, courses will also deal with current issues and ways to participate in the planning processes.

Members of the special consortium are:

1. ACCESS Group of Community College Districts of:
   Charlotte, North Carolina
   Kansas City, Missouri
   Chicago, Illinois
   Eugene, Oregon
   Costa Mesa, California

2. State of North Carolina with its Rural Renaissance Project representing 57 Community Colleges

3. American Association of Community and Junior Colleges

4. Goldmark Communications Corporation

The new learning and technology system, developed jointly by the ACCESS Group and the technology partner, is being applied to nationwide adult education. Satellite technology applied to the system can specifically improve education at all levels in rural areas including health courses in rural hospitals, as well as career education and general subjects in senior citizen's homes and penal institutions throughout the country. To enjoy the full potential of an optimum system of terrestrial and satellite distribution, a large number of high quality programs is required. These now represent a major on-going effort of the consortium.

In order to enable a satellite TV transponder to provide low-cost ground coverage as well as program diversity and scheduling flexibility, a new technology, now in the testing stage, will be employed. This is the RTS System, which stands for Rapid Transmission and Storage, and was developed by Goldmark Communications Corporation (GCC) jointly with the leading group of Community College Districts represented in the ACCESS Group and the State of North Carolina.

This system of program format and delivery is based on still pictures and sound, and uses motion only when necessary for clarity or emphasis.

Of these new type of programs, over 500 half-hour modules are now in production, some combined into complete courses and designed by faculty teams of the ACCESS Colleges and North Carolina. The new format makes it possible to create extremely high-quality learning material for a fraction of the cost of conventional motion-type educational programs, and the rate of production is substantially higher. Also programs can be presented in different languages simultaneously. The RTS System permits the storage of programs on video tape, records, etc., with a considerable compression in time and storage space. For instance, a one-hour video reel or record can store up to 120 different half-hour programs, or 60 one-hour, or 240 fifteen-minute, etc., or any mix of these. It is possible to view up to 60 different programs simultaneously from one video tape or select any one, instantaneously. The equipment ordered by the ACCESS Colleges is designed to carry up to eight simultaneous, instantaneously selectable from any of thirty.

The RTS programs can also be transmitted over standard television transmitters, satellites, cable TV or microwave, at high speed whereby up to 120 different half-hour programs can be transmitted simultaneously during an hour. A single satellite transponder could receive and broadcast over a 24-hour period over 2,800 different half-hour programs. In practice, conventional TV programs could occupy part of this period.

The application of the RTS System to satellite transmission makes it possible to reach the widest possible audience across the nation at the least possible cost by making the satellite signal strong enough to be picked up by a small and simple ground receiver. One way to provide a strong ground signal is to concentrate the transmitted power into a restricted ground area and to shift the satellite transmitting antenna ground pattern across the country in appropriate steps. For example, the ATS-6 Satellite with its two transponders could cover the continental United States, Alaska and Hawaii, in approximately 2.4 hours and would be ready every 24 hours in all parts of the country. Programs requested by automatic coding through the telephone could result in some 280 different programs available for users in each of the ten sections of the country during every 24-hour period. Because of the low cost of the ground equipment, the desired programs can be stored and shown as often as desired at times most suitable for the learning audience in learning centers, institutions, hospitals, etc.

Satellites such as the CTS, with greater ground coverage, would only require approximately four different ground segments. Thus a six-hour period would provide up to 720 different half-hour programs every 24 hours for each of the four ground segments.

In addition to the RTS method, conventional video transmission could, of course, be used as well where a half-hour program would occupy an equal one-half hour elapsed time, and would be the only learning material which could be received during that period within the ground coverage of the satellite. Actually, it is our expectation that it will be a combination of terrestrial and satellite distribution that will yield the most effective utilization of programming methods and delivery technologies for the services envisaged.

Studies have shown that using the RTS System, one of the most effective uses of a satellite for education would be in the role of a National Video Library. Rapidly increasing numbers of programs in the RTS format are being produced to be incorporated into a national library service. Programs produced in a given state in the RTS format can be made available by mail to all the learning centers, as well as to educational and other institutions within that state. Adults could come to learning centers a short distance from home and enroll in courses for college credit, receive vocational training, engage in self-improvement, master new skills and hobbies. In addition, they would study national and community problems and issues, and new techniques to help deal with these through local and state planning.

Mailing of these programs, which in North Carolina alone already run into the hundreds, may not be practical across the country, but would be within a state. Thus, the satellite or if not available, the Public Broadcasting System at night-time could assume the role of a Central Video Library with all programs generated in the other states available on demand.

The educational consortium identified earlier is considering three major groups of learners/users:

1. Adults in rural communities

2. Students in rural 2 and 4 year colleges

3. Professionals:

a) In the health field

b) Educators, engineers, architects, businessmen, government employees, etc.

c) People in institutions (health, old-age, penal, etc.)

d) Students in rural elementary and secondary schools

e) People requiring literacy traiding and high school equivalency courses throughout the country

The major program needs applied to the adult learner targets, delivered in institutions or learning centers are the following:

1. Courses for 2 and 4 year colleges with or without credits
2. Vocational training
3. Courses in self-improvement
4. Development of new interests and skills
5. Instruction in health care, nutrition and hygiene
6. Child and home care
7. Increasing awareness of community and national problems which should result in community involvement

Regarding effectiveness of the services provided in conjunction with existing institutions, the consortium intends to develop a system for judging individual student achievement and to compile appropriate records. For those learners who are taught outside of accredited institutions, a suitable method of assessment will be developed concerning learners' achievements and retention of participants' records.

Dr. Goldmark is presently director of research for the Goldmark Communications Corporation. Born in Budapest, Hungary, he has a Ph.D. in Physics from the University of Vienna. He has also received honorary doctors degrees in Humane Letters, Science, and Engineering from Dartmouth College, Fairfield University, and the Polytechnic Institute of New York respectively. From 1936 to 1971, he was the Chief Engineer, President and Director of Research for the CBS Laboratories in Stamford, Connecticut. He is an active member of various professional societies and is a Fellow in the IEEE, Society of Motion Picture and Television Engineers, Audio Engineering Society, British Television Society, Franklin Institute, and the American Academy of Arts and Sciences. He has received numerous awards over his professional career from many professional societies and is the recipient of the Morris Liebmann Memorial Prize for Electronic Research, the Vladimir K. Zworykin Prize.

IN MEMORIUM

Dr. Peter C. Goldmark was killed in an automobile accident on December 7, 1977, two weeks after receiving the National Medal of Science from President Carter. Since his retirement from CBS Laboratories, he had devoted a major part of his energies to the development and application of communications technologies to education. The College Industry Education Conference expresses its deep sympathy to Dr. Goldmark's family, noting that the termination of his brilliant career is a tragic loss for the people of this country.

The Editors

RWI

SESSION 8.4

WHO ON CAMPUS HEARS INDUSTRY'S VOICE

Harold E. Roush
Director of College Relations
RCA, Incorporated
Cherry Hill, New Jersey

This session is planned to provide a forum for identifying methods, techniques and new ideas on how to improve communications between industry, business and government and faculty and university administrators. Conversations and visits are prevalent between the two communities. Effective programs by some corporations and universities have enhanced the degree of understanding on some campuses. Those programs that are perceived to be most effective will be reviewed and pitfalls will be identified. Hopefully, new ideas will eminate from the discussion and the presentations. These ideas should create new avenues of effective relations. Negative attitudes about inconvenient or non-cooperative efforts will be identified.

Certainly we are aware of summer employment of faculty, consultant and research contracts, and contributions of money and equipment. Advisory councils and associate programs have long been excellent platforms for campus-industry relations.

Who are the publics that faculty should be encouraging to have an interest in curriculum development, facilities planning and financial support? What are some of the reasons business managers use to justify time and money invested in college relations? Certainly recruiting is one obvious reason but the participants' motivations for taking a personal interest include an offspring on campus, previous associations with faculty and relatives in the neighborhood. Whatever the drawing card, how do we maintain the interest after the original motivation wanes?

Harold (Bud) E. Roush, Director, College Relations and Employee Services, RCA Corporation. BSME, Penn State University, 1954. Registered Professional Engineer in Pennsylvania.

1954-1957 United States Navy; 1957-1961 Hamilton Watch Company, Lancaster, Pa.; 1961-1966 Link/Librascope Ordnance Div., General Precision, Inc.

1966 to Present - RCA Corporation, Corporate Staff, College Relations and Employee Services, College Recruiting and Management Programs for recent graduates, Employee Services.

Member of the College Placement Council, including several regional placement associations, Engineering Manpower Commission, American Society for Engineering Education, the Cooperative Education Association, and the American Defense Preparedness Association.

RW1

INDUSTRY CAMPUS RELATIONS

PANELIST

Arthur F. Hartford
Manager, University/Industry Relations
E.I. duPont De Nemours and Company
Wilmington, Delaware

There are a variety of ways in which Industry attempts to communicate its ideas to educators. Some methods are quite formal and designed for specific campus situations. This presentation will enumerate industrial contact efforts conducted over the past several years in the Du Pont Company.

- Corporate Visitation
  - College and University Administrators and Faculty
  - Plant and Laboratory Visits
  - Matching special interests and expertise
- Communications
  - Corporate
  - College Relations
  - Technical Publications
- Technical Society Activity
  - Officer Positions
  - Committee Assignments
  - Preparation of Papers for Society Publication or Presentation at Society Meetings
  - Society Meeting Attendance
- Academic Consultants
  - Exchange of Technical Information
  - Seminars to Broaden Coverage of Company personnel
- Technical Seminars
  - Technical Society Assignments
  - Special Requests
  - Through Publications
- Summer and Co-op Employment
  - Students
  - Faculty
- Year-In-Industry
  - ASEE - Engineering Department
  - Engineering Consultants
- Membership on Advisory Committee
- Campus Recruitment
  - Faculty Interaction with Former Students
  - Company Recruitment Brochure
  - Campus Career Day Participation

Mr. Hartford was graduated in 1941 from Northeastern University, Boston, Massachusetts with a BS degree in Industrial Engineering. After serving 4 years in the United States Navy, he was employed by the Du Pont Company in 1945. His initial employment was in the Engineering Department where he had several assignments before transferring to the Company's Personnel Division in 1950. He is currently Manager of University and Industry Relations in the Du Pont Company's Employee Relations Department.

His professional activities include past member Board of Directors of Eastern College Personnel Officers (ECPO), a past member of the Board of Governors of the College Placement Council, Past Chairman of the Engineering Manpower Commission, current Chairman of the Middle Atlantic Section of ASEE, and a past member of the Board of Directors of ASEE.

PANELIST

Russell R. O'Neill
Dean of Engineering
U.C.L.A.
Los Angeles, California

Russell R. O'Neill is a Professor of Engineering and Dean, School of Engineering and Applied Science at the University of California, Los Angeles. He received his B.S. and M.S. degrees in Mechanical Engineering from the University of California, Berkeley and his Ph.D. degree in Engineering from the University of California, Los Angeles. Mr. O'Neill joined the staff of the University of California, Los Angeles in 1946. Prior to 1946, he was associated with the AiResearch Manufacturing Company in Los Angeles as design engineer, the Dow Chemical Company in Midland, Michigan as design and development engineer; and Dowell, Incorporated, also in Midland, as engineer. He is a licensed Mechanical Engineer in the State of California; a member of the National Academy of Engineering, Sigma Xi, Tau Beta Pi and the American Society for Engineering Education.

PANELIST

John D. Alden
Director of Manpower Activities
Engineers Joint Council
New York, New York

John D. Alden

John Alden is Director of Manpower Activities for Engineers Joint Council, a federation of 38 U.S. engineering societies. His responsibilities include conducting and publishing EJC's well-known surveys of engineers' and technicians' salaries, enrollments and degrees, and the demand for engineers.

Mr. Alden is a graduate of Cornell University with a bachelor's degree in chemistry, and also has a BSEE degree from M.I.T. Before joining EJC he served as a career Engineering Duty Officer in the U.S. Navy, specializing in submarine construction, logistics, management and quality control.

PANELIST

William Atchley
Dean of Engineering
West Virginia University
Morgantown, West Virginia

William Lee Atchley received his Ph.D. in Structural and Applied Mechanics from Texas A&M University in 1965. His industrial experience includes jobs at Hughes Aircraft, Missouri Highway Department, National Park Service and the U.S. Naval Civil Engineering Labs. He currently is a Professor of Mechanical Engineering and Mechanics at West Virginia University. He has done a great deal of research in low cost housing materials for urban areas and has many publications as well as serving on the boards of several civic organizations.

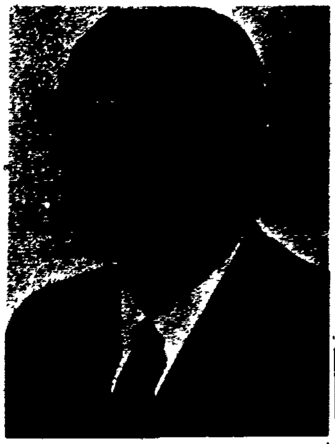
1978 CIEC CONFERENCE BANQUET

MASTER OF CEREMONIES
James P. Todd
Chairman, Engineering Technology Department
California State Polytechnic University
Pomona, California

"HIGHER 'N A KITE" THE CONQUEST OF AIR AND SPACE

SPEAKER:

Zeno Klinker
Comedy Writer
Hollywood, California



ZENO KLINKER, one of Hollywood's top comedy writers, first started his career as a musician, playing piano, accordion, guitar and banjo with many big neme orchestras and for most of the major motion picture studios in Hollywood where he also occasionally played small parts in pictures.

His first venture in humor writing was at an early age when he started writing humorous greeting cards and booklets. The very first one sold almost a half million copies.

Mr. Klinker, who still flies his own plane, started flying in his middle teens and later became an aerial motion picture cameraman during the early barnstorming and stunting days of aviation. This led to his starting his world-famous collection of rare and amusing histroical aviation movies from all over the world (now the world's most complete), which includes every funny happening from the Wrights to rockets.

Edgar Bergen, during his first year on the air, happened to see Mr. Klinker showing some of his funny aviation movies and was so taken with his humorous talk accompanying them that he hired him to write the jokes for the Edgar Bergen-Charlie McCarthy radio show, which Mr. Klinker did during all the years it was the number one comedy show on the air.

He is now in his 24th year with Edgar Bergen, still writing the jokes for Charlie McCarthy, Mortimer Snerd and for the other dummy who was named after Mr. Klinker.....Effie Klinker. He also has written for motion pictures, television and for various other comedians.

SITE - 1978
COLLEGE INDUSTRY EDUCATION CONFERENCE
SAN DIEGO, CALIFORNIA

OUR HOST CITY

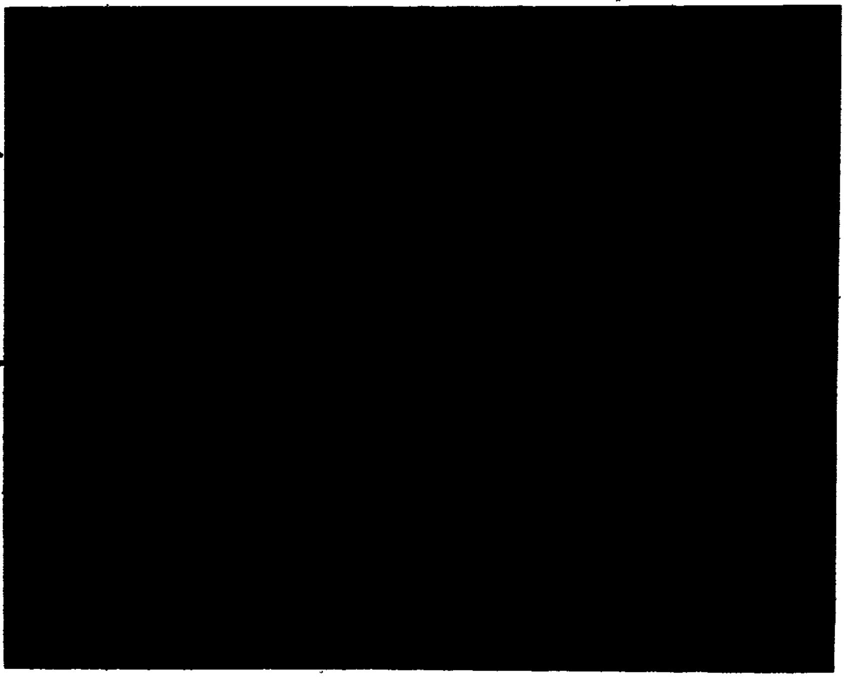
1978 College Industry Education Conference
January 24-27, 1978

The third annual College Industry Education Confernece co-sponsored by the Relations With Industry Division, Continuing Engineering Studies Division, Engineering Technology Division, Cooperative Education Division and the Technical Education Council for the ASEE will be held in San Diego on January 24-27, 1978. You are encouraged to attend and participate in this conference. Make your plans now so that your calender will be free.

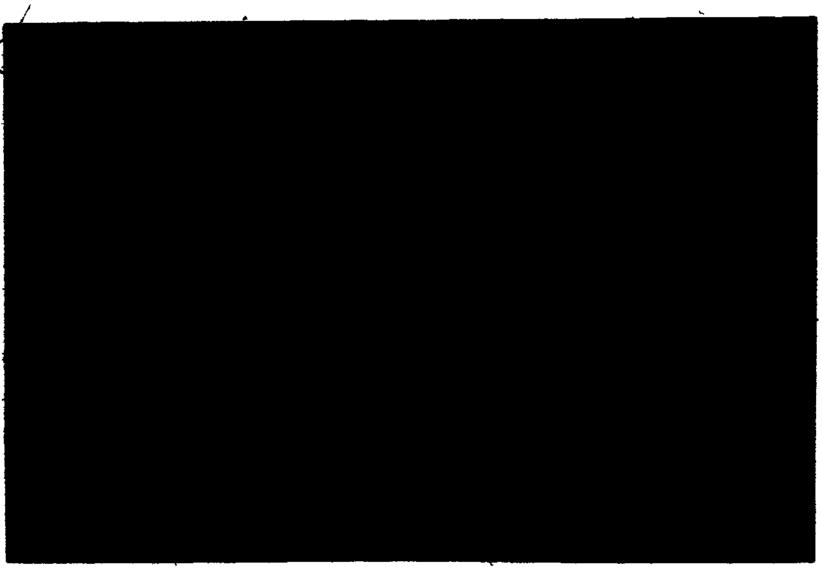
Town and Country Hotel

San Diego, California

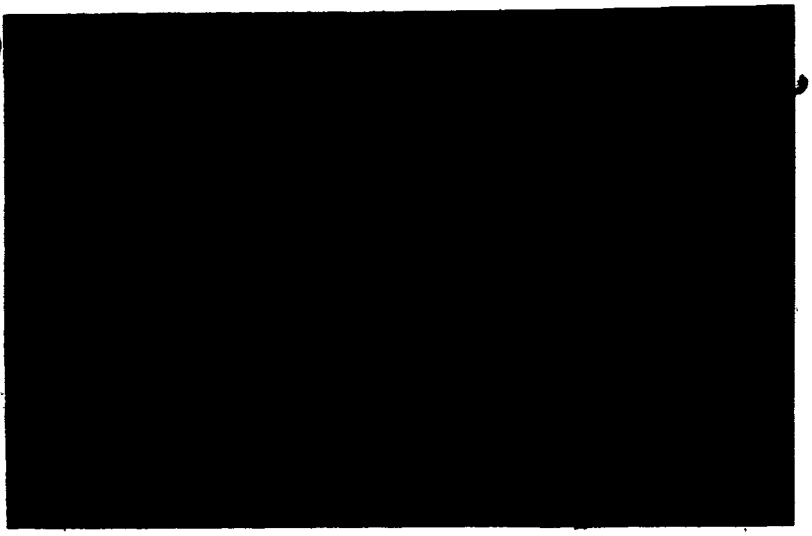
SEE YOU THERE



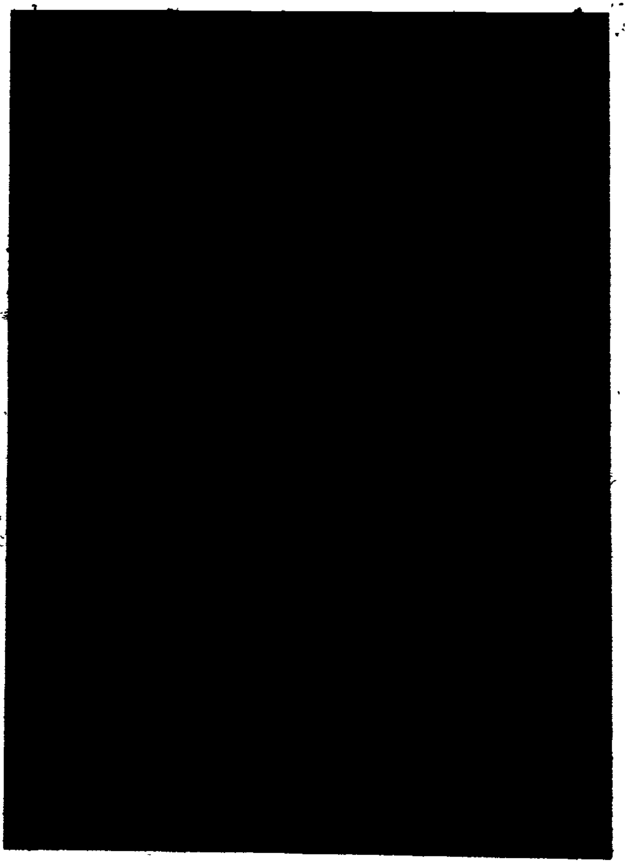
PALOMAR OBSERVATORY--The hugh dome on Palomar Mountain, 65 miles north of San Diego city, houses the world's largest telescope. The giant 200-inch mirror enables scientists to explore an area one billion light years away. The observatory is reached over the scenic "highway to the stars" through San Diego's back country.



HARBOR TOUR--San Diego Harbor Excursion boats give visitors to San Diego a close-up look at Navy ships and shore installations, commerical freighters, the picturesque tuna fishing fleet, aquatic wildlife ranging from sea gulls to sea lions, and the city's beautiful skyline. Don't forget your camera!

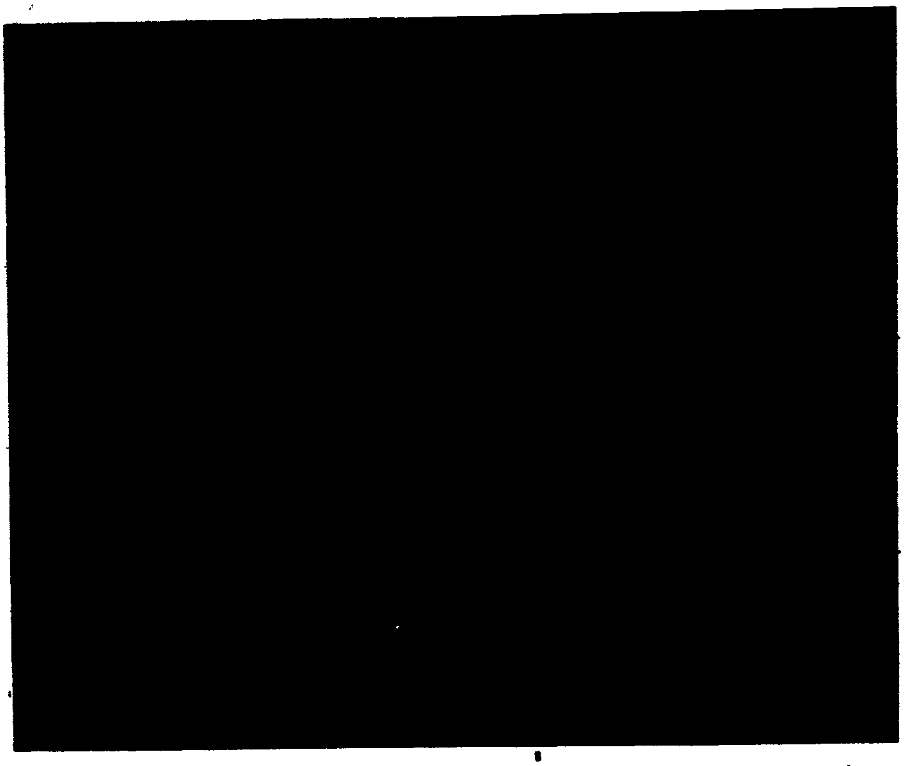


SEAFOOD CENTER-- Harbor Seafood Mart at the foot of Market Street along San Diego Bay, is operated by five fish processing firms and includes a major restaurant, two fast-service seafood bars, and a curio and expresso coffee shop--as well as retail and wholesale live and processes seafood. Outside seating is available to visitors with "food to go" and for those just wanting to relax and watch the boats go by.



STATELY CALIFORNIA TOWER--This example of rich, ornate Spanish-Moorish architecture is a familiar landmark in San Diego's famed Balboa Park. The park covers 1,400 acres in the heart of the city and is the site of recreational and cultural facilities and the world-renowned San Diego Zoo.

MAJESTIC COASTLINE--San Diego offers something for everyone in the realm of water fun. Done of the most popular bathing beaches is the famous La Jolla Cove, also a favorite with skin diving enthusiasts.



NATURAL HABITAT--San Diego Zoological Society's new 1,800-acre Wild Animal Park about 30 miles northeast of downtwon San Diego enables visitors to see animals--such as these elephants--in a natural environment. The Wild Animal Park's population also includes rhinoceros, lions, cheetahs, giraffes, zebras, antelope, cranes, and ostriches. The Zoological Society also operates the San Diego Zoo, which contains the world's largest collection of wild animals.

1978 - 1979 CIEC CONFERENCE COMMITTEE BREAKFAST

MODERATOR
James P. Todd
Chairman, Engineering Technology Department
California State Polytechnic University
Pomona, California

No conference would be a success without a session devoted to the evaluation of the current conference as well as learning of the plans for the next one. This conference committee breakfast is designed primarily for those people who participated in the planning and operation of the 1978 CIEC Conference, as well as those individuals who are responsible for the 1979 College Industry Education Conference, which will be held in Mobile, Alabama.

Anyone is invited to attend and give their insight into how we might make the 1979 College Industry Education Conference more effective.

"Jim" is the Chairman of the Engineering Technology Department and a Professor in the School of Engineering at the California State Polytechnic University in Pomona. He was the Associate Dean of Engineering from 1970-72 while the B.S.E.T. and Masters of Engineering programs were being developed. Prof. Todd received his B.S. and M.S. degrees in Mechanical Engineering from Stanford University. He is a registered professional engineer (mechanical) in California. Prof. Todd was the 1976-77 Chairman of the Technology and Engineering Coordinating Committee (TECC) of ASEE, having been the Secretary during 1975-76. He is currently Secretary of the Engineering Technology Division (ETD) of ASEE. His thirteen years of industrial and consulting experience includes such companies as Pratt & Whitney Aircraft, Aerojet-General, Lycoming Division of AVCO, Cosmadyne Corp. and JPL. Among his professional society affiliations are ASME, ASEE, AIAA, and ASTM.

CONTINUING ENGINEERING STUDIES DIVISION SPECIAL INTEREST GROUP REGISTRATION AND CERTIFICATION

Thomas F. Talbot, P.E. Ph.D.
Director, Continuing Engineering Education
University of Alabama in Birmingham
Birmingham, Alabama

THE EFFECT ON CONTINUING EDUCATION OF REQUIRED CONTINUING EDUCATION FOR REGISTRATION AND RE-REGISTRATION

To function as responsible members of the engineering profession, engineers must continually update their knowledge. The typical engineer who graduated from college twenty-five years ago had no exposure during the formal education process to such developments as solid state devices which have resulted in compact computers; supersonic transports; Sputniks; the energy crisis and many major and minor technical innovations that have been developed during this period. Engineers who graduated twenty-five years ago and are trying to practice engineering without increasing their knowledge since that time are not effective and, in all likelihood by this time, are unemployed. Consequently, continuing professional development becomes a necessity for every practicing engineer. As a result of space programs and the multitude of high technology products that have recently reached the market place, the public is becoming more aware of the growth of technical knowledge, and is expecting more from the technical community.

Generally engineers respond to their perceived needs for new knowledge by studying the specific requirements of their current jobs, self-study, and participation in organized learning experiences. The technical societies have contributed to the continuing education activities by offering a variety of programs. Some of the societies have programs whereby engineers can become certified at the end of the program. Others only award continuing education units and leave it up to individuals to organize their studies to meet their needs, while still others offer no formal continuing education activities other than the presentation of technical papers and reports at their local and annual meetings.

Much controversy has arisen over the necessity of providing formalized continuing education for practicing engineers. Among the members of the profession, those in education have been most supportive of the requirement for continuing education for registration and reregistration, whereas those in industry have been the most vocal against it. The public, however, is becoming more aware of the potential obsolescence of professionals, and several states have passed laws requiring a certain amount of formal continuing education in order to maintain professional registration. Presently for the engineering profession, one state has passed a mandatory continuing education requirement and another has passed a law authorizing the board of registration to require formal education as a condition for reregistration.

The trend in the country appears to be the establishment of mandatory requirements for formal continuing education to maintain professional engineering registration. The effect of mandatory continuing education requirements for reregistration of engineers is complex and will be addressed at this session. The nature and type of various continuing education programs will be discussed, along with the effect of increased mandatory continuing education for reregistration requirements. Some individuals project that mandatory continuing education will be required in all fifty states by 1985. If these projections are right, the demand for continuing engineering education programs will be greatly increased. The public's concern for public safety has been the main motivating factor for the trend towards continuing education for reregistration.

THOMAS F. TALBOT, P.E. Ph.D.

Thomas F. Talbot, P.E. Ph.D. received a B.M.E. from Auburn University in 1952 and a Master of Science (M.E.) from Calif. Inst. of Technology in 1953 and a Ph.D. (M.E.) from Georgia Inst. of Technology, 1964. He taught at Ga. Inst. of Tech. and Vanderbilt Univ. and served for 6 months as a visiting professor in the Dept. of Metallurgy & Materials, Univ. College, Univ. of Wales, Swansea, Wales, U.K. He joined the faculty of the School of Engineering, Univ. of Ala. in Birmingham in 1967 and became a Professor of Engineering in 1970 and Director of Continuing Engineering Education in 1972 when the office was established. He served for three years in the U.S. Air Force as a Project Engineer at the Arnold Engineering Development Center and is currently a member of the Air Force reserve. He has had industrial experience with several major corporations and has served as a consultant for many companies. Professional Society activities include membership in ASM, ASME, ASEE, AWS, AAUP, and SAE.

CONTINUING ENGINEERING EDUCATION IN A MANDATORY RELICENSURE PROGRAM

James H. Miller
Student
Worcester Polytechnic Institute
Worcester, Massachusetts

Heidi S. Pivnick
Student
Worcester Polytechnic Institute
Worcester, Massachusetts

Abstract

This paper concerns the role of continuing education in a mandatory relicensure program for engineers. A projection was developed for the demand for continuing engineering education in the next twenty years if, in that time, states pass mandatory licensure laws. This paper is a condensed version of a larger report presented to the National Institute of Education in the fall of 1977.

Continuing engineering education programs are provided by several different educational sources such as major universities, professional engineering societies, and industries. The programs vary from short one-day overviews to semester-long in-depth courses. But although there are a wide range of educational opportunities, continuing education programs reach only approximately fifteen percent of the total engineering population.

This number will increase sharply when a mandatory relicensure program is implemented. Laws have been proposed in state legislatures requiring engineers to participate in continuing education as a provision of license renewal. This law is presently in effect in the State of Iowa. A projection to 1985 has been made by the authors, showing the effect of the implementation of this requirement in all fifty states on the number of engineers engaged in continuing education.

Assuming that this law will be put into effect, the demand for continuing engineering education will skyrocket. We will be unable to provide for the increased need without the use of technology. Information for this paper was gathered predominantly from personal interviews with:

- John Alden, Executive Secretary, Engineering Manpower Commission
- Morton Fine, Executive Director, National Council of Engineering Examiners
- Donald Marlowe, Executive Director, American Society for Engineering Education
- Paul Robbins, Executive Director, National Society of Professional Engineers

and many others from the engineering community.

Statistics

In order to achieve the stated goal of projecting the effect of a mandatory licensure and relicensure program on continuing engineering education, the authors were faced with the task of determining exactly how many professionals were acting in an engineering capacity. One of the problems in determining a fixed figure for the number of engineers in the United States is in the definition of the term "engineer."

Three major concepts of what is meant by the terms "engineer" and "engineering" are encountered in national manpower statistics. Probably the most common is the "occupational" approach used by the U.S. Department of Labor and other government agencies, in which people are categorized according to the work they do. The count of persons "working as" engineers excludes those currently employed under other occupational titles, even when they are closely related to engineering. The Department of Labor specifies that the term "engineer" refers to individuals employed in "engineering" at a level which required knowledge of engineering equivalent at least to that acquired through the completion of four-year college course with a major in one of those fields, regardless of whether they hold a college degree. The problems that are encountered in utilizing the "occupational" approach are numerous. This method runs into difficulties with job titles, and is liable to obtain different responses depending on who is asked to do the categorization. Systems analysts, computer specialists, designers, planners, applied scientists, and others who may do engineering work but whose job titles do not include the word "engineering" may or may not be counted as engineers within these specific guidelines. Unemployed engineers present another problem, in that if they take temporary work in other occupations, they become employed salesmen or taxicab drivers by the "working as" method of counting. This can significantly affect labor force statistics which are obtained by adding the employed and the job-seeking unemployed.

A second concept is involved in the "educational" approach, which is the basis for the data collected by the National Center for Education Statistics of the Department of Health, Education, and Welfare. In this case, the field of college study determines the classification regardless of what students or graduates are planning to do. The strong point of this approach is in that of its definition of an "engineer." There is little ambiguity about a college degree. While the educational approach is reasonable for counting degrees, when applied to the working population it would exclude many persons who are recognized as engineers but do not hold degrees. Also, employment counts based on education usually refer to the person's highest degree which confuses the status of engineers with a Master's Degree in Business Administration or other non-engineering field. For these reasons, the educational approach has drawbacks in providing a workable definition of the engineer.

The third major approach is to define engineering by "professional" identification, which can be measured in various ways. One method is to ask the individuals to classify themselves according to their overall education and experience. The National Science Foundation uses a variation of this approach, in which they establish a set of criteria based on the answers to several questions dealing with education, employment, and professional affiliation. More restrictive definitions of professional identity are sometimes used such as membership in an engineering society or state registration as a Professional Engineer. The narrower the criteria becomes, the smaller will be the group ultimately counted as "engineer."

Another problem in pinpointing a figure of the number of engineers is how to reach the population in order to count them. The difficulty with using the data gathered by the Bureau of Census is that it only seeks detailed information on a small sample. Although the samples were surveyed for certain data concerning the occupation of employed members of the household, the information in many cases was provided by someone other than the wage earners themselves. This does not provide for an accurate estimate. The Department of Labor obtains their statistics by surveying a sample of the establishments in which engineers and scientists were employed in private industry and supplementing this count by obtaining data on engineers in the federal, state, and local governments, educational institutions, non-profit organizations, and the self-employed based on the occupational definition. In all cases except self-employment, the information was provided by the employers rather than by the working engineers themselves.

In 1972, the National Science Foundation conducted a postcensal survey closely examining 100,000 people identified as engineers, scientists, technicians, or other closely related occupations in the 1970 census in addition to 5700 other names with a college degree but not in any one of the "target occupations." Criteria was developed to categorize respondents into scientific and engineering fields on the basis of factors including education, experience, and professional identification.

The big advantage of this approach is that it identified a body of scientists and engineers whose professional qualifications are not subject to serious challenge. It is therefore possible to analyze other characteristics of this population, such as participation in continuing engineering education programs, with reasonable assurance that they apply to recognizable professional groups. To keep their information up-to-date, NSF supplements their statistics with additional data from the National Academy of Sciences and the Laboratory for Research on Higher Education at the University of California at Los Angeles. This is the most comprehensive source of data on the engineering population available today and consequently the authors have chosen to use these statistics in all following references. The National Science Foundation's latest figures bring the total of engineers in the United States up to approximately 1.1 million.[1]

Licensure and Relicensure

At this time, laws are in effect requiring all engineers to be legally registered in the state or territory in

[1] U.S. Scientists and Engineers: 1974, Surveys of Science Resources Series, National Science Foundation, NSF 76-329, p. 8.

which they practice. Although this law is currently in effect, only approximately forty percent[2] of all working engineers are licensed. This small percentage can be attributed to the many exemptions available including governmental, industrial, and utilities. These exemptions place the liability of work done in the hands of the employer rather than the individual. It is in the opinion of both the state legislatures and the professional societies that before action can be taken to mandate professional development activities for the purpose of license renewal, something should be done to enforce the initial registration requirement.

The purpose of the periodic relicensure concept for license renewal is to insure the public from registrants that do not keep up-to-date in their specific technical field. In contrast to the question of licensure, relicensure is the subject of debate between the legislatures and the professional societies.

In an effort to prepare for a state mandated relicensure program, the five following recertification type programs have been proposed:

A. Point Credit System
B. Professional Advancement Recognition Program
C. Registrants Documents Professional Growth
D. Registrants Police Their Peers
E. Re-examination of All Registrants[3]

A more detailed explanation of these programs may be found in an American Society of Civil Engineers' publication called Ethics, Professionalism, and Maintaining Competence.

Continuing Engineering Education

Continuing engineering education is increasingly being recognized as a major vehicle for professional development in the light of an ever expanding body of technical knowledge. There are three major suppliers of continuing engineering education in the United States: professional technical societies, universities, and industrial in-house programs. Each has its advantages and limitations. All the major societies such as IEEE, ASME, ASCE, and AIChE offer continuing education courses. Most courses are of one to five days in duration and are taught by leading professionals in the field from academia, industry, and government. The courses are predominantly held in major metropolitan areas where the demand is greatest. They can also be given in-house at the industrial plants. One comprehensive education program is given by the Educational Activities Board of the IEEE. The number of courses offered has increased ten-fold since 1972[4] and its attendance has grown likewise.

The engineering societies have found that the most successful course length, in terms of enrollment, is the two-day program. One-day courses do not cover enough material while three or more days present cost-efficiency problems for the engineers' employer. For example, for a five-day course, a company must pay travel expenses and lodging for five days. The two-day course is a compromise between content and cost. For all societies, the same constraints of cost and content influence program length.

One advantage of a society-based course is that the society is able to choose the leading experts in the field of study for each course. In industry, the choice of instructors is usually restricted to the personnel of the company. The universities can sometimes utilize outside experts but the location is restricted to one area except for very large programs such as UCLA Extension and the University of Wisconsin Extension.

Industry has a vital role in providing continuing education for its engineers. One reason is the fact that business and industry employ over 70% of the engineers in the coutry.[5] Large corporations such as IBM, General Electric, and the Bell System have extensive continuing engineering education programs for their employees.

Most large firms have some form of in-house continuing education for their engineers but smaller companies do not have the resources to invest in an extensive program. The employees of the smaller companies are at a disadvantage. Engineers from smaller companies can use uni-

---

[2] Paul Robbins, interview with the Executive Director of the National Society of Professional Engineers (NSPE), Washington 20 September 1977.

[3] Preprints for the ASCE Professional Activities Committee Specialty Conference: Ethics, Professionalism, and Maintaining Competence, (New York: ASCE, March 1977), pp. 171-172.

[4] Vincent J. Giardina, interview with the Manager, Continuing Education IEEE, Piscataway, NJ, 22 September 1977.

[5] U.S. Scientists and Engineers, p.5.

niversity programs such as the continuing engineering education program at George Washington University. At GWU last year, more than 6000 engineers and scientists attended courses given predominantly in the Washington metropolitan area and also in such places as Florida, California, Argentina, and Spain. A key to the success of the George Washington program is marketing. Over $250,000 were spent on advertising last year. Most of the engineers taking courses were from organizations that were unable to develop a continuing engineering education program but were willing to pay the fees of the course, travel, and lodging for the engineers. In fact, 99% of the enrollment had the courses paid for by the employer. In the opinion of Jack Mansfield, Director of Continuing Engineering Education at GWU, if a mandatory relicensure program were put into affect with all exemptions repealed, the demand for courses would triple at GWU. He felt that the program could handle this increase.[6]

A Technological Delivery System

The large program at George Washington University could not possibly reach all engineers in the United States. They are spread too thinly over all parts of the country making traditional continuing education in some areas unfeasible. In no one region in the U.S. is there more than 20% of the total national engineering population. Technology could play an extensive role in delivering continuing education to engineers in the entire country, regardless of region. The most active organization at this time in media-based continuing engineering education is the Association for Media-Based Continuing Education for Engineers (AMCEE). AMCEE is a consortium of four-year engineering degree granting institutions.

Conclusions

After detailed investigation of the project topic, the following conclusions were drawn:

1. The implementation of mandatory licensure and relicensure programs for engineers is inevitable.

In order to implement these programs, all industrial, governmental, ~~and~~ utility exemptions will be repealed.

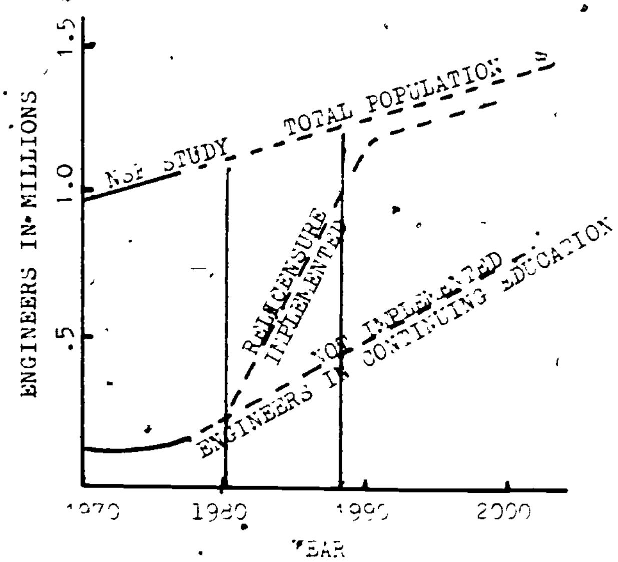
2. Relicensure will be contingent upon professional development activities with a special emphasis on involvement in continuing engineering education programs.

This will be an added requirement to that of submitting a renewal fee.

3. If the implementation of continuing engineering education does not change; it will be unlikely that continuing education establishments will be able to provide education programs to those in need of them.

A projection has been developed of the demand for continuing engineering education in the next twenty years if, in that time states pass mandatory licensure laws.

PROJECTED DEMAND FOR
CONTINUING ENGINEERING EDUCATION



An illustration of this projection can be seen in the figure above.

The population of engineers was taken from the National Science Foundation Study of Scientists and Engineers in 1974. The participation in continuing engineering education programs was extrapolated from data provided by the professional engineering societies, continuing engineering education departments of major universities such as George Washington and Northeastern, and a study done by the National Industrial Conference Board of New York in 1976 concerning "Industry and Education." The large sudden increase in demand projected is due to the assumption that a mandatory relicensure program requiring continuing education as a condition of license renewal is implemented in all states over a five-year period from 1980 to 1985 with a license renewal period of

[6] Jack Mansfield, interview with Director, Continuing Engineering Education at George Washington University, Washington, D.C., 5 October 1977.

three years. Hence, the demand will peak about the year 1988.

Bibliography

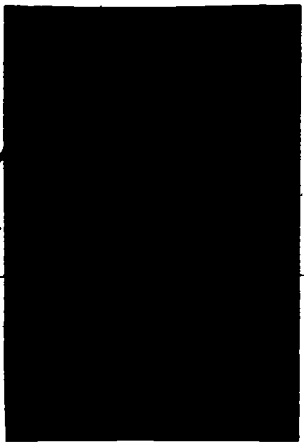
Giardina, Vincent. Manager of Continuing Education IEEE, New Jersey. Interview, 22 September 1977.

Mansfield, Jack E. Director of Continuing Engineering Education, George Washington University, Washington. Interview, 4 October 1977.

Preprints for the ASCE Professional Activities Committee Specialty Conference: Ethics, Professionalism, and Maintaining Competence. New York: ASCE, March 1977.

Robbins, Paul H. Executive Director NSPE, Washington. Interview, 20 September 1977.

U.S. Scientists and Engineers: 1974, Surveys of Science Resources Series. Washington: NSF 76-329.



HEIDI S. PIVNICK JAMES H. MILLER

Heidi S. Pivnick and James H. Miller are juniors at Worcester Polytechnic Institute in Worcester, Massachusetts. Miss Pivnick is studying computer science with a special interest in commercial applications and Mr. Miller is working towards a degree in electrical engineering. Together they worked on a research project concerning continuing education at the National Institute of Education in Washington, D.C. in partial fulfillment of the degree requirements at W.P.I. Mr. Miller also has experience working for the U.S. Army Corps of Engineers. Both students are active in school activities. Miss Pivnick is a member of the Trustee Committee on Academic Policy and Student Affairs and Mr. Miller serves on the Faculty Curriculum Committee.

CONTINUING ENGINEERING STUDIES DIVISION
SPECIAL INTEREST GROUP
PERSONALIZED CONTINUING EDUCATION

Dean E. Griffith
Director, Continuing Education Studies
University of Texas at Austin
Austin, Texas

The Personalized Continuing Engineering Education Special Interest Group (PCEESIG) was organized in November, 1974 to provide a forum for those interested in exchanging information on developments in this field.

PCEESIG members have published a number of bibliographiea and articles, a book, a workbook, and guide manuals to various aspects of this field. Most, but not all, of these have appeared through ASEE publications.

In addition, PCEESIG members have conducted four workshop-discussion sessions at recent ASTD and CIEC meetinga. These sessions have been designed to share PCEESIG member's findings on professional development, career management, personalized education and personalized instructional technology with others active or interested in this field.

In January, 1977, PCEESIG members elected to broaden considerably membership of the Group in order to establish a national network of mutual assistance in implementing PCEE. A Directory of Active Practitioners of PCEE was published in May, 1977 listing 44 individuals; the end of year (1977) listing target is 100 practitioners. Individuals newly active in personalizing education for practicing engineers, engineering technologists, or applied scientists, including engineering managers, are invited to share their problems and successes with this national network.

The current scope of PCEE implementation nationally, and the unresolved PCEE problems needing resolution or research will be the focus of the PCEESIG meeting Friday morning, January 27, 1977, 7:00-9:00 p.m. Come and meet your colleagues in this field and learn of the significant resources available to assist you in implementing PCEE in your organization.

Dean E. Griffith has directed the continuing engineering education programs of The University of Texas at Austin since 1965. Griffith is Chairman, Individualized Continuing Engineering Education Special Interest Group, CES Division, ASEE, and has held numerous other positions in that Division. Griffith has taught at Rice University and the University of Houston, and has studied Chemical Engineering at Rice University and Iowa State University from which he holds B.S. and M.S. degrees. Griffith has worked for or consulted with: Atomic Energy Commission (Ames Laboratory), E. I. du Pont, Shell Oil Company, Goodrich-Gulf Chemical Company, Scott Petty Mining Company, Dow Engineering and Construction Services, Dow Chemical Company, Radian Corporation. Griffith has written numerous articles and papers on continuing professional education and was Editor of the Barnes and Noble Professional Engineering Career Development Series. Griffith's primary current interests in continuing engineering education are in self-assessment, personalization, evaluation and needs assessment.

CONTINUING ENGINEERING STUDIES DIVISION
SPECIAL INTEREST GROUP
PROFESSIONAL SOCIETIES

Stanley M. Greenwald, P.E.
Executive Secretary
State Board of Engineering and Land Surveying
New York State Education Department
Albany, New York

CONTINUING EDUCATION IN PROFESSIONAL SOCIETIES

In the last few years the professional societies have initiated many activities in the continuing education field for their membership. The members of the various professional societies have been very vocal over the past three years asking serious questions from the various professional society staffs on what they are getting for their dues.

In order to help to overcome thiscriticism they have begun to offer more member services. The continuing education programs of the various societies have thus increased as they preceive a problem in this area. They are primarily of the live lecture variety and are given throughout the country. Their biggest problem is that they have a large membership scattered over a wide geographic area. They are prime candidates for continuing education utilizing multi-media techniques and in particular video-tape cassette programs. The American Chemical Society is already putting together video tapes in conjunction with MIT through an NSF Grant. The Institute of Electrical and Electronic Engineers is beginning to put together a series of video tapes dealing with microprocessors and they should be completed by early fall of 1977.

The professional societies have had some experience with audio tape cassette programs. Societies such as the American Society for Training and Development, IEEE, American Chemical Society and others, have put together audio tapes of some of the main speakers at their various conferences. In addition, several of them have tried to package and market audio tape cassette programs dealing with specific subject areas in their field of speciality. The problem becomes the cost to the membership. Although the membership is large the interest in any one particular scientific segment is very fragmented and thus the cost per tape is high. In most cases the individual engineer or scientists must individually purchase these items. Several companies have subscribed to this kind of service and have put it in their library, thus making it available to their employees. This has been a somewhat discouraging adventure for several of the societies however, and they are constantly looking for way of reducing costs to the individual member.

The latest technique that is being used by professional societies with some success is in trying to develop some rapport with the various continuing education divisions of the engineering schools around the country. By forming consortia they have a marketing arm which they do not have to pay for in their overhead cost. In this author's opinion this will increase over the next decade and these professional societies will become copartners with the universities to serve the engineers and scientists throughout the country. At the present time there is a certain amount of friction between the two groups, as they feel that each is trying to take over the entire market. This is an impossibility. There is more continuing education necessary than there are resources and manpower by any one single organization to accomplish this objective.

Probably one of the strong points for the professional societies is their ability to evaluate any program. Among their various technical groups and organizations within the society they have experts that could tell the universities whether or not the information that is being presented is the latest up to date material. This is a plus factor and the universities should be utilizing the professional society more for this evaluation procedure. The Institute of Electrical Electronic Engineers is trying to work with the Continuing Engineering Studies Division of the ASEE to accomplish this task.

Multi-media package education programs have the potential of providing quality programs for the various local sections of any society around the country. Hardware costs for each individual section seems to be the biggest stumbling block. However, a close working relationship between the professional society and the university or industry in the local area could help reduce this problem. The NSF could support experiments in this area and help determine if it is feasible.

An interesting development in continuing education that effects the professional societies is the increasing emphasis placed on professionals by the various states to continue their education. This is being accomplished by state legislative action and the professional groups themselves.

A chart, published in a recent issue of the Chronicle of Higher Education, is attached to indicate the current status of such efforts. If these groups are moving in this direction the engineering and scientific societies must ask themselves "Can we be very far behind?". If it comes to pass that the scientific and engineering community moves in this direction the professional societies will play a key role. This will require extensive use of all multi media techniques to disseminate the information. The number of instructors required to do the job over a widely dispersed constituency, along with the cost and individual time constraints, make the typical approaches of workshops, seminars, etc. ineffective.

The professional societies will not be able to finance such an effort alone. Consortia will have to be formed between societies, between the professional society and universities, and between industrial employers and the societies. A new organizational model for continuing education activities will be needed because of the lack of resources, amnpower, and time by any one of the groups mentioned alone.

Executive Secretary, New York State Board for Engineering & Land Surveying. Mr. Greenwald is responsible for al engineering licensing activities in the State of New York. He was previously with the American Society of Mechanical Engineers as their Director of Professional Development. A former Assistant Professor of Mechanical Engineering and Director of Cooperative Education at Pratt Institute, Mr. Greenwald has also spent several years in industry involved with engineering and training assignments. Active in the CES division of ASEE, he has authored and contributed numerous articles on Continuing Education and Professional Development.

SESSION P

CONTINUING ENGINEERING STUDIES DIVISION SPECIAL INTEREST GROUP UNIVERSITY CONTINUING EDUCATION DIRECTORS

San Diego

William W. Ellis
Director of Professional Education
School of Engineering/Applied Science
Princeton University
Princeton, New Jersey

For over fifteen years the professional and technical societies have attempted to define the problems encountered in providing educational opportunities for the individual who has already completed a formal educational degree program. They have been joined in this search for problem definition by a large number of universities both public and private, large and small.

The importance of the problem has been recognized by all fifty states where laws have been enacted requiring participation in continuing education programs as a condition for relicensure in at least one profession regulated by the state. Iowa has enacted a law requiring "Continuing Education" as a condition for relicensure of engineering and is the first state to do so. The Iowa Board of Engineering Examiners has until May of 1978 to establish procedures for compliance. Organizations of manufacturing engineers, quality control engineers, and cost engineers require continuing education or retesting for recertification. State Societies of Professional Engineers in Florida, New Jersey, Ohio, and Wisconsin award Professional Development Recognition Certificates to members who qualify by meeting minimum continuing education standards.

Employers in the public and private sector have given careful attention to the problem, developed on-site educational opportunities, and supported attendance at programs given by universities and professional societies.

Because of diverse interests, many different approaches to continuing professional education have been proposed. Programs have been developed which follow traditional educational disciplines. Others stress the need for unique solutions for sectors of activity including many which are concerned with the socio-technical problems of our times.

During this fifteen year period selected parts of the overall problem have been defined and often solutions have been found which are successful. Admittedly the measure of success most commonly used is success in the market place. Professional societies have developed programs which have remained viable over a number of years and many private and public universities that began to offer programs in the mid-sixties are still doing so.

This growth of non-traditional educational activity in universities has produced a new and very non-traditional educational administrator. His responsibilities seem to require a very broad range of skills: marketing, planning, organizing, measurement and evaluation, and diplomatic to name but a few. Sometimes he came from a tenured faculty position and sometimes he came from a totally non academic background, but always he faced a whole new set of rapidly changing and challenging problems. At times problems seemed to change much faster than solutions could be found.

The Special Interest Group for University Continuing Education Directors (SIGUCED) is intended to serve as a forum for the discussion of current problems facing this group. A list of possible topics might include:

1) Acceditation of organizations providing programs

2) AMCEE Compendium of Continuing Education Programs

3) University of Wisconsin-Extension (Madison) nationwide survey of continuing professional education activities and opportunities

4) One or two day Workshops for University Directors of Continuing Engineering Education as suggested by Oklahoma State University — Engineering Extension

5) The need for a report similar to the one entitled Engineering College Research and Graduate Study for Engineering College Continuing Education

6) Continuing Education Program Marketing

7) On campus and off campus faculty compensation - who sets maximum and minimum, what about sliding scales?

8) Recruiting of continuing education administrative personnel, job security, future opportunities for professionals in continuing education

9) Role for cooperation between universities

10) Role of the for profit road show and the for profit management firm

SIGUCED will have its first meeting at 7 am on Friday, January 27, 1978. There does not seem to be any organization now serving the needs of the individuals with professional responsibility for this very important segment of continuing professional education. SIGUCED assumes that there is a need for such an organization. This interest group's primary function will be to afford university directors with an opportunity for face to face discussion of issues. Solutions to problems identified by this discussion can then be developed as appropriate. Every effort will be made to avoid duplication. The first item of business at San Diego will be to determine if there is a need for this SIG. If the answer to this question is an affirmative one, the first item on the agenda will be to identify problems, assign priorities to these problems, and make as much progress as possible in two hours.

WILLIAM W. ELLIS

Bill Ellis is the Director of Professional Education for the School of Engineering/Applied Science at Princeton University. Prior to assuming this position he was Director of the Office of Post College Professional Education at Carnegie-Mellon University from the time it was established in 1964. In 1970 he was also named as Director of Special Education for Carnegie-Mellon's Transportation Research Institute. He had previous engineering experience at DuPont and Ownes Illinois and later joined M&R Dietetic Laboratories in Columbus, Ohio where he was responsible for spray dryer and other food processing research and engineering design activities in Holland and the United States. Active in the American Institute of Chemical Engineers he has served as Director and Member of Council as well as National Chairman of the Public Relations and Continuing Education Committees. Internationally known as a leading proponent of continuing education for practicing professionals, he has d[illegible]ected programs in North America and in Europe.

SESSION 9

INDUSTRY INVOLVEMENT — THE EFFECT OF MANAGEMENT OF HUMAN RESOURCES

Paul Doigan
Manager, Entry Level Recruiting
Professional Development Operations
General Electric Company
Schenectady, New York

Addressing the subject of effective management of human resources. Dr. Paul Chenea draws upon his wealth of knowledge as an academician, researcher, and administrator. As Vice President in charge of the General Motors Research Laboratories, he heads a team in applied research and development. Before coming to General Motors, Dr. Chenea served as Vice President for Academic Affairs at Purdue University. He is well known in the fields of science and engineering.

A member of the National Academy of Engineering, Dr. Chenea has received five honorary degrees and was elected as a fellow in the American Academy of Arts and Sciences and the American Society of Mechanical Engineers. He is quite active in ASEE, AIP, and AAAS as well as several other technical societies. In addition, he serves on visiting committees at a number of universities.

Dr. Paul Doigan has been employed by the General Electric Company since 1951 and is currently Manager--Entry Level Recruiting and Representative--Northeastern Region for the Professional Development Operation. In this position he has BS/MS recruiting responsibility with the schools located in the Northeast, and doctoral recruiting with all schools throughout the United States.

A 1941 graduate of the University of Connecticut with a BS in Chemistry, Dr. Doigan earned a BS in Meteorology from New York University in 1943, an MS from the University of Massachusetts in 1946, and a PhD from New York University in 1950. He is a Fellow of the American Institute of Chemists and a member of ACS; IEEE; ASEE; Eastern College Personnel Officers; Sigma Xi; Sigma Pi Sigma; and Phi Lambda Upsilon. He is currently serving as Chairman of the Engineering Manpower Commission of the Engineers Joint Council.

EFFECTIVE MANAGEMENT OF HUMAN RESOURCES

Dr. Paul F. Chenea
Vice President of
General Motors Research Laboratories
Warren, Michigan

Summary

The General Motors Research Laboratories employs over 670 people with college degrees. Nearly half of these are PhD's. The Laboratories operates on the "bottom-up" philosophy. Management communicates Corporate goals and problems downward and lets research proposals and ideas for scientific projects flow upward. Incentives are provided by a dual track system that allows research scientists and engineers to advance to a high level of compensation by making valuable technical contributions rather than by moving into management. Publication and interaction with the scientific community are encouraged.

The GM appraisal system gives the employe a chance to find out where he stands and how he can improve and management a chance to see what he is and what he can become. The General Motors Research Laboratories is large enough and GM's interests broad enough to provide a wide spectrum of jobs to be filled. It is management's responsibility to find the optimum match of researcher and research job — for the satisfied scientist is the most effective scientist.

Introduction

Effective management of human resources is the ultimate goal of every manager. It is the foundation on which the success — or failure — of every organization is built.

I am not qualified to discuss how others handle human resources. But I can tell you how the General Motors Research Laboratories manages its scientists and engineers, how it selects top-quality technical people, how it motivates them and encourages further professional development and growth, and how it identifies and keeps track of talented people.

The Research Laboratories is almost sixty years old. It was founded by Charles Kettering. From the very beginning the quality of the staff has been emphasized. Early in his association with GM, Kettering said, "A problem is not solved in a laboratory. It's solved in some fellow's head. The apparatus just helps get his head turned around so he can see the thing right."

That attitude remains. The General Motors Research Laboratories — indeed, any research laboratories — is only as good as the people who work there.

Recruiting

Finding well-trained technically competent people is *not* difficult. You engineering educators are doing an excellent job, turning out a good product. But finding that rare person who combines talent and creativity with that excellent training *is* difficult. GM Research goes about it in several ways.

Professional personnel recruiters visit university campuses. In the 197[illegible]8 recruiting year Research Laboratories' recruiters will visit 41 campuses, many of them a number of times. In addition, members of GM Research management make an effort to be personally involved in seeking out talented young people. By maintaining personal contacts with faculty members of the graduate schools of distinguished universities, they learn of and evaluate the best available candidates.

The Research Laboratories financially supports with grants, in a few universities, specific research efforts directly relevant to its own work. These are usually unrestricted grants but do involve interaction of GM personnel with university personnel and students. Out of their contacts some exceptional people are identified and hired.

The Labs makes extensive use of consultants from universities to assist with specialized problems. My own first contact with GM Research was in the capacity of a consultant. Often these consultants bring outstanding students to management's attention.

The General Motors Scholarship Plan is another way of identifying talented engineering students. It began two years ago with a pilot program involving eleven schools. Last year it included 26 institutions. The students are selected in their sophomore year and awarded the scholarships, which pay their tuitions and fees plus book allowances, for their junior and senior years. Two summers of internship in the same operating unit of a GM division give the students in-plant developmental experiences. They also give management an opportunity to evaluate the students as potential employes. In addition, the Laboratories has a summer work program employing outstanding graduate students, which serves the same purpose.

These are the ways in which GM Research gets new graduates. Older, experienced engineers and scientists with an employment track record elsewhere are obtained through ads in technical journals, placement centers at professional society meetings, and personal contacts. It is GM's policy, however, to promote from within, wherever possible to maximize opportunities for its employes. To this end, GM has a computerized internal search procedure to identify existing employes to fill job openings. Some employes are transferred to other Staffs and Divisions of GM where the match of employe and job appears to be better. Since Research has such a large bank of exceptional people, this means we lose more than our share — an unfortunate side effect of the system for us, a fortunate one for the man or woman who is promoted.

But that side effect is unfortunate for the Laboratories only in the short term. It is a policy of the Labs to encourage an infusion of bright Research people into Divisions and Staffs. For, in the long run, it benefits both the General Motors Research Laboratories and the Corporation. It creates openings for additional bright young people with recent college degrees. The quality of person the Labs contributes to the Corporation is high. GM's President "Pete" Estes and Executive Vice President Howard Kehrl are both Research alumni.

Backgrounds of Professional Employes

Of the approximately 1500 people in the Laboratories, over 670 have college degrees (Fig. 1). PhD's

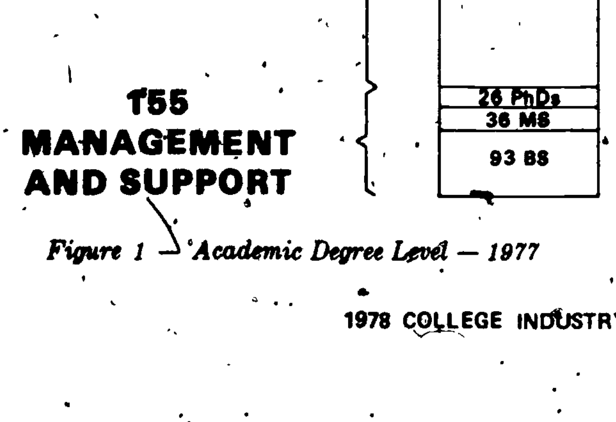


Figure 1 — Academic Degree Level — 1977

SCHOLASTIC DISCIPLINE	NUMBER	%
Chemistry & Chem. Eng.	122	24
Mechanical Eng.	119	23
Electrical Eng.	67	13
Other Eng. (Aero., Eng. Mech., Gen., Civil, etc.)	50	10
Mathematics and Computer Science	53	10
Physics	38	7
Metallurgy, Ceramics, Materials Eng.	35	7
Social Sciences	25	5
Biological Sciences	8	1
	517	100%

Figure 2 — Educational Background of R&D Professionals

make up 297 of these or almost half of our professionals. Bachelors total 189, and Masters, 186.

Not all of these people are engaged directly in research. Some perform management and support functions, such as library and personnel work.

The technical people have a variety of educational backgrounds. The largest grouping now is in chemistry and chemical engineering (Fig. 2). This is a fairly recent development. In the past, mechanical engineers have made up the largest group of employes. This change reflects the fact that a great deal of GM's current research emphasis is on materials, and on the effects of its products on the environment — generally chemistry-related problems. About 60% of the research personnel have some type of engineering degree; about 24% are in the physical sciences; about 10% are in mathematical or computer sciences; and the remaining 6% are in social and biological sciences.

The managers at the Research Laboratories have very definite ideas of the kinds of people they want to hire. They look for men and women who have learned how to attack real problems. They want innovators, original thinkers who will look at more than one side of a question to find the answer.

A problem in recent years has been some young technical people coming out of universities who are steeped in "systems" thinking and social consciousness. There is nothing wrong with either characteristic; both play important roles in industrial life. But many of these young scientists and engineers are so impatient to tackle the *whole* problem — be it energy, pollution, transportation, whatever — that their efforts in their own disciplines are diluted.

Where do they come from? In the last five years more than half of the new PhD's have come from the schools listed in Figure 3.

Many others have been lone recruits from schools as far flung as Hull in England and the University of Tasmania. While the Researchers come from many geographic locations, they seek the common goal of a stimulating and rewarding professional environ-

University of California, Berkeley	13
University of Michigan	13
University of Illinois	13
Purdue University	11
Stanford University	9
California Institute of Technology	6
Massachusetts Institute of Technology	6
Cornell University	6
Iowa State University	5
Ohio State University	5
Case Western Reserve	5
Princeton	4
University of Wisconsin	4
Carnegie-Mellon	4
North Carolina State	3

Figure 3 — Sources of PhD Researchers 1972-1977

ment. Striving to provide this professionally fulfilling environment is one of management's most important tasks.

Organization

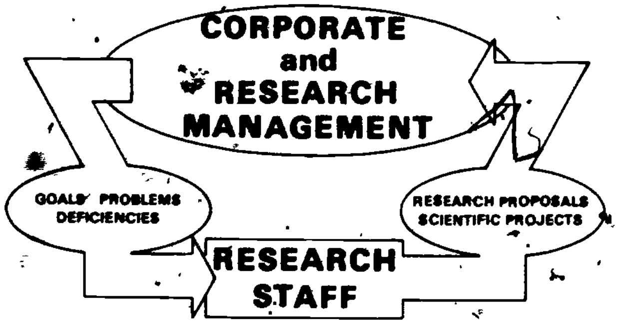


Figure 4 — "Bottom-Up" Philosophy

At the General Motors Research Laboratories this task is met in part by a bottom-up philosophy (Fig. 4). Management does not assign projects. Instead, it communicates Corporate goals and problems downward and lets research proposals and ideas for scientific projects flow upward. Management simply gives the Researchers the facts and then stands back and gets out of their way. It is a permissive environment, but it works well with our creative, talented scientists and engineers.

Layers of management are kept to a minimum. GM Research has no supervisors for its technical people — only group leaders who are leaders by virtue of their technical competence. They are active research scientists and engineers themselves.

The key to this bottom-up technique, of course, is effective communication. And this can get complicated in an organization as decentralized as General Motors. The Laboratories' management and the Corporation's top management work hard at keeping communication open and efficient. Equally important is communication with the operating people in the Divisions who usually know first and most clearly what the current and potential product and processing problems are. Similarly, other Staff employes play a most vital role in communicating Corporate Staff problems to Research personnel. Contacts take place frequently and at all levels either by Research staff visits to Divisions and Staffs, or vice versa, or by telephone and correspondence.

In addition to these internal inputs, the Research staff has wide contacts outside the Corporation which suggest scientific issues that are of potential interest to General Motors. Out of all this, priorities are established and a research program for the Laboratories is formulated. Although the Research scientists themselves largely formulate the program, they are heavily influenced by what they hear from Divisions, Staffs, management, and professional colleagues.

The fact that it is the Research scientist's or engineer's own program is a most important motivating factor. He feels responsibility for its progress and justifiable pride in its accomplishments.

The checks and balances in this system come about largely through reviews: departmental reviews, budget reviews, as well as an annual Corporate-level review. These reviews probably consume 15% of Research management's time during the year but it is time well spent. They inform management of program content and progress. And they convey to the Research worker management's appraisal of the significance and value of what is being done. And you can't beat that as a motivating factor.

Motivation

Keeping the Research scientists and engineers motivated and productive is no major problem at GM. The nature of the work — as challenging as it is — does this for us. But management does offer some additional incentives.

In many research organizations the scientists can advance beyond a certain position and salary level only by leaving the lab bench and going into management. Research scientists and engineers at GM Research Laboratories can advance to very high levels of compensation simply by making valuable technical contributions. With this dual track they can advance while remaining in the lab where they are most effective.

Scientists and engineers are actively encouraged to publish in technical journals and to give talks at professional society meetings. Bibliographies of publications and presentations are printed in each Research department's annual report and compiled in a booklet each year. This booklet is distributed throughout the Laboratories and used as a handout by the Personnel Department to inform prospective employes of the variety and professional level of research conducted at the Labs. The bibliographies not only underscore the significance management places on publication, but also let each scientist and engineer in the Labs see what everyone else is doing. This is good for communication and good for motivation.

Engineers and scientists highly value the esteem of their colleagues. The opportunity for GM Researchers to publish the results of their efforts is a strong incentive to further efforts.

Though they want to publish, both outside and inside the Corporation, many of GM's research workers come to us without the requisite writing skills. To bridge this educational gap, the Research Labs has organized a series of 24 hours of technical writing classes with a heavy engineering and scientific orientation that focuses on sections from recent Research Laboratories reports. Since 1970, 600 Researchers have taken this course of instruction. In addition, editing workshops are held for managers who edit reports and publications that come out of their groups.

Interaction with the scientific community is a vital part of research. In addition to fostering such interaction by employe participation in seminars and conferences, the GM Research Laboratories has sponsored an international symposium on a subject of strong current interest every year since 1957. The 1977 symposium dealt with mechanics of sheet metal forming and included participants from institutions and firms ranging from the University of Cambridge in Great Britain to Nagoya University in Japan, and from Rockwell International to Toyota Motor Company. Guests invited to attend the symposium were equally as far ranging in their geographic points of origin. But they all had one thing in common: a high level of expertise in technical areas relevant to metal forming. The opportunity to meet and share knowledge with colleagues from all over the world is an enriching intellectual experience for both hosts and guests.

The Labs' scientists and engineers have been recipients of numerous awards and honors from a variety of outside organizations. Within the Corporation several awards are granted in recognition of outstanding performance. The Charles L. McCuen Special Achievement Award is one of them. It is named for the Research head who succeeded Kettering. Restricted to employes of the Research Laboratories, it recognizes extraordinary accomplishment which is considered to be highly significant when viewed in terms of its impact on the success of the Corporation.

Continuing Education

The Corporation strongly encourages continuing education. Tuition is refunded for job-related night school classes. Educational leaves are granted. A fellowship program is offered to degree holders who want to do more advanced graduate work.

A variety of non-credit classes is offered at the Labs or in buildings elsewhere at the Technical Center where the Labs is located. These are taught by GM and Wayne State University personnel. Closed-circuit TV brings teachers from the University of Michigan into Laboratory classrooms to give specialized graduate courses in engineering and scientific subjects for college credits.

In addition, monthly lectures by GM scientists and others keep Research employes updated on new research developments in the Labs or on things of Corporate-wide interest going on elsewhere. Consultants are also invited to speak on special technical subjects of research interest. Professor Ilya Prigogine, recipient of the 1977 Nobel Prize for Chemistry, has been a longtime consultant of the Research Laboratories. He gave a talk to interested Laboratories personnel last November on his research and its relation to the physical, biological, and social sciences.

Employe Appraisal

How does a Corporation the size of GM keep track of its talented people and avoid losing them in the crowd? It has a system that involves several appraisal forms. The employe fills out an appraisal worksheet describing his job's key elements, major contributions he has made, and difficulties he has encountered. He provides his own action plan for improving his job performance and effectiveness. And he indicates his career goals.

His group leader fills out a performance appraisal review — sort of a report card — grading the employe's effectiveness in executing his job, organization and planning, communicating information, working with others, and the like. The group leader also includes an action plan outlining ways in which management and the employe can improve job performance.

From these two forms management compiles an appraisal summary form. This identifies the effectiveness of each employe in his current job, attempts to determine his fields of greatest potential and estimates at what level he will be working five years in the future and at the end of his GM career. The bottom line is an evaluation of when the employe will be ready for a lateral move or a promotion. It is this information that is stored in a computer for use in the internal search procedure mentioned earlier.

The system works well. It gives the employe a chance to find out precisely where he stands and how he can improve and it gives management a chance to see what he is and what he can become.

In a recent interview Steve Fuller, GM Vice President for Personnel Administration and Development, said, "If we run the system right, not only will employes not get lost — they won't even have a place to hide."

A Place for Every Employe

The GM Research Laboratories is large enough and GM's interests are broad enough that there is a wide spectrum of jobs to be filled and functions to be performed from the very theoretical to the very practical, from highly analytical to completely experimental. Thus it can accommodate a wide range of talents and tastes in its research scientists and engineers. Each research worker can find his niche and need not conform to any pattern. Management's responsibility is to find the optimum match of researcher and research job — for the satisfied scientist is the most effective scientist.

Dr Paul F. Chenea is Vice President in charge of the General Motors Research Laboratories He joined General Motors in 1967 as Scientific Director of the Research Laboratories and became Vice President in 1969.

Dr Chenea has a B.S degree (1940) from the University of California and M.S (1947) and PhD (1949) degrees in engineering mechanics from the University of Michigan. He remained at the University of Michigan as a faculty member until 1952 when he became a professor of engineering mechanics at Purdue University Subsequent assignments of increasing responsibility at Purdue included Associate Dean of Engineering, head of the School of Mechanical Engineering, acting head of the Division of Mathematical Sciences, and Vice President for Academic Affairs

Dr Chenea is a Fellow of the American Academy of Arts and Sciences and the American Society of Mechanical Engineers. He is also a member of many engineering, scientific, and educational societies, including the American Society for Engineering Education

CAREER DEVELOPMENT PROGRAMS FOR ENGINEERING TECHNOLOGY GRADUATES

Gerald A. Rath
Director, Engineering Technology
Wichita State University
Wichita, Kansas

There are two frequently asked questions concerning engineering technology program graduates. The first is "What kind of job does the engineering technology program graduate obtain when he graduates?" The second is "Where can the engineering technology graduate expect to be several years after he graduates?" These questions can be asked by prospective students, parents, guidance counselors, potential employers, or university administrators.

This session is intended to address itself to some possible answers for the second question. The number of engineering technology program graduates has become sufficiently large that people in various areas have begun to give some consideration to career development programs for these graduates. The students are having no difficulty securing suitable jobs upon graduation, but little is known about the path(s) which they might follow up the corporate ladders. The diverse backgrounds of the session participants as well as their varying present areas of activity give them unique perspectives from which to address this question. In as much as there are undoubtedly more differences than similarities amongst the various employers in the United States it would be quite presumptuous for any individual to assume that their solution or approach to career development would be appropriate for any other particular employer to follow. However, it is hoped that the presentations in this session will stimulate the attendee's thinking and hopefully inspire them in their career development program activities.

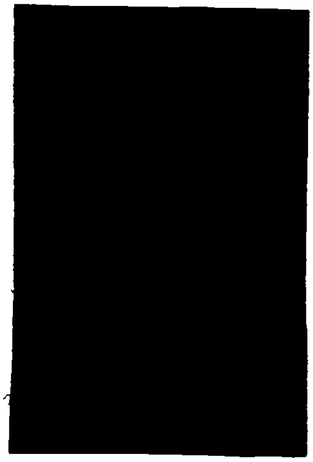
Frank Henry addresses the topic from the viewpoint of an employment manager in a high technology corporation. He focuses on the inter-corporate "roadblocks" which are confronted by graduates of new educational programs which are different from the traditional educational programs from which the majority of the present corporate employees have graduated.

Fred Abitia addresses the question from the viewpoint of cooperative education and the role which it plays in the career development of the technical graduate. The increased activity in cooperative education across the country will certainly influence the total career activities of many of the technical program graduates today and in the future.

George Coover discusses the approach which a major employer of engineering technology graduates has taken to assure the continual development and professional advancement of such graduates. He discusses a method by which a large, very diversified corporation has effectively incorporated the engineering technology graduates into their technical activities.

Stanley Greenwald presents the professional society views on the need for continual professional development of the individual. He emphasizes the need for formalized educational opportunities if the technical professional is going to maintain his viability within the rapidly advancing technical field of today.

The participants by no means claim to be experts in the subject of career development for engineering technology graduates. Their hope is that their remarks will stimulate further thought and discussion on the part of industry and education in addressing the task of developing career development programs for the individuals which can make them viable members of the technical and scientific community throughout their professional careers. All of the session participants welcome and solicit any reactions which anyone may have to their comments.



Gerald Rath joined the faculty of Wichita State University, Wichita, Kansas, in January, 1976 as director and associate professor of engineering technology. At Wichita State he has been responsible for the establishment of the bachelor of engineering technology program which was approved by the Kansas Board of Regents in December, 1975. After receiving a B.S.E.E. degree from Iowa State University in 1955 Mr. Rath was a research engineer at Delco-Remy Division of General Motors Corp. in Anderson, Indiana until 1966, with the exception of twenty months service as a communications officer in the United States Air Force. In September, 1966 Mr. Rath joined the faculty of Purdue University, West Lafayette, Indiana as an assistant professor of electrical engineering technology. He was on the faculty of Purdue University until January, 1976. He has a M.S. degree in Engineering from Purdue and is a Registered Professional Engr. in Ind.

COOPERATIVE EDUCATION: DEVELOPING TOMORROW'S ENGINEERS TODAY

Fred Abitia
Director, Cooperative Education
California Polytechnic State University
San Luis Obispo, California

On June 5, 1975, Senator Vance Hartke invited the attention of the Senate to excerpts from the proceedings of three conferences on "Cooperative Education: The Emerging Manpower Resource." Thus Senator Hartke launched what is considered a major effort by Congress to persuade the American populace that the welding together of the campus world and the world of work via Cooperative Education is good for the student, college, employer, and Nation.[1]

BACKGROUND

This is not the first time, of course, that our Government has sought to influence education, nor are the underlying reasons much different from the past. Throughout our history, whenever the need for skilled leadership in agriculture, science, and technology has become apparent, programs have been developed and enacted; i.e., Morrill Act of 1862, Smith Hughes Act of 1917, and Manpower Development and Training Act of 1962.

Title VIII of the Higher Education Act of 1965, the Cooperative Education legislation, represents a similar effort; however, the impetus for Cooperative Education is best described by Lloyd E. Frisbee, a Vice President for Lockheed of California, in a recent speech, in which he laments the fact that there is a diminishing availability of new college graduates to replace the experienced engineers who are being lost from industry. Frisbee's concern is based not only on the reduced number of engineering and technology graduates, but also on the growing awareness that today's trends in business and industry are not conducive to the rapid development of capabilities of new-hires on jobs.

Thus, at the core of Frisbee's thesis is the realization that a critical situation now exists, regardless of how many graduates are available. This means the real need will be for graduate engineers who have developed job-oriented capabilities before they are hired.[2]

[1]U.S. Congressional Record, Proceedings and Debates of the 93rd Congress, 2nd Session, Senate, June 5, 1975; Cooperative Education (Washington, DC: U.S. Government Printing Office, 1975).

[2]Lloyd E. Frisbee and Ted Kubasak, "Design as an Education Objective," AIAA Paper No. 75-1047 (New York: AIAA, 1975).

This, then, is the dilemma which confronts our technological society. Add to this a whole host of other factors such as the student cries for relevance, increasing costs in education, and predicted enrollment drops of as much as 23 per cent by 1990,[3] and Cooperative Education begins to look like a possible answer to many of these problem areas.

PRIMARY OBJECTIVES OF THE COOPERATIVE EDUCATION PROGRAM

Although these observations seem legitimate, they are not nearly as simple to incorporate in terms of program design and implementation. There are limits to the scope of any Cooperative Education program that would be effective. As such, the general consensus and the hallmark of the Cooperative Education programs in engineering has been the idea that every professional area has certain factors which cannot be taught solely in the classroom or laboratory. Working side by side with professionals who are already successful in the student's major is a very important element in the student's preparation for a career.

In addition, because of the spiraling costs of education, students must earn money to help pay for their education. They work evenings, part time, and during vacations. They feel compelled to work, but in most cases these jobs have little relationship to the student's education program. Thus the decision by engineering programs throughout the Nation to adopt Cooperative Education programs is viewed as a cogent response to students, faculty, and employers' desires to extend the classroom into the industrial and governmental complexes. More specifically, the advantages to the student, employer, and school are the following:

1. By coordinating work experience with the campus education program, theory and practice are more closely integrated and students find greater meaning in their studies.

2. This coordinating of work and study increases student motivation. As students see connections between the jobs they hold and the things they are learning on the campus, greater interest in academic work develops.

[3]Frisbee and Kubasak.

3. For many students, work experience contributes to a greater sense of responsibility for their own efforts, greater dependence on their own judgments, and a corresponding development of maturity.

4. Because the work experiences involve the students in relations with co-workers who come from a variety of backgrounds, and because success in these jobs requires constructive relationships with colleagues, most students in Cooperative Education develop greater understanding of other people and greater skills in human relations. It is particularly valuable for those students to work with adults as a bridge between their years of schooling—living almost entirely with their own contemporaries—and their own adult life among mixed age groups.

5. Cooperative Education helps markedly to orient college students to the world of work. Most college students are generally concerned about their future life work. They want to know more about the range of occupations open to them and the potentials and limitations of these fields. They want to know about the qualifications demanded and their own fitness. In Cooperative Education programs students have opportunities for exploring their own abilities in connection with real jobs, and they find a direct means of gaining vocational information and guidance, not only in the occupations in which they are employed, but also in a number of related fields. They have a chance to test their own aptitudes more fully than is normally possible on the campus. With this realistic try-out, a student may discover that he wants a different career than the one he thought he wanted on entering college; he can then change academic plans to prepare for this more informed vocational choice. Furthermore, students are able to understand and appreciate more fully the meaning of work to the individual and the function of occupations in providing the wide range of goods and services characteristic of our economy.[4]

Other assumed advantages to the student are:

1. The student's earnings contribute to financing his own education, leading to self-dependence and independence and contributing to his self-esteem and confidence.

2. Since the student is carried as a productive employee with an attendant rating of his performance, he usually develops good work habits.

3. His role as a team member in a real and productive working environment inculcates a seriousness of life and purpose which is often denied the traditional college graduate.

[4] Report on Cooperative Education, Summary of the National Study, by Ralph W. Tyler and Annice L. Mills, 1961.

4. As a result of this alternation between the college and the Cooperative Education position, the student tends to appreciate better the role of each environment.

5. A smoother transition into full-time employment awaits the graduate of the Cooperative Education program because of his undergraduate experience. Often the length of apprenticeships and training programs upon graduation is reduced or even eliminated for him because of his Cooperative Education experience.

ADVANTAGES TO THE COOPERATING ORGANIZATION

1. The student can be thoroughly grounded in established employer practices and organization while he is still at a formative level.

2. The program is an excellent source of temporary and potentially permanent manpower.

3. The infusion of bright young people, fresh from an educational environment, into an organization can provide new ideas and viewpoints which can be refreshing and stimulating.

4. Most Cooperative Education programs are developed in such a way that allows continuous job coverage so the employer usually does not have to be concerned about job continuity.

5. The Cooperative Education student serves as a "goodwill ambassador" for his cooperating organization, with faculty and other students, upon returning to campus.

6. A mutually important industry-college relationship is enhanced.

7. The Cooperative Education program provides the company with a low-cost training program because the Cooperative Education student generally earns a salary which is below the average salary paid to a graduate. He more nearly "earns" his salary at the beginning stages of professional employment.

ADVANTAGES TO THE SCHOOL

1. The establishment of a relationship with the cooperating organizations can reduce the "isolationism" of the college and result in a better rapport with the commercial community.

2. The faculty of the institution can be kept up to date and stimulated by the events which transpire in the daily life of the Cooperative Education student and which can be brought to the classroom by the student.

3. In certain instances the student in industry has the advantage of using facilities and equipment of the most modern sort. It is sometimes too costly for the college to supply equipment of either a specialized nature or of recent vintage.

4. The placement of graduates of a Cooperative Education program is much easier for the college because of their background of experience.

5. Fund-raising activities are often aided substantially by the contributions of organizations participating in the school's Cooperative Education program because they recognize the benefits of their involvement with the education institution through the Cooperative Education program.

6. As Cooperative Education student can alternate on a year-round basis, the college physical plant can be used more efficiently with the existing facilities.

7. Institutions which are well known for their Cooperative Education programs tend to interest that student who finds such a program attractive. This can have a positive effect on applications to the college and total enrollment.

PROGRAM DESIGN

Generally, the program requires a student to spend about half of his time on campus studying and the other half off-campus in full-time employment. It will usually take 5 years instead of 4 to earn a degree; however, the job-related experience, increased motivation, career awareness, financial benefits, and employment contacts for the future far outweigh the additional time expended.

The "two-man team" principle is generally observed wherein one student works on the job, while his partner or "alternate" is in school. At the end of a predetermined time period the students change places in such a manner that the job slot is filled continuously.

EVALUATION OF WORK EXPERIENCE

The actual work experience of a student is evaluated by the employer, the student, and the school coordinator. The university coordinator has first evaluated the employer's acceptability as a source of Cooperative Education opportunities. If found acceptable, an agreement between the employer and the university is developed and students are placed. Sometime during the student's work period, the Coordinator does an on-the-job evaluation and looks for such things as changes in responsibilities of the student on the job; attitude toward the work situation, fellow employees, and his immediate supervisor; and the quality of work being done by the student.

The employer evaluation attempts to measure the student's day-to-day performance on the job, the amount of growth which has taken place as a result of the work experience, and whether or not the student might be considered for a full-time position at a later date.

The student evaluation, on the other hand, allows the student to give his side of the story. The aforementioned data are compiled and used in assigning grades, as a guide in curriculum development in engineering and technology, and in future selection of employers by the Cooperative Education program.

STUDENT DEBRIEFING

To appraise the effectiveness of the Cooperative Education program and to determine the most important experiences and thoughts in a student's work experience, debriefing interviews are conducted with individual students and student groups soon after their return from a Co-op assignment.

Student responses are invariably positive in debriefing interviews: "Great experience—better than any book . . . My Co-op experience gave me some realistic goals to consider in the future . . . I learned more in a few weeks than I learned in months of school . . . I saved $2,400 . . . I think everybody should go out on a Co-op assignment."

CONCLUSION

Little known and practiced a few years ago, Cooperative Education is fast becoming an important alternative in engineering programs throughout the Nation. In addition, under Title VIII of the High Education Act of 1965, fifteen million dollars have been appropriated by Congress to foster more growth via Federal grants; however, the benefits to be accrued by students, employers, and institutions of higher education are now a known fact and will become a focal point in education and industry, with or without Government support.

Dr. Fred Abitia is the Director of Cooperative Education at California Polytechnic State University, San Luis Obispo, which has one of the largest Co-op programs on the West Coast. Prior to assuming his present position, he was employed by Tran-Century Corporation as Operations Executive, specializing in engineering and technology developments in Africa. He has worked in industry as a designer and materials expert; has taught at universities both at home and abroad; and has served on numerous boards, committees, and evaluation teams.

ONE INDUSTRIAL APPROACH TO CAREER DEVELOPMENT

George B. Coover
Regional Representative
General Electric Corporation
San Francisco, California

When I hear the term Career Development, several things come to mind. For purposes of simplification, I will refer to both the short-term and the long-term considerations. For the short-term, I mean from the point of first-time full-time professional employment upon graduation--in this case a BS degree in engineering technology--through the orientation or apprenticeship years. Long-term I will identify as those years between the so called apprenticeship period and sometime--a few years later--when thoughts of a second career or retirement planning and other options enter the picture.

I hope that we all understand that four years of interruptive non-sequential fifty-minute module educational chunks are not really terminal or complete as far as preparing one for a contribution in their initial area of interest and training for the next forty years. The four years are for teaching learning discipline, exposure to specialized areas of technology, and an opportunity for cultural and social adjustment. The four-year programs have long been recognized as the best balanced bag to serve "everybody's" special interests "out there."

For the short term, as one of those "out there", we now take this four year product and begin to mold it so that contributive energy and results can be focused on the specific job to be done. First of all, we must try to match an individual's area of interest functionally--that is, manufacturing, technical marketing, field engineering, or product engineering. The apprenticeship will take a different path in each case. In manufacturing we have a two to two and a half year program where the entry level person will have six month assignments in each of the four or five areas such as manufacturing engineering, quality control, supervision, materials management, planning, etc. At the same time they will be participating in formal in-house training in manufacturing studies such as manufacturing costing, direct methods and time standards, statistical quality control, manufacturing problems analysis, and the like. There will also be some product orientation courses as well as professional orientation to the Company. They will also be introduced to Career Dimensions--a method for helping them with their career planning and development. The true length of the apprenticeship period for each individual will vary dependent upon age, prior related work experience, product orientation, personal and family considerations, etc. A similar course of action is planned for those starting in technical marketing and field engineering. The bulk of the complementary and supplementary studies will, of course, complement the specific functional activity or product line. In the case of product engineering, our apprenticeship period will be shorter with perhaps only one to three six-month assignments. The related studies will, in most cases, be in continued or specialized technical depth.

Upon completion of the more or less arbitrary apprenticeship period, the professional will then be in a "permanent job" and move more in the direction of designing and implementing a career plan and goal. It is almost impossible to do so earlier since they lack the maturity, perspective, experience, knowledge of mechanisms of how to accomplish their objectives, etc. They are now in a much better position to evaluate additional degree programs such as MBA, MSIA, MSIE, or other formal masters programs or whether additional in-house continuing education programs would be in their best interests. At this point in time they must also concentrate on "establishing" themselves, gaining a reputation for performance, becoming "visible" to management for accomplishments, etc. In-house courses now available are such things as Advanced Manufacturing Studies, Management Practices, Problem Solving and Decision Making, Advanced Mathematics and Programming, Contracts and Negotiations, etc.

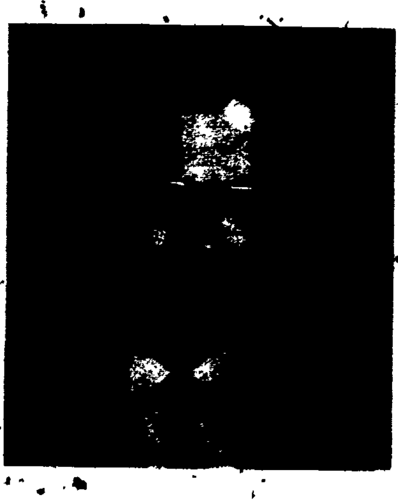
Assuming our professional is pretty well "established" by their late twenties or early thirties, they can now proceed to close the loop or recycle their career plan. Of course they will have done a certain amount of review annually. They may be a specialist, an individual contributor, a well established supervisor or manager. Considerations relative to achievement levels, personal, professional, social, community involvements on the outside, etc., will now have a much greater impact on the master plan. Now is the time for not only reviewing career dimensions but also embarking on what we call mid career planning. The steepest slope of the professional achievement curve is the period from the age of the late twenties to the early fifties. Everything impacts on success--the breaks (timing), economy, personal energy and health, product technology, politics, etc. Career direction may have changed several times during this period also. A greater focus on "consolidation" of position will become evident.

People come from all walks of life. Early definition may be by degree and grade point average. These disappear rapidly with new measurement criteria--results and performance--success as measured in dollars by gross compensation. In today's environment of survival on an international basis, productivity is given great attention. Therefore, in this manufacturing industry (GE) we stress:

1) Job match with the individual (functional work)
2) Challenging work assignments
3) Supervision and coaching
4) Relevant continuing education (lifelong learning)
5) Career planning and development.

For the middle and top level managerial professionals we again offer a broad spectrum of tools and skills in house such as: Effective Cash Management, Managing in an Inflationary Economy, Strategic Planning, Modern Marketing Techniques, Mathematics for Management, Modern Engineering, and many other types of executive workshops and seminars. External programs are also available such as professional seminars and workshops offered on university campuses as well as through other organizations.

Assuming for the moment that we are all "self limiting," we make available the foregoing concept of career opportunity to all entry level professionals--technical and non-technical. Age, level of competence, experience (or lack of); background, etc., will, of course, have a big influence on that first job or position match. From that point on, however, we hope we have developed a logical framework within which the new professionals can maneuver themselves with optimum dispatch.



GEORGE B. COOVER

Served as a pilot with the United States Army Air Corps in World War II. Joined General Electric Company upon graduation from Iowa State University in 1949 with a BS General Engineering degree. Has held various manufacturing and marketing assignments in power, ordnance, and atomic products. Has been associated with professional personnel recruitment and college relations since 1956. Currently responsible for college relations and entry level professional personnel recruiting coordination in twenty Western States. Member of a number of technical and professional societies (Amer. Soc. for Engr. Ed.; American Institute of Industrial Engineering; American Institute of Astro and Aeronautics; Society of Auto. Engr.; Reg. P.E.; Western College Place. Assoc.; Rocky Mountain Place. Asso.; Midwest College Place. Asso.)

PROFESSIONAL DEVELOPMENT — THE KEY TO ACCEPTING TECHNOLOGICAL CHANGE

Stanley M. Greenwald, P.E.
Executive Secretary
State Board of Engineering and Land Surveying
New York State Education Department
Albany, New York

Management is faced with an unprecedented rate of technological and organizational change. Management is also faced with the growing awareness of product safety and an increasing competitiveness in the marketplace.

The dynamics of change and the organization's capability to adjust to such challenges will reflect in its ability to survive and prosper. The dual problems of technology and human resources often require solutions that are directly opposite to one another. The growing demands and sophistication of today's work force exceeds its predecessors. The work force is new, and managers have come to realize that many once tried methods of managing human resources are no longer effective.

Technological change is highly visable in the fields of nuclear energy, solar energy, micro-electronics, computers, space flight, composite materials, and a multitude of other products too numerous to list. Whether an organization prospers or perishes is often determined by the degree to which it utilizes technological innovation.

Organizational change is clearly indicated by the fact that two-thirds of major industrial organizations in the United States, have reported recent major structural changes. It is estimated that large organizations undergo at least one major change every two years. Mergers, acquisitions, product diversifications and the expansion of international operations require major upheavals in the chain of command. The growth of multinational organizations can require a complete change in an organization structure. American corporations such as Coca-Cola, Gillette, IBM, NCR, Hoover, Pfizer, etc.,[1] obtain more than 50% of their profits from foreign operations.

This growth will proceed unabated for several years. Obviously, organizations will undergo dramatic changes to accommodate such increases in profits.

Although not a new phenomenon, the age of consumerism is now. The consumer movement, coupled with social and economic discontent of the 1960's has led to wide scale acceptance of the right of consumers to safe, pollution free, and economical products. The energy shortage, excessive pollution, unsafe products, and material shortages have resulted in laws and agencies at all levels of government, to combat such problems.

Industry is undergoing major technological change in response to our energy and material shortages. The automobile industry is changing its approach to the technology of producing automobiles and also its organizational structure. The shift in energy sources from gas and oil to coal, nuclear, and solar sources will create traumatic organizational and technological problems. The type of change is not limited to the above listing. We can also include occupational, marketing, demographic, educational, social, etc., areas. The common denominator to assure change is the motivation of the employee to accept change coupled with technological updating to keep abreast of the latest innovations in the field. Clearly, the employee's positive attitude toward change coupled with the latest technical information will assist organizations in meeting the demands of change.

Both ingredients are the basis for strong management support of continuing education.

It is no accident that technology intensive corporations, ie., Dupont, General Motors, IBM, Xerox, Union Carbide, General Electric, provide extensive continuing education programs on an in-plant basis and are strong supporters of professional societies and university programs. Dupont estimates that 25% of its technical staff participates in continuing education programs. General Motors employs 1500 full-time continuing education instructors. The course catalogs of IBM, General Electric, and Union Carbide are larger than many state universities'. Various researchers estimate that more than 50% of all engineers participate in continuing education. Clearly, if management is to meet the challenges of change, all tools must be utilized at its disposition. Continuing education is the single most proven tool in obtaining the positive motivation of employees toward change and in keeping abreast of technological innovation.

MOTIVATION OF ENGINEERS

It is no accident that Herzberg's Hierarchy of Values was developed after investigating the motivational problems of engineers. Like Herzberg, Maslow and McGregor all developed their theories during the post W.W.II era, a time of immense technological growth in the United States. Herzberg's need heirarchy focuses on the lower level security and physiological needs and the higher order growth and recognition needs.[2]

The lower order protective and physiological needs of food, water, sex, shelter, family, and security are dependent upon the economic conditions of the individual. These needs are strong at the beginning of the engineer's professional career but tend to decline rapidly during the next five years. However, during this five year period, the higher order needs for growth, recognition, self-esteem, and self-fulliment increase rapidly.

At the beginning of his or her career, the professional person may have strong needs to become firmly established within the organization. Stress, anxiety, and frustration are often evident during this process. When the organizational status is attained and the professional person becomes fully integrated within the system, the need for security diminishes. At this point, the need for recognition and self-esteem is intensified.

The stronger the growth needs, the more likely a person will avoid obsolescence. This point reflects the fact that individuals with high achievement needs are self-reliant and are willing to assume responsibility for their own career success. Such individuals succeed in business organizations and remain abreast new developments and learnings within their technical specialities.

Evidence shows that engineers are motivated by different incentives as needs and career goals change. In general, however, all engineers feel that job challenge is very important. The youngest age group gives this challenge top priority, while most engineers find it only slightly less important than job freedom. Job challenge, although easy to implement, is frequently neglected[3] when motivating mid-career and older engineers. Younger engineers are more familiar with current technology and often receive the most challenging assignments. Employers must recognize that the older engineers who have kept abreast of technological change, through continuing education, can be as effective as or more effective than their younger colleagues. Mid-career and older engineers should be encouraged to participate in professional development activities.

The younger engineer has high expectations of being promoted within his discipline.[4] However, these expectations decrease dramatically with age. The young engineer is located at the bottom of the engineering ladder. The older engineer has fewer opportunities for advancement because of the narrowing affect of promotional levels within the corporate ladder structure.

Participation in continuing education has a positive effect on job satisfaction and salary, according to Klus and Jones. Of those who attended more than five courses in the preceding two years, 67.3 percent were highly satisfied with their job. They also report that, "Those who participated in over five programs have a significantly higher percentage of salary increases and promotions."[5] Clearly, those engineers who seek additional education or those who are propelled into courses by the need for technical updating or change of fields, are highly motivated. The cause and effect is not easy to determine; however, easy access to continuing education programs will always increase the engineer's motivation.

Engineers obviously are helped by professional development programs and they also want them. Approximately, 64.3 percent of all engineers studied in a survey by H.G. Kaufman[6] participated in courses to keep up to date. Sixty-two percent did so to prepare for increased responsibility, while less than 50 percent attend courses to improve present performance.

SURVEY

The lack of a common acceptable base for defining and measuring continuing education has created a void in this educational area. Universities, professional and technical societies, employers, and proprietary organizations are all involved in providing various levels of continuing education. Definitive information, concerning the scope and level of society sponsored programs, is seriously lacking. Data from universities and major employers has recently become available through various organizations. However, information describing the activities of professional and technical societies is not yet available. To remedy this situation, a comprehensive survey, involving a large majority of the major societies, was recently completed.

The survey, representing a large percentage of the major professional and technical societies in the United States, indicated a substantial level of continuing education activity during the base year of 1976. The survey also indicated that the goals of most organizations includes the expansion of continuing education in order to meet the current and future challenges of technical change.

It is indicative of the lack of a central inventory of continuing education sponsors, that duplicate questionnaires were necessary. Approximately, one-hundred and eighty names were obtained from the combined mailing lists of Engineers Joint Council (EJC), American Society of Engineering Education (ASEE), Continuing Education Division, and the Council of Engineering & Scientific Society Executives (CESSE). Because of the lack of a central listing and in many cases the lack of individuals responsible for continuing education, it was necessary to query the executive director of each association and also the individual responsible for the continuing education program.

The survey yielded fifty-seven responses from all of the major engineering and technical societies in the United States. Of this number, thirty-nine indicated that a continuing education program is currently in operation or in the developmental stages. Eighteen societies answered that they do not sponsor a program, however, of this number, six societies responded that a program is in the planning stages and four indicated the possibility of planning a program. Thus, of the total respondents, eighty-six percent indicated programs in operation, development, or planning stages.

The respondents that indicated a program in the operation or developmental stages, represent approximately one million members. Engineers, scientists and other technical personnel often join a multitude of organizations to foster their own awareness of technological innovations. Their overlapping memberships should be considered in analyzing the results of this survey. The four basic engineering societies: The American Society of Mechanical Engineers (ASME), American Society of Civil Engineers (ASCE), American Institute of Chemical Engineers (AIChE), and the Institute of Electrical and Electronic Engineers (IEEE), represents almost 350,000 individuals. Because these are the basic societies in the field of engineering, their members do not hold duplicate memberships among these societies. However, they may hold additional memberships in the specialized societies ie., American Society for Quality Control. Combining the membership of the basic societies with one-third of the remaining total, we have an engineering and technical population of about 565,000 represented by this survey. This number is approximately fifty percent of the total engineers in the United States. Clearly, we can conclude that approximately 50% of the engineers in the United States hold memberships in societies that are conducting or developing continuing education programs.

Course Offerings

The duration of the various societies' short courses generally last from one to three days as reported by 92% of the respondents. Nine organizations indicated that some courses are held less than one day and fifteen groups stated that their courses can last more than three days. It is significant that only five organizations offer programs in successive afternoons or evenings, similar to the traditional college scheduling.

The societies reported that approximately 1,100 courses were offered to about 30,000 attendees during 1976. The majority of the attendees were not members of the sponsoring organizations. Since only forty-five percent of the attendes were members, we can conclude that the organizations provide valuable services to all of the technical and professional community and not only to their members.

All professional and technical associations depend on local chapters for membership and grass roots appeal. In addition, cooperative arrangements with other societies, universities, and proprietary organizations are often concluded to assist in the presentation of programs. Consequently, it is not surprising that 64% of the respondents report that they offer continuing education programs in conjunction with their local chapters. Forty-nine percent co-sponsor programs with local universities and 33% with proprietary organizations. All of the reporting societies sponsor courses at the national level.

Although a recent innovation has occured in the field, the continuing education unit, CEU, is being utilizied by fifteen of the thirty-nine respondents. Only several years ago, the CEU was formally recognized as a measure of continuing education and amidst controversy, it is being adopted by many organizations.

CONCLUSIONS

The university was expected to provide all of the basic and professional education needed by engineers and allied technical personnel. However, in a recent article, "The Challenge of Continuing Education", by Myron Tribus, the author points out that universities have failed to meet their obligations in this area. The author further states that universities are, "part of the problem, not the solution". Dr. Tribus adds, "I am impressed with the efforts now being put forth by the major professional societies, ie., IEEE, ASME, AIChE, which have developed good programs to motivate and help engineers toward continuing learning.

It is no accident that professional societies can help to motivate engineers because the society is in a unique position to provide continuing education activities.

The relationship between the engineer and his or her professional society transcends employment and educational opportunities. It exists for the entire professional life of the engineer and will often cross geographical, discipline, social, and generation boundaries. The professional society, utilizing its vast resources of membership, education, technology, knowledge, and standards, can be a catalyst in the development of new programs that will meet the challenges of technical obsolescence.

The pragamatic benefits of continuing education programs sponsored by societies, are three fold: 1.) peer approval, 2.) direct application to work situations and 3.) professional, career, and financial growth. Peer approval is a key factor in the motivation of high level professionals. Selection by superiors to attend high level, and often expensive courses, is a form of reward and recognition. The course attendee is rewarded for superior performance by his superiors and is recognized by his peers.

The implications of the data from the survey are clear. Professional and technical societies are a substantial source of continuing education programs and because of this activity, the societies are playing an increasing role in meeting the challenges imposed by increasing technological and organizational change.

Government, universities, and industry have relied on such societies for the delivery of state of the art technical papers. These societies should also be relied upon to provide many continuing education programs. Previous articles and studies have focused on the university as being the main source of continuing education. This survey and future reports demonstrate that professional and technical societies are also substantial sources of continuing education. Because a variety of continuing education programs is beneficial for the profession, all approaches and sponsors must be encourage to meet career requirements for all engineers and allied technical personnel.

SUMMARY OF RESULTS

- Eighty-six percent of the major professional and technical societies operate or are in the process of developing continuing education programs.
- The above organizations have a combined membership of approximately one million members.
- The memberships represent about 565,000 individuals which is about 50% of all engineers in the United States.
- The societies offered approximately 1,100 courses to about 30,000 attendees of which only 45% were members of the sponsoring organization.
- Most of the society programs are offered in cooperation with their local chapters as indicated by 64% of the respondents.
- Societies cooperate with universities in about one-half of all course offerings.
- The CEU is being utilized by 38% of the respondents.

1.) Business Week, January 12, 1974, p. 53

2.) "The Motivation to Work", Herzberg, Maunser and Snyderman. Wiley & Sons, New York, N.Y. 1959

3. Thompson, P., Dowden, J., and Price, J., "What Motivates Engineers?" Mechanical Engineering, Vol. 97, No. 3, Mar. 1975, p. 21.

4. Ibid. p. 22

5. Klus, J., and Jones, J., Engineers Involved in Continuing Education, ASEE, 1975, p. 23.

6. Kaufman, H.C. Obsolescence and Professional Career Management, New York, N.Y. AMA 1974, p. 44.

Executive Secretary, New York State Board for Engineering & Land Surveying. Mr. Greenwald is responsible for all engineering licensing activities in the State of New York.

He was previously with the American Society of Mechanical Engineers as their Director of Professional Development. A former Assistant Professor of Mechanical Engineering and Director of Cooperative Education at Pratt Institute, Mr. Greenwald has also spent several years in industry involved with engineering and training assignments.

Active in the CES division of ASEE, he has authored and contributed numerous articles on Continuing Education and Professional Development.

REMOVING THE BARRIERS

Frank R. Henry
Employment Manager
Sundstrand Corporation
Rockford, Illinois

Following a twelve year military career specializing in the areas of electronics and nuclear power, Henry left a nuclear instrumentation teaching position to join the Sundstrand Personnel Department in 1967.

From 1968 to 1975 Henry was a supervisor in the Training and Customer Relations Departments of Sundstrand's Machine Tool Division (now White-Sundstrand.) He returned to Personnel late in 1975 as Employment Manager, responsible for those divisions of Sundstrand located in the Rockford area.

Henry attended Old Dominion College and Rock Valley College in addition to receiving three years of technical training while in the Army. He received the Outstanding Service Award in 1973 from the California Society of Professional Engineers. He is a member of ASEE, MCPA and the Rockford Personnel Association.

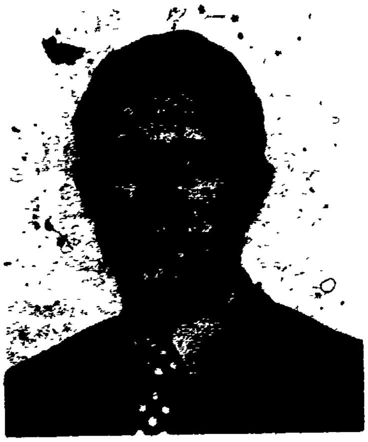
INTERNATIONAL DIVISION BUSINESS MEETING

Valdimir Yackovlev
Chairman, International Division
Central University
Caracas, Venezuela

The International Division of ASEE was established by the Board of Directors as an answer to a need felt within the Society to provide a forum for the exchange of information and sharing of common interests of these members of the Society who had an interest in the international dimension of engineering education. At the same time, the fast changing conditions of todays world have made it quite apparent that ASEE does have a role to play on the international level. Being the oldest, largest and most respected society in the field of technological education it is looked upon by other organizations, and by individuals active in the field of engineering education, as the logical place to get information and resources. This is true both within the United States as well as world-wide.

The International Division provides this needed forum to discuss the international dimensions of engineering education. To this end, the Division has been responsible for the organization of such events as the World Congress on Engineering Education, held at Etes Park in 1975, as well as other Mid-winter meetings which examined such topics as Engineering Education in China; the international implications of the Energy Crises, etc. Also, the Division serves as a resource to the Society, as well as to other organizations, such as governmental departments or non-governmental organizations. To provide expertise in the international dimension of engineering education. As many such occasions, members of the International Division have served on assignments overseas, on International and Regional Committees and Working Groups and serve as liason members with other organizations.

281



Vladimir Yackovlev, who is the Chairman of the International Division of ASEE, is a Civil Engineer, educated in Venezuela and the United States. After graduating from the Central University of Venezuela, he came to the United States where he got his M.Sc. degree from the University of Illinois. He returned to his country and began working at his university as an instructor. After getting some experience there, he came once more to the U.S., where he obtained his Ph.D. degree at the same university. Very early in his career Dr. Yackovlev became interested in engineering education and it is in this field where he has become known internationally. After some 40 publications in this field and participating in numerous meetings on engineering education both in his personel capacity as an expert in this field, as well as a representative of his country, he is an active spokesman for engineering education in Latin America. Aside from his duties as Chairman of the International Division of ASEE, Dr. Yackovlev is a Member of the UPADI Committee on Engineering Education on the Panamerican level; a member of the Committee on Education and Training of Engineers of the World Federation of Engineering Organizations and a member of the International Working Group on Engineering Curriculum Design of UNESCO. In his own country - Venezuela - he is the Director for International Affairs of the Venezuelan Society for Engineering Education. He has held various academic positions at his university, being at the present time the Executive Secretary of the Venezuelan Fund for Research and Personel Development for the Petroleum and Petrochemical Industries.

RWI

SESSION 10.3

IS ENGINEERING ALL ITS CRACKED UP TO BE

E. R. Brown, Jr.
Manager of Exempt Personnel Resources
Union Carbide/Linde Division
New York, New York

E. R. Brown, Jr., received A.B. Degree, Indiana University in 1947. Graduate study at Michigan, Michigan Tech, Indiana and Columbia.

Employed by Joseph E. Seagram, Indiana University, General Motors and R. H. Macy in a variety of employee relations assignments prior to joining Union Carbide in 1948. Initially assigned to Sault Ste Marie, Michigan as Employee Relations Supervisor, then Niagara Falls, NY as Recruiting Manager for the Metals Division, followed by Employment Manager at Union Carbide Corporation Headquarters in New York City. Currently Manager-Exempt Personnel Resources for the Linde Division with responsibility for Manpower Forecasting and Planning, recruitment, college relations, exempt mobility, career development, co-op and summer programs and placement of surplus people.

PANELIST

Dr. Joseph Hogan
Dean of Engineering
University of Notre Dame
Notre Dame, Indiana

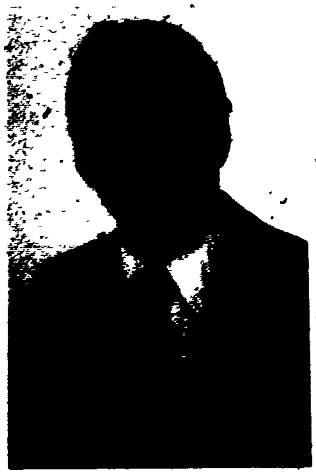
Dr. Hogan has been Dean of the College of Engineering at the University of Notre Dame since 1967. Prior to that, he was Dean of Engineering at the University of Missouri-Columbia. His education includes a BSEE from Washington University, an MSEE from the University of Missouri, and a Ph. D. from the University of Wisconsin, where he was a University Fellow. Active in professional societies, he has been a member of the Board of Directors and a Vice President of ASEE, as well as National Chairman of the Relations with Industry Division. In IEEE, he has served as chairman of the Education Medal Committee and as a member of the Awards Board. He is a member of the Board of Directors and secretary of the Council of ECPD. Dr. Hogan is a Registered Professional Engineer in Missouri and Indiana and a member of NSPE.

PANELIST **Robert W. King**
Director of Development
Union Carbide
New York, New York

Bob King joined Union Carbide in 1942 as an engineer at the corporation's chemicals facility in South Charleston, West Virginia. He served in management positions there until 1960, when he moved to the New York Office as Director of Engineering for the then Chemicals Division. He remained with that Division in management positions until 1965 when he moved to the Linde Division as a Vice President and General Manager of the Cryogenic Products Department. In January 1974, he became a Senior Vice President of Linde. On March 1, 1975, Bob's responsibilities included Gas Products Businesses, Welding and Distributor Products, and Environmental Systems.

On January 1, 1977, Mr. King became Director of Corporate Development, Union Carbide Corporation.

PANELIST



Henry C. Bourne, Jr.
Division Director for Engineering
National Science Foundation
Washington, D.C.

Henry C. Bourne, Jr., is currently Division Director for Engineering, National Science Foundation, on leave from Rice University, where he held an appointment as Professor of Electrical Engineering. He received his Sc.D. in 1952, from Massachusetts Institute of Technology. His research interests concern magnetic materials and devices with recent publications on flux reversal processes in magnetic thin films and amorphous magnetic materials for bubble memory applications. He is a member of the Institute of Electrical and Electronics Engineers, American Physical Society, American Society of Engineering Education, and American Association for the Advancement of Science.

SESSION Q

1978 CIEC CONFERENCE LUNCHEON

James P. Todd
Chairman, Engineering Technology Department
California State Polytechnic University
Pomona, California

JAMES P. TODD

James P. Todd is the Chairman of the Engineering Technology Department, and a Professor in the School of Engineering at the Calif. State Polytechnic University in Pomona. He was the Associate Dean of Engineering from 1970-72 while the B.S.E.T. program was being developed. Mr. Todd received his Bachelor's degree and Master's degree from Stanford University in Mechanical Engineering. He is a registered professional engineer (mechanical) in California and has assisted in teaching the E.I.T. refresher course offered by Cal Poly each year. Prof. Todd is currently Chairman of the Technology and Engineering Coordinating Committee (TECC) of ASEE, having been the Secretary during 1975-76. He is, also, the Secretary of the Engineering Technology Division (ETD) of ASEE. His thirteen years of industrial and consulting experience includes such companies as Pratt & Whitney Aircraft, Aerojet-General, Lycoming Division of AVCO, Plasmadyne Corp. and JPL. Among his professional society affiliations are ASME, AIAA and ASTM.

RWI

APPENDIX A

RELATIONS WITH INDUSTRY DIVISION

B. J. Whitworth
Vice President - Product Reliability
Hughes Tool Company
Houston, Texas

The Relations With Industry Division was formed in 1950 to provide within ASEE an organization for industry representatives and educators to jointly have an input into the education of engineers. The Division's membership consists of members representing industrial corporations and educational institutions, and individual members from both industry and educational institutions. The RWI Division is the operating arm of the College Industry Council of ASEE, and its officers and Board of Directors are common to both organizations. Through its committee structure, the Division assists ASEE in achieving its broad goals and the specific objectives of the Division which are:

1. To increase college-industry understanding of mutual problems and objectives;
2. To maintain friendly and fruitful relationships between engineering education and industry and consulting firms.
3. To keep engineering educators informed of industry's diverse and changing requirements and the adequacy of the education of their graduates in industry.
4. To cooperate with educational institutions, professional societies, and other segments of the engineering profession in such matters as:
   - Counseling, selecting, and recruiting potential engineering students;
   - Providing secondary school counselors with pertinent information pertaining to the preparation for admission to engineering colleges;
   - Endorsing professionally sound standards for recruiting engineering graduates;
   - Developing professional competence and professional consciousness in young engineers;
   - Encouraging utilization of engineering talents;
   - Identifying teaching aids and facilities available from industry;
   - Assisting in the interchange of personnel between industry and engineering education;
5. To encourage adequate interchange of engineering technology between industry and the engineering colleges;
6. To maintain college-industry alertness to, and understanding of, changing professional climates in academic and industrial areas;
7. To evaluate trends of influence on engineering education and their implications;
8. To promote adequate support of engineering educational institutions;
9. To stimulate broader industrial representation and participation in the ASEE.
10. To maintain liaison and cooperation with the various divisions of the ASEE and other segments of the engineering profession in furthering mutual objectives;
11. To assist in studies and projects that relate to engineering education.

B.J. Whitworth joined ASEE in 1956. He has served as Section Rep., Gulf Southwest; member of Steering Com., Houston Chapter; and Chairman, CIC/RWI. Mr. Whitworth has been with Hughes Tool Company since 1949. His assignments have been related to engineering development of various company products. He has worked as Project Engineer; technical supervisor; Chief Engineer; and presently is Vice President, Product Reliability. Through much of the time with Hughes, he has been involved in recruiting and training technical personnel. Mr. Whitworth has served on industrial advisory boards for a number of educational programs. He is a member of Texas Society of Professional Engineers, American Society of Mechanical Engineers, and American Petroleum Institute. He earned his B.S. in Industrial Engineering in 1949 from Texas Tech University, and his M.S. in Mechanical Engineering in 1956 from Rice University.

1976-77 OFFICERS

CHAIRMAN

Walter R. Turkes
Associate Dean of Eng.
School of Engineering
323 Benedum Hall
University of Pittsburgh
Pittsburgh, Pa. 15261
412/624-5262

CHAIRMAN ELECT:

B. J. Witworth
Hughes Tool Co.
P. O. Box 2539
Houston, Texas 77001

SECRETARY-TREASURER

Harold E. Roush
RCA, Building 202
Cherry Hill
Camden, N. J. 08101

DIRECTORS

1976-77

William L. Atchley
Dean of Engineering
West Virginia University
Morgantown, W. Va. 26506
304/293-4821

Karl W. Doerr
Manager, University Rels.
Education Department
Westinghouse Electric Corop.
Ardmore Blvd. & Brinton Rd.
Pittsburgh, Pa. 15221
412/256-5674

Robert L. Heyborne
Dean, School of Eng.
University of Pacific
Stockton, Ca. 95204
209/946-2575

1976-78

Robert W. Ellis, Jr.
Dean, School of Tech.
Florida Internation U.
Tamiami Trail
Miami, Florida 33144
305/223-2300

H. L. Taylor
Inland Steel Company
East Chicago, In. 46312

William J. Verner
Assistant Dean
College of Engineering
Ohio State University
Columbus, Ohio 43210

1976-79

R. N. Mills
General Electric Company
Ossining, New York 10562

C. W. Morgan
University of Texas
at Austin
Austin, Texas 78712

P. C. Zanetti
Technovate, Inc.
Pompano Beach, Florida 33060

EX-OFFICIO DIRECTORS

Arthur F. Hartford, Jr.
Manager, Univ./Indus. Rels.
E. I. Du Pont deNemours & Co.
13526 Nemours Building
Wilmington, De. 19898
302/774-6238

Stephen R. Davis
Dean, School of Engineering
Lawrence Inst. of Technology
21000 West Ten Mile Road
Southfield, Mi. 48075
313/356-0200

1977 CIEC CHAIRMAN

George B. Coover
General Electric Co.
P. O. Box 3736
San Francisco, Ca. 94119

EDITORS - NEWSLETTER

Robert Bolton, Project Eng.
Advanced Product Engineering
General Motors Tech. Center
Warren, Mi. 48090
313/575-1422

Richard S. Maslowski
Chairman, Electrical Engineering Department
Lawrence Inst. of Tech.
21000 West Ten Mile Road
Southfield, Mi. 48075
313/356-0200

1977 ANNUAL MEETING

Harold W. Turner
Bechtel Corp.,
50 Beale Street
San Francisco, Ca. 94119

SECTION REPRESENTATIVES -- RELATIONS WITH INDUSTRY DIVISION

NEW ENGLAND

Dr. Edward A. C. Dobois
Polaroid Corporation
750 Main Street, 2G
Cambridge, Ma. 02139

MIDDLE ATLANTIC

Dr. George W. Bierley
Pennsylvania State University
Wilkes-Barre Campus
P. O. Box 1830
Wilkes Barre, Pa. 18708

NORTH CENTRAL

Charles H. Ebert, Jr.
Westinghouse Electric Corp.
Gateway Ctr., Westinghouse Bldg.
Pittsburgh, Pa. 15222
412/255-3800

NORTH MIDWEST

Larry Segar
IBM
Rochester, Mn. 55901

GULF SOUTHWEST

B. J. Witworth
Chief Engineer
Hughes Tool Co.
P. O. Box 2539
Houston, Texas 77001

ROCKY MOUNTAIN

Elmer Wyant, Manager
Technical Vitality
IBM
Department 340, Bldg. 001-2
P. O. Box 1900
Boulder, Co. 80302

PACIFIC SOUTHWEST (NORTH)

W. A. Goddard
IBM - Dept. 634, Bldg. 122
Monterey & Cottles Road
San Jose, Ca. 95193

ST. LAWRENCE

Deo R. Dobbins, Manager
Technical Placement
Eastman Kodak Company
343 State Street
Rochester, New York 14650
716/325-2000 ext. 52714

SOUTHEASTERN

James F. O'Brien, Jr.
Associate Director
Engineering Extension Service
Auburn University
Auburn, Al. 36830

ILLINOIS-INDIANA

Walter J. Williams, Sr.
Staff Engineer
Intl. Tel. & Tel. Co.
Aerospace Optical Division
Fort Wayne, Ind. 46803

MIDWEST

David Lillard, Personnel Administrator
Black & Veatch
1500 Meadow Lake Parkway
Kansas City, Mo. 64114
816/361-7000

PACIFIC NORTHWEST

Carl H. Hough, Manager
Professional Development
Boeing Company
P. O. Box 3707
Seattle, Wash. 98124

PACIFIC SOUTHWEST (SOUTH)

Richard T. Remy, Manager
Fellowship & Rotation
Hughes Aircraft Co./M-101
Culver City, Ca. 90230

RWI/CIEC COUNCIL/DIVISION COMMITTEES

NOMINATING COMMITTEE CHAIRMAN

A. F. Hartford
E. I. DuPont Nemours & Co.
Wilmington, Delaware 19898

AUDIT COMMITTEE CHAIRMAN

H. E. Roush
RCA
Camden, New Jersey 08101

INDUSTRIAL MEMBER LIAISON COMMITTEE CHAIRMAN

W. D. Cheek
General Motors Corporation
Detroit, Michigan

LONG-RANGE PLANNING AND PROGRAM CONTENT COMMITTEE CHAIRMAN

P. ~~V. Smith~~
Exxon Corporation
Florham Park, New Jersey

BY-LAWS AND CONSTITUTION COMMITTEE CHAIRMAN

W. J. Verner
Ohio State University
Columbus, Ohio

MEMBERSHIP COMMITTEE CHAIRMAN

G. A. Sold
Detroit Edison Electric Co.
Detroit, Michigan

AFFIRMATIVE ACTION (MINORITIES AND WOMEN) GUIDANCE PROJECT CHAIRMAN

I. B. Miller
University of Houston
Houston, Texas

LEGISLATIVE ACTION CHAIRMAN

B. L. Atchley
West Virginia University
Morgantown, West Virginia

PROGRAM CHAIRMEN

Annual Conference

H. W. Turner
Bechtel Corporation
San Francisco, California

CIEConference

G. B. Coover
General Electric Company,
San Francisco, Calofornia

A. F. Hartford
E. I. DuPont Nemours & Co.
Wilmington, Delaware

WOMAN'S ACTION GROUP CHAIRMAN

D. S. Frohreich
University of the Pacific
Skockton, California

REPRESENTATIVE TO MEMBERSHIP POLICY COMMITTEE

S. W. Anderson
Commonwealth Edison Company
Chicago, Illinois

EDITORS

R. A. Bolton
General Motors Corporation
Warren, Michigan

R. W. Maslowski
Lawrence Institute of Tech.
Southfield, Michigan

REPRESENTATIVE TO EDITORIAL REVIEW BOARD

R. S. Maslowski
Lawrence Institute of Tehcnology
Southfield, Michigan

EXECUTIVE COMMITTEE

W. R. Turkes
University of Pittsburgh
School of Engineering
323 Benedum Hall
Pittsburgh, Pa. 15261

H. E. Roush
RCA, Building 202
Cherry Hill
Camden, N. J. 08101

COUNCIL HISTORIAN

J. C. Reed
University of Florida (Emeritus)
Gainesville, Florida

REPRESENTATIVE TO GUIDANCE COMMITTEE

E. D. Rebucci
General Electric Company
Philadelphia, Pennsylvania

RESIDENCY PROGRAM CHAIRMEN

W. D. Cheek
General Motors Corporation
Detroit, Michigan

R. W. Ellis
Florida International University
Miami, Florida

SECTION RWI REPRESENTATIVE

G. C. Durkin
Eastman Kodak Company
Rochester, New York

B. J. Witworth
Chief Engineer
Hughes Tool Co.
P. O. Box 2539
Houston, Texas 77001

APPENDIX B
CONTINUING ENGINEERING STUDIES DIVISION

Raymond J. Page
Director, Continuing Engineering Education
General Motors Institute
Flint, Michigan

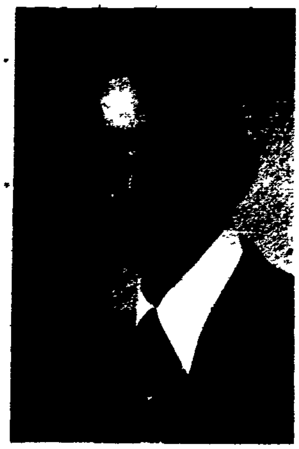
Since it's formation in 1965, the Continuing Engineering Studies Division has become a focal point for those who have been charged with the responsibility for maintaining the competence of individuals working in industry, education and government. The strong leadership and activity of the division has nurtured an active interchange of ideas, involvement and information transfer of benefit to personnel involved in developing continuing education programs for engineers and engineering managers.

Divisional activity can take many forms. One of these is the co-sponsorship of the College Industry Education Conference. At this year's conference, as a result of comments from participants in previous conferences, several workshops have been developed to allow each participant to explore selected topics in-depth. Such workshops should provide for even greater information exchange and idea stimulation. To enhance the valves of the division to the membership, additional professional seminars and workshops are being considered, not only at annual meetings and the CIEC, but also at geographical locations during the year. The division also contributes by providing a broad range of programs at the ASEE Annual Meeting.

A most significant activity of the CES Division is the special interest groups. Every member has the opportunity to participate in these groups which are organized around the specific topical interests of the members. Programs, such as fixed service television systems, career management, personalized individualized continuing engineering education programs, certification and registration of engineers, and packaged videotape producers/users are just a few of the special interest groups which have been formed. Members are encouraged to participate and will be welcomed into the groups. In addition, new groups are continually being developed as members find a commonality of interest and a desire to study and discuss specific areas of activity. In addition, the division has several standing committees which are directly involved in providing information to those who have managerial roles in continuing education. The publications committee has published a CES Directors Handbook, white papers on special topics, conference proceedings, a membership directory and has other publications in process.

The newsletter has been expanded considerably to provide articles of interest to the membership. Each issue now contains features which probe in-depth the problems facing those who are responsible for CES programs. Section representatives in each ASEE geographic section also circulate newsletters within their section providing "What's Happening" locally. These representatives also arrange programs on CES topics at the section meetings.

The CES Division is active and alive. You are cordially invited to join this group, participate in its activities and share in its exchange of concerns and knowledge. You will be welcomed!



Raymond J. Page received his BSME and MSIE degrees from Purdue University. His industrial employment has been with Sylvania Electric Company, National Cash Register Company and National Gypsum Company. He has taught at SUNY at Buffalo, Cornell University and General Motors Institute where he is currently Director of Continuing Engineering Education. In this position, he is responsible for providing technical programs to General Motors Units.

He has been active in professional society activities for several years. He was a member of the ASME Policy Board Education and served as the National Chairman of it's Continuing Education Committee. His ASME offices also include several at the section and regional level and a term as Vice President. He has been active in the CES Division of ASEE since it's formation and is currently Chairman.

CES DIVISION EXECUTIVE COMMITTEE

Chairman

Raymond J. Page, Director
Continuing Engineering Education
General Motors Institute
1700 West Third Avenue
Flint, Michigan 48502
(313) 766-9412

Chairman-Elect

Peter F. Chapman, Manager
Production Training Department
Shell Oil Company
P. O. Box 481
Houston, Texas 77001
(713) 667-5661

Secretary

Leroy W. Ledgerwood, Jr.
Production Technical Training Coordinator
EXXON Production Research Company
P. O. Box 2189
Houston, Texas 77001
(713) 965-4739

Treasurer

Lois B. Greenfield
Associate Professor
College of Engineering
University of Wisconsin
Madison, Wisconsin 53706
(608) 262-3507

Immediate Past Chairman

Joseph M. Biedenbach, Director
Continuing Education for Engineering
and the Health Sciences
College of Engineering
University of South Carolina
Columbia, South Carolina 29208
(803) 777-6693 or 777-4177

Director

Donald B. Miller
Manager of Human Resources
IBM - Central Products Division
5600 Cottle Road
San Jose, California 95193
(408) 256-6213
Term Expires 1978

Director

John P. Klus
Department of Engineering
University of Wisconsin-Extension
432 North Lake Street
Madison, Wisconsin 53706
(608) 262-2061
Term Expires 1978

Director

Charles J. Sener
Bell Systems Center for
Technical Education
Lisle, Illinois 60532
(312) 983-2010
Term Expires 1979

Director

Richard Wiegand
Director, Continuing Education
Georgia Institute of Technology
Atlanta, Georgia 30332
(404) 894-2400
Term Expires 1979

Director

Robert M. Anderson, Jr.
Engineering Coordinator for
Continuing Education
Electrical Engineering Building
Purdue University
West Lafayette, Indiana 47907
(317) 493-9201
Term Expires 1980

Director

Alfred H. Cassell
Assistant to Chief Mech. Engineer
Lawrence Livermore Lab, U. Calif.
Box 808 L 123
Livermore, California 94550
(415) 447-1100 X 8941
Term Expires 1980

CES DIVISION COMMITTEE CHAIRMAN

Long Range Planning Committee

Chester F. Brisley
Professor & Assoc. Chairman
Department of Engineering & Applied Sciences
University of Wisconsin-Extention
Milwaukee, Wisconsin 53203
(414) 224-4191

By-Law Committee

David K. Blythe
Associate Dean
College of Engineering
University of Kentucky
Lexington, KY 40506
(606) 258-5949

Membership Committee

Donald B. Miller
Manager of Human Resources
IBM-General Products Division
5600 Cottle Road
San Jose, CA 94193
(408) 256-6213

Honors and Award Committee

Morris E. Nicholson
Director, Continuing Education & Engineering Science
University of Minnesota
Minneapolis, Minnesota 55455
(612) 373-3132
Term Expires 1978

Nominating Committee

Joseph M. Biedenbach
Director, Continuing Education for Engineering
University of South Carolina
Columbia, SC 29208
(803) 777-6693

CES Newsletter Editor

Alfred H. Cassell
Asst. To Chief Mech. Engineer
Lawrence Livermore Lab. U. Cal.
Box 808 L. 123
Livermore, CA 94550
(415) 447-1100 X 8941

CES Newsletter Associate Editor

Thomas F. Talbot
School of Engineering
University of Alabama at Birmingham
University Station
Birmingham, Alabama 35294
(205) 934-4550 or 5406

Publications Committee

Stanley Greenwald
Director, Professional Development
American Society of Mechanical Engineers
345 E. 47th Street
New York, NY 10017
(212) 644-7782

Program Planning Committee

George J. Maler
Associate Dean, Engineering Administration
University of Colorado
Boulder, Colorado

1978 Annual Meeting
CES Division Program Committee

William H. Knight, Director
Engineering Extension
Washington State University
Pullman, Washington 99163
(509) 335-4677

1978 CIEC Meeting
CES Program Chairman

Charles J. Sener
Bell Systems Center for Technical Education
Lisle, Illinois 60532
(312) 983-2010

Joint CES/ERM RM Committee
On Effective Teaching Institutes

Lois Greenfield, Chairman
Room 20, T-24
College of Engineering
University of Wisconsin
Madison, Wisconsin 53706
(608) 262-3507

CES DIVISION SPECIAL INTEREST GROUP CHAIRMAN

Packaged Videotape Users/
Producers Group (OVU/PG)

Neal P. Jeffries
Manager of Education
Structural Dynamics Research Corp.
5729 Dragon Way
Cincinnati, Ohio 45227
(513) 272-1100

Special Interest Group on
Career Management SIGOCM

Donald B. Miller
Manager of Human Resources
IBM-General Products Division
5600 Cottle Road
San Jose, CA 95193
(408) 256-6213

Special Interest Group
International Continuing Education

John P. Klus
Department of Engineering
University of Wisconsin - Extension
432 North Lake Street
Madison, Wisconsin 45706
(608) 262-2061

Special Interest Group on
Registration & Certification
(SIGRAC)

James T. Cobb, Jr. (Chairman)
Dept. of Chemical & Petroleum Engrg.
1240 Benedum Engineering Hall
University of Pittsburgh
Pittsburgh, PA 15261
(412) 624-5286

Special Interest Group
on Professional Societies

Stanley Greenwald
Director, Professional Development
American Society of Mechanical
Engineers
345 E. 47th Street
New York, NY 10017
(212) 644-7782

Special Interest Group
University CE Directors

William W. Ellis
131 Squaw Run Road
Pittsburgh, PA 15238

Special Interest Group on
Personalized Continuing
Engineering Education

Dean E. Griffith (Chairman)
College of Engineering
Cockrel Hall 10.342
The University of Texas at Austin
Austin, TX 78712
(512) 471-3396

Special Interest Group in
Instructional Television,
Fixed Service

Morris E. Nicholson
Director, Continuing Education
& Engineering Service
University of Minnesota
Minneapolis, Minnesota 55455
(612) 373-3132

CES DIVISION COMMITTEE MEMBERS

CES Division Chairman's Council

Raymond J. Page (Chairman)
Peter F. Chapman
Joseph M. Biedenbach
Israel Katz
John Van Horn

Nominating Committee

Joseph M. Biedenbach (Chairman 77-78)
Robert M. Anderson, Jr.
Howard R. Shelton

By-Laws Committee

David K. Blythe (Chairman)
William H. Knight
John Van Horn
Iz Katz
Robert Anderson
Al Ackoff
Lois Greenfield

Honors and Awards Committee

Morris E. Nicholson, Jr. (Chairman 77-78)
David K. Blythe
George J. Maler
Monroe Kriegel
Joseph M. Biedenbach
Raymond J. Page
John Klus (Chairman 78-79)
Ad Hoc Members (Jay Gilbert, Eleanor Anderson, Thomas F. Talbot)

Joint CES-ERM Committee On Effective Teaching Institutes

Lois Greenfield
Dean E. Griffith
Joseph M. Biedenbach
Jim Stice

Program Planning

George J. Maler (Chairman)
William H. Knight
Charles J. Sener
Howard R. Shelton

CES DIVISION SECTION REPRESENTATIVES

NEW ENGLAND

Robert J. Hall
Director, Continuing Education
Worchester Polytechnic Institute
Worchester, Ma. 01609
(617) 753-1411

ST. LAWRENCE

Said E. Matar
Coordinator of Technology
Extension Studies
Ryerson Technical Institute
Toronto, Canada M5B1E8
(416) 595-5064

SOUTHEASTERN

James K. Johnson, Jr.
Director, Continuing Engineering
Education
116 Riggs Hall
Clemson University
Clemson, S. C. 29631
(803) 656-3308

ILLINOIS-INDIANA

Alan T. McDonald
Mechanical Engineering
Purdue University
West Lafayette, Ind. 47907
(317) 494-1835

PACIFIC NORTHWEST

Anthony L. Rigas
Continuing Engineering Education
College of Engineering
University of Idaho
Moscow, Id. 83843
(208) 885-6373

NORTH MIDWEST

Morris E. Dicholson, Jr.
Director, Continuing Education in
Engineering and Science
11 Mines Metallurgy
University of Minnesota
Minneapolis, Minn. 55455
(612) 373-3132

ROCKY MOUNTAIN

George J. Maler
Associate Dean
College of Engineering and
Applied Science
University of Colorado
Boulder, Col. 80302
(303) 492-7118 or 492-6471

MID WEST

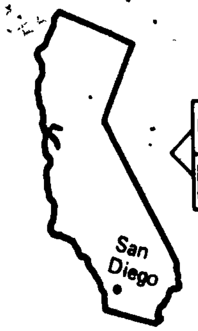
James M. Beauchamp, Jr.
130 Engineering Building
University of Missouri
Columbia, Missouri 65201
(314) 882-3001

GULF SOUTHWEST

Lee J. Phillips
Assistant Director for
Engineering Studies
Texas Engineering Extension Service
College Station, Texas 77843
(713) 845-7621

PACIFIC SOUTHWEST

Alfred H. Cassell
Asst. to Chief Mechanical
Engineer-CES Programs
Lawrence Livermore Laboratory
P. O. Box 808 L0123
Livermore, Cal. 94550
(415) 447-1100 Ext. 8551



APPENDIX C

COOPERATIVE EDUCATION DIVISION

Robert L. Heyborne
Dean, School of Engineering
University of the Pacific
Stockton, California

The Cooperative Education concept originated with Dean Herman Schneider in 1906 at the University of Cincinnati. His basic concept was that engineering students would be better trained and more productive and useful to themselves and their employers if regular alternating full time periods of on-the-job professional practice related to the educational objective were included as a fundamental part of the total educational effort. The formation of the Cooperative Education Division in 1929 gave official ASEE sanction for the Division to promote this concept and to serve the commonality of interests between business, industry, government, students and education.

H. P. Hammond, who was President of the American Society for Engineering Education in 1936-37 stated at the annual meeting at Cornell University in 1934 that "The most noteworthy single development in engineering education in this country since 1893 was the establishment of the cooperative system. Whatever the merits of the cooperative plan may be, and it has much to recommend it, it is certain that it has been the most single important innovation in engineering education during the life of this society."

Over the past forty-nine years the Cooperative Education Division has shared Schneider and Hammond's belief, and has worked diligently to bring students, industrialists and engineering educators together in the common cause of producing a superior form of education for students. In the early 1970's the Division developed standards of practice and guidelines for accreditation of Co-op programs that were officially adopted by the Engineers Council for Professional Development and are now used by ECPD examination teams when they visit a co-op school. The Division has provided leadership for the establishment of new programs, for evaluating student work performance, for academic credit, for coordinator training, and many other functions that contribute to better education through stronger and more effective cooperative programs.

It is clear that cooperative education is a three party partnership of educational effort. The student is the principal being guided in his professional development by his college and his employer. The student receives a richer education and graduates with maturity and experience unmatched by the usual four-year graduate. The employer also realizes many advantages from participation including the opportunity to direct a student through a variety of experiences to test and to prove the worth of the student as an employee. Studies have shown that co-op students as permanent employees after graduation are more productive and advance more rapidly. If you are an employer and are not participating in co-op we urge you to contact one of the Division Officers (many of whom are employers) and learn more about the program and what it can do for you.

A highly significant development concerning cooperative education took place during the past year and it is very important that all employers and others who are operating or participating in cooperative programs be aware of this development. The explanation necessitates another brief retreat into history. Members of the Cooperative Division provided the leadership and were mainly responsible for the successful formation in 1963 of a new organization to be known as the Cooperative Education Association (CEA). This was in response to and for the benefit of non-technical colleagues who, although they were welcome and active in CED-ASEE found difficulty in seeing the need to join an engineering society. The objective in forming CEA was to establish an organization that would represent the interests and promote the expansion of the cooperative education concept into other academic disciplines. From 1963 until 1977 the two organizations worked in harmony and common effort of purpose. The two groups jointly sponsored an annual meeting each year, and through joint committees complemented one another in the approach to problems and issues having the common denominator of cooperative education. Coordination was through the Joint Council for Cooperative Education comprised of the Executive Boards of both CEA and CED, and the Joint Board of Control.

By the early 1970's significant disenchantment had developed among the CEA membership. Some felt that CED was dominating the activities of CEA through positions of elected leadership in CEA and through the Joint Council, and some felt that the classic definition of co-op as defined and utilized by CED was too narrow and confining. Gradually the definition of co-op as interpreted by CEA was broadened to include virtually any kind of program linking work and study...even to those persons holding full time jobs who take an occasional night class in a totally unrelated field of study. The Cooperative Education Division does not recognize this as co-op and feels that many who are counted as co-op students today are falsely labeled. While the Division recognizes the value of any work experience even though it may not be related to the students educational objective, this is not cooperative education. CED feels it is imperative that a direct and carefully supervised relationship between the work experience and the students academic objective must be maintained. This is the essence of cooperative education and this is what CED stands for.

In October 1976 officers of the CEA served notice to the CED that they wished to terminate the relationship. At the next Board meeting of CED, in January 1977, the Division officers voted unanimously to accept the CEA recommendation for dissolution of the CEA-CED Joint Council, the CEA-CED Joint Board of Control, and all jointly held funds effective June 30, 1977.

Since the Cooperative Education Association chose to dissolve this relationship it is vitally important for all engineers and engineering technologists, both employers and educators, to realize that the professional organization that serves their interests is the Cooperative Education Division of the American Society for Engineering Education. It is not the Cooperative Education Association. Recent conversations with people who are involved in engineering co-op programs has indicated a serious lack of understanding about the Division and its former relationship with CEA. For example, one engineer stated that because he was a member of CEA he assumed that he was therefore automatically a member of the Cooperative Education Division. Obviously this is not the case and emphasizes the need for accurate information.

Membership in the Cooperative Education Division is obtained only by joining ASEE...the American Society for Engineering Education. Upon payment of ASEE dues ($27.50/year) you are asked to check a "special interest" card choosing three principle areas of interest, e.g. Relations With Industry Division, Continuing Engineering Studies Division, Cooperative Education Division, Technical College Council, International Division, Engineering Technology Division, etc. When you check number 16 (Cooperative Education) you automatically become a member of CED and there are no further dues. Your name will appear on the ASEE-CED roster and you will receive all information concerning cooperative education including the Newsbrief publications, notification of meetings and other information that will keep you involved in the activity of the Division and the promotion of Cooperative Education on a broad national basis.

Individuals who are not engineering-technical by training, but who have a strong interest in cooperative education programs are most welcome in ASEE and in the Cooperative Education Division. Such persons who wish to join should follow the procedure outlined above. Membership application forms are available from Division officers or directly from ASEE Headquarters, One DuPont Circle, Washington, D.C. 20036. Be sure to check number 16 on the special interest card.

If you have questions about CED membership, conferences, programs or if you have suggestions about how to make the Division even more effective in serving the needs of business, industry, government and students, please let us know.

CED OFFICER ROSTER

Robert L. Heyborne (Chairman)
Dean, School of Engineering
University of the Pacific
3601 Pacific Avenue
Stockton, California 95211
Phone: 209/946-2575

Willard "Dave" Bostwick (Chairman-Elect)
Assistant Dean, School of Engineering & Technology at Indianapolis
Purdue University
799 W. Michigan Street
Indianapolis, Indiana 46202
Phone: 317/264-8865

Tarry G. Slusher (Past Chairman)
Iraq Directorate
CE Lummus Company
1515 Broad Street
Bloomfield, New Jersey 07003
Phone: 201/893-3537

E. J. Lanik (Secretary-Treasurer)
Coordinator of Cooperative Education
University of Houston
Houston, Texas 77004
Phone: 713/749-4479

Anthony L. "Tony" Rigas
(ASEE-CIEC/CED Conference Chairman, 1978)
School of Engineering
University of Idaho
Moscow, Idaho 83844
Phone: 208/885-6373

George K. Howe
(ASEE-CED Conference Chairman, 1978)
Department of Cooperative Education
Northeastern University
360 Huntington Avenue
Boston, Massachusetts 02115
Phone: 617/437-3458

Tom Padgett
(ASEE-CIEC/CED Conference Chairman, 1979)
Associate Director, Cooperative Education
Auburn University
Auburn, Alabama 36830
Phone: 205/826-5410

Alvah K. Borman (Division Editor)
Dean of Graduate Placement Services
Northeastern University
360 Huntington Avenue
Boston, Massachusetts 02115
Phone: 617/437-2430

EXECUTIVE BOARD

Industry

R. Wayne Bogener (term expires 1978)
Professional & Technical Employment
Caterpillar Tractor Company
Peoria, Illinois 61629
Phone: 309/675-4268

Richard Rice (term expires 1979)
Manager, College Relations
Diamond Shamrock Corporation
1100 Superior Avenue
Cleveland, Ohio 44114
Phone: 216/694-5843

George H. Upchurch (term expires 1980)
Cooperative Education Administrator
Lawrence Livermore Laboratory
P. O. Box 808
Livermore, CA 94550
Phone: 415/447-1100, Ext. 7371

Government

Charles Raduazo (term expires 1979)
Cooperative Education
National Security Agency
Ft. George G. Meade, Maryland 20755
Phone: 301/796-6161

John Leveen (term expires 1980)
Training Supervisor
NASA Ames Research Center
Mail Stop 241-3
Moffett Field, CA 94035
Phone: 415/965-5624

Frank D. Christhilf (term expires 1978)
Director of Cooperative Education
Personnel Division AD 422
National Oceanic & Atmospheric Admin.
6001 Executive Blvd.
Rockville, Maryland 20852
Phone: 301/443-8247

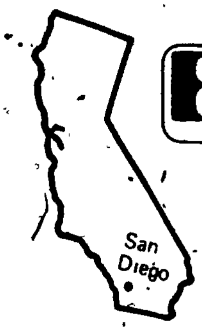
Schools

Elizabeth "Betsy" Corlew (term expires 1978)
Coordinator of Cooperative Education
University of Tennessee
Knoxville, Tennessee 37916
Phone: 615/974-5323

William H. Hitch (term expires 1979)
Associate Director of Cooperative Education
Georgia Institute of Technology
Atlanta, Georgia 30332
Phone: 404/894-3320

Roger E. Hedgepeth (term expires 1980)
(CEA/CED Conference Chairman, April 1977)
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24060
Phone: 703/951-6491

Robert L. Heyborne is Dean and Professor of Electrical Engineering at University of the Pacific in Stockton, CA. He holds the Ph.D. in Electrical Engineering from Stanford University and has more than ten years of industrial experience in addition to his teaching. Dr. Heyborne's American Society for Engineering Education Activities include service as Chairman of the Pacific Southwest Section, Chairman of the Rocky Mountain Section, three years as a Board member of the RWI Division, and five years as a Board member of the CED Division. He is a member of the ASEE Accreditation Processes Committee. Dr. Heyborne is a past chairman of the California Engineering Liaison Committee, a member of the IEEE, American Geophysical Union, International Scientific Radio Union, Sigma Xi, Sigma Tau, and Phi Kappa Phi. He has received numerous awards for excellence in engineering teaching, and in 1972 was named the "Engineer of the Year" by the Joint Council of the Professional Engineering Societies of the San Joaquin Valley.



APPENDIX D
ENGINEERING TECHNOLOGY DIVISION

Kenneth C. Briegel
Research Supervisor
Honeywell Incorporated
Minneapolis, Minnesota

The Engineering Technology Division of the American Society of Engineering Education prides itself in the promotion and development of Engineering Technology Education. Its members consist of those who are interested in the objectives of the division.

The objectives consist of a Chairman, two Vice Chairman, Secretary, Treasurer, and two Members at Large. Since the Engineering Technology Division was established, its membership has increased. Members are finding that the Engineering Technology Division has actively participated in activities which promotes Technical Education.

During the past several years with the increased membership, the Division has become one of the strongest supporting arms of ASEE. Members are taking an active part in the various committees and activities. The support given to the ASEE annual conference in Grand Forks, North Dakota, June 1977, was outstanding.

The participation in the various sessions dealing with Engineering Technical activities showed that more and more interest is being generated in this Division. The program supported by ETD was well received.

The Newsletter published biannually has been increasingly important to disseminate information to the membership.

Kenneth C. Briegel, Past Chairman of the Board of the American Society of Certified Engineering Technicians. Served as National President for two years. Graduate of University of Minnesota. Honeywell Research Supervisor, Technicians Laboratory. One of the first four Senior Engineering Technicians to serve on the Institute for the Certification of Engineering Technicians Board of Trustees. He holds ICET Certificate #2. Served two terms as Chairman of the ICET Board. U.S. Navy technicial advisor in WW II and Korean War. Presently Chairman of Region VI of the Engineering Technology Committee for ECPD, Chairman of the Engineering Technology Division, American Society for Engineering Education (ASEE). A member of the Board of Trustees at Northwestern Electronics Institute and is also active in civic and church activities.

OFFICERS - ENGINEERING TECHNOLOGY DIVISION--1977-1978 (As of July 1, 1977)

CHAIRMAN

Kenneth C. Briegel
Research Supervisor,
Honeywell Incorporated
2600 Ridgeway Parkway, N.E.
Minneapolis, Minnesota 55413
(612) 378-5489

VICE-CHAIRMAN & PROGRAM CHAIRMAN

Isaac A. Morgulis
Associate Dean of Technology
Ryerson Polytechnical Institute
50 Gould Street
Toronto, Ontario
Canada M5B 1E8
(416)595-5134

VICE-CHAIRMAN & NEWSLETTER EDITOR

Frank A. Gourley, Jr.
Asst. Director, Engineering Technologies
Department of Community Colleges
Education Building
Raleigh, North Carolina 27611
(919) 733-7946

SECRETARY

James P. Todd
Chmn., Engineering Technology Dept.
California State Polytechnic University
3801 West Temple Avenue
Pomona, California
(714)598-4322

TREASURER

Amogene F. DeVaney
Prof. of Engr. and Math
Amarillo College
Amarillo, Texas 79178
(806)376-5111

MEMBERS-AT-LARGE

George B. Coover
General Electric Company
55 Hawthorne Street
San Francisco, California 94105

Jon Grove
Society of Manufacturing Engineers
20501 Ford Road
Dearborn, Michigan 48128

APPENDIX E

INTERNATIONAL DIVISION

Vladimir Yackovlev
Chairman, International Division
Central University
Caracas, Venezuela

The International Division of ASEE was established by the Board of Directors as an answer to a need felt within the Society to provide a forum for the exchange of information and sharing of common interests of these members of the Society who had an interest in the international dimension of engineering education. At the same time, the fast changing conditions of todays world have made it quite apparent that ASEE does have a role to play on the international level. Being the oldest, largest and most respected society in the field of technological education it is looked upon by other organizations, and by individuals active in the field of engineering education, as the logical place to get information and resources. This is true both within the United States as well as world-wide.

The International Division provides this needed forum to discuss the international dimensions of engineering education. To this end, the Division has been responsible for the organization of such events as the World Congress on Engineering Education, held at Etes Park in 1975, as well as other Mid-winter meetings which examined such topics as Engineering Education in China; the international implications of the Energy Crises, etc. Also, the Division serves as a resource to the Society, as well as to other organizations, such as governmental departments or non-governmental organizations. To provide expertise in the international dimension of engineering education. As many such occasions, members of the International Division have served on assignments overseas, on International and Regional Committees and Working Groups and serve as liason members with other organizations.

Vladimir Yackovlev, who is the Chairman of the International Division of ASEE, is a Civil Engineer, educated in Venezuela and the United States. After graduating from the Central University of Venezuela, he came to the United States where he got his M.Sc. degree from the University of Illinois. He returned to his country and began working at his university as an instructor. After getting some experience there, he came once more to the U.S., where he obtained his Ph.D. degree at the same university. Very early in his career Dr. Yackovlev became interested in engineering education and it is in this field where he has become known internationally. After some 40 publications in this field and participating in numerous meetings on engineering education both in his personel capacity as an expert in this field, as well as a representative of his country, he is an active spokesman for engineering education in Latin America. Aside from his duties as Chairman of the International Division of ASEE, Dr. Yackovlev is a Member of the UPADI Committee on Engineering Education on the Panamerican level; a member of the Committee on Education and Training of Engineers of the World Federation of Engineering Organizations and a member of the International Working Group on Engineering Curriculum Design of UNESCO. In his own country - Venezuela - he is the Director for International Affairs of the Venezuelan Society for Engineering Education. He has held various academic positions at his university, being at the present time the Executive Secretary of the Venezuelan Fund for Research and Personel Development for the Petroleum and Petrochemical Industries.

APPENDIX F

AUTHOR INDEX
SESSION CHAIRMAN INDEX
ADDRESS LIST
1978
COLLEGE INDUSTRY EDUCATION CONFERENCE
SAN DIEGO, CALIFORNIA

Dr. Fred Abitia
Director/Coordinator
Cooperative Education Program
Calif. Poly. State University
San Luis Obispo, CA 93407
(805) 546-2645

Maurice L. Albertson
C.E. Department
Colorado State Univ.
Fort Collins, CO 80521
(303) 491-5753

John D. Alden
Director, Manpower Activities
Engineers Joint Council
New York, New York 10017

John W. Anderson
Corp. Vice President
Honeywell Inc.
Minneapolis, MN 55408
(612) 870-6311

Ronald H. Anderson
Instruction Technologist
Bell Systems Center for
Technical Education
6200 Rte. 53
Lisle, IL 60532
(312) 983-2035

William Atchley
Dean of Engineering
West Virginia Univ.
Morgantown, WV 26506
(304) 293-4821

Efrain E. Barberii
Manager, Western Region
INAPET
Caracas, Venezuela

Merton R. Barry
Professor and Director
International Engr'g. Programs
The Univ. of Wisconson
Madison, WI 53706
(608) 263-2191

Cliff S. Barton
Prof. and Assist. to Dean
College of Engineering Sciences
and Technology
Brigham Young University
Provo, Utah 84602
(801) 374-1211 x4326

Joseph M. Biedenbach
Director of CE for Engineering
College of Engineering
University of South Carolina
Columbia, S.C. 29208
(803) 777-6693

David Blackburn
Reader in Engineering Science
Open University of the United Kingdom
North American Office
New York, New York

Alvah K. Borman, Dean
Graduate Placement Services
Northeastern University
Boston, MA 02115
(617) 437-2430

Willard D. Bostwick
Asst. Dean of Engineering
Purdue Univ. at Indianapolis
799 W. Michigan Street
Indianapolis, IN 46202
(317) 264-8865

Kenneth C. Briegel
Supervisor
Research Technicians Lab
Honeywell Inc.
Minneapolis, MN 55413
(612) 378-5489

Ernest R. Brown, Jr.
Manager, Exempt Personnel Resources
Union Carbide Corporation
New York, NY 10017
(212) 551-4581

Frank S. Burroughs, Jr.
Vice President
C.F. Braun & Co.
Alhambra, CA 91802
(213) 570-3212

Francis V. Cannon, Jr.
Dean of Engineering
Milwaukee School of Engr'g.
Milwaukee, WI 53201
(414) 272-8720 x211

Dr. Stephen R. Cheshier
Prof. and Head of E.E. Tech. Dept.
Purdue University
West Lafayette, IN 47907
(317) 494-8451

Walter O. Carlson
Exec. Director/Dean
Southern Technical Institute
Marietta, GA 30060
(404) 424-7230

Dr. Paul F. Chenea
Vice President
General Motors Corporation
GM Research Laboratories
Warren, MI 48090
(313) 575-2747

Santiago E. Chuck
Div. of Engr'g. & Architecture
Instituto Tec. de Monterrey
Monterrey, N.L. Mexico
58-69-68

Edward M. Conklin, Jr.
Manager of Personnel & Organiza.
Operations Staff
Ford Motor Co.
American Drive
Dearborn, MI
(313) 322-1790

George B. Coover
Representative-Western Region
Professional Development Opera.
General Electric Companu
San Francisco, CA 94119
(415) 546-4306

George T. Craig
Chairman, Dept. of M.E.
San Diego State Univ.
San Diego, CA 92182
(714) 286-6061

Hershner Cross
Sr. Vice President
Corporate Admin. Staff
General Electric Company
Fairfield, CT 06431
(203) 373-2229

Ralph E. Davey
Dept. Head - Aviation
Wentworth Institute of Tech.
Boston, MA 02115
(617) 442-9010

Ann L. Decker, CPS
Sec., Engr'g. Tech. Dept.
Calif. State Poly. Univ.
Pomona, CA 91768
(714) 598-4322

Frank E. Demaree
Asst. V.P.-Engr'g.
Technical Planning
Illinois Bell Telephone Co.
Chicago, IL 60606
(312) 727-4244

Robert Dietch
Manager of Engr'g. Design
Southern Calif. Edison Co.
Rosemead, CA 91770
(213) 572-3261

Dr. Paul Doigan
Manager-Entry Level Recruiting
General Electric Company
Schenectady, N.Y. 12345
(518) 385-4003

Charles S. Elliott
Coordinator of Engr'g. Ext. Programs
Wayne State University
Detroit, MI 48202
(313) 577-3812

William W. Ellis
Director of Professional Educ.
School of Engr'g./Appl. Science
Princeton, N.J. 08540
(609) 452-6633 or 5101

Lyman L. Francis
Prof. of Engr'g. Technology
University of Missouri
Rolla, MO 65401
(314) 341-4606

Donna S. Frohreich
Assistant Professor
School of Engineering
University of the Pacific
Stockton, CA 95211
(209) 946-2151

Jay Gilbert
Associate Professor
Empire State College
Suffern, NY 10901
(914) 356-6406

Dr. Peter C. Goldmark
Pres. & Dir. of Research
Goldmark Communications Corp.
Stamford, CT 06904
(203) 327-7270

Lawrence P. Grayson
National Instit. of Educ.
Washington, D.C. 20208
(202) 254-6050

Stanley M. Greenwald, P.E.
Executive Secretary
State Board for Engineering
& Land Surveying
N.Y. State Educ. Dept.
99 Washington Avenue
Albany, NY 12234

Dean E. Griffith
Alumni Visiting Prof. of Engr'g.
Clemson University
Clemson, SC 29631
(803) 656-3375

Robert "Buck" L. Grigsby, Jr.
President
Midlands Technical College
Columbia, S.C. 29250
(803) 796-1266

John V. Hamme
Assoc. Prof. Ceramic Engr'g.
& Dir., Co-op Engr'g. Educ.
N.C. State University
Raleigh, NC 27607
(919) 737-2300

Arthur F. Hartford, Jr.
Manager, Univ. & Indus. Relations
Du Pont Company
Wilmington, DE 19898
(302) 774-6238

Martha Henegar
Director of Public Relations
Nashville State Tech. Institute
Nashville, TN 37209
(615) 741-1222

Frank R. Henry
Employment Manager
Sundstrand Corporation
Rockford, IL 61101
(815) 226-6265

John J. Herald
Manager, Engineering Training
Westinghouse Educ. Dept.
Westinghouse Electric Corp.
Pittsburgh, PA 15221
(412) 256-5696

Robert L. Heyborne
Dean, School of Engineering
University of the Pacific
Stockton, CA 95211
(209) 946-2575

Larry A. Hill
Director, Cooperative Educ.
University of the Pacific
School of Engineering
Stockton, CA 95211
(209) 946-2151

Joseph C. Hogan
Dean, College of Engineering
University of Notre Dame
Notre Dame, IN 46556
(219) 283-1125

Robert H. Hollister
Develop. Engr'g. Manager
Westinghouse Electric Corp.
South Boston, VA 24592
(804) 575-7971

Carl P. Houston
Associate Dean
College of Technology
University of Houston
Houston, TX 77004
(713) 749-1341

Neal P. Jeffries
Director of Education
Center for Mfg. Technology
Cincinnati, OH 45227
(513) 272-1100

Martha J. Johnson, Ed.D.
Director of Cooperative Educ.
VPISU
Blacksburg, VA 24601
(703) 951-6491

Richard A. Johnson
Coord. of Special Projects
Georgia Power Company
Atlanta, GA 30303
(404) 522-6060 x2079

William F. King
Director of Lincoln College
Northeastern University
Boston, MA 02115
(617) 437-2500

Robert W. King
Dir. of Corporate Development
Union Carbide Corporation
New York, NY 10017
(212) 551-6207

Zeno Klinker
Comedy Writer
Hollywood, California

John P. Klus
Chairman, Dept. of Engr'g. &
Applied Science
University of Wisconsin-Ext.
Madison, WI 53706
(608) 262-2061

Otis E. Lancaster
Chief, Section of Math & Stat
Assoc. Dean & Westinghouse
Prof. Emeritus
The Pennsylvania State Univ.
University Park, PA 16802

Dr. Howard Lawrence
Dean of Instruction
State Tech. Institute
Memphis, TN 38134
(901) 388-1200

John D. Leer
Tech. Programs/Col. Relations
Radio Corporation of America
Cherry Hill, NJ 08101
(609)963-8000

John M. Lester
Department Chairman
Dept. of Electrical Engr'g.
State Univ. of NYA&T College
Farmingdale, N.Y. 11735
(516) 420-2084

Donald B. Miller
Program Mgr. Human Resources
IBM General Products Division
San Jose, CA 95193
(408) 256-6213

Mrs. June Q. Moore
Assistant ~~Coordinator~~
Cooperative Engr'g. Program
Univ. of Tennessee
Knoxville, TN 37916
(615) 974-5323

Isaac A. Morgulis
Assoc. Dean of Technology
Ryerson Poly. Institute
Toronto, Ontario
CANADA M5B 1E8
(416) 595-5134

Morris E. Nicholson
Director, Continuing Education
in Engr'g. and Science
University of Minnesota
Minneapolis, MN 55455
(612) 373-3132

Margaret Norquay
Director, Open College/Ryerson
Open College/Ryerson
Ryerson Poly. Institute
297 Victoria Street
Toronto, Ontario
CANADA M5B 1W1
(416) 595-5273

Russell R. O'Neill
Dean and Professor
School of Engr'g. & Appl. Science
University of California
Los Angeles, CA 90024
(213) 825-2977

Thomas V. O'Reilly
Director ~~of Salary~~ Admin.
& Recruiting
Abex Corporation
New York, NY 10036
(212) 560-3265

Mary Diederich Ott
Research Associate
College of Engineering
Cornell University
Ithaca, NY 14853
(607) 256-7414

William T. (Tom) Padgett
Assoc. Director Cooperative Educ.
Auburn University
Auburn, Alabama 36830
(205) 826-5410

Raymond J. Page
Director, C.E. Education
General Motors Institute
Flint, Michigan 48502
(313) 766-9412

Dashamir M. Petrela
Division Chairman
Division of Engineering
State Univ. of NYA&T College
Farmingdale, NY 11735
(516) 420-2084

Geoffrey Peters
Professor
Open University
Milton Keynes, England
0908-74066

Heidi S. Pivnick
Student
Worcester Poly. Institute
Worcester, MA 01609
(617) 798-0331)

Samuel L. Pritchett
Professor and Head
Dept. of I.E. Technology
Purdue University
West Lafayette, IN 47907
(317) 494-8452

Winston D. Purvine
President Emeritus
Oregon Institute of Tech.
Klamath Falls, OR 97601
(403) 882-6321

Marilyn Randolph
Personnel Manager
Pacific Telephone
500 E. Main
Alhambra, CA 91423
(213) 576-6455

Gerald A. Rath
Director and Assoc. Prof.
Engineering Technology
Wichita State University
Wichita, KA 67208

(316) 689-3425

David R. Reyes-Guerra
Executive Director
Engineers' Council for Professional
Development
New York, N.Y. 10017
(212) 644-7684

Richard S. Rice
Manager od College Relations
Diamond Shamrock Corp.
Cleveland, OH 44114
(216) 694-5843

Anthony L. Rigas
Director, Cooperative Education
University of Idaho
Moscow, ID 83843
(208) 885-6373

Kerry Robertson
Student
School of Engineering
University of the Pacific
Stockton, CA 95211
(209) 946-2151

James L. Rogers
Director
Instructional Television Network
Case Western Reserve University
Cleveland, OH 44106
(216) 368-2034

Harold E. Roush
Director, College Relations
RCA Corporation
Bldg. 202-2
Cherry Hill, NJ 08034
(609) 779-6391

Charles J. Sener
Director, Education and Training
Bell System Center for Tech. Educ.
6200 Route 53
Lisle, IL 60532
(312) 983-2010

Dr. B. J. Shell
President
Northrop University
Inglewood, CA 90306
(213) 776-3410

Howard R. Shelton
Sandia Laboratories
Albuquerque, NM 87115
(505) 264-7361

William W. Sisson
Director of Placement and
Corporate Relations
Rose-Hulman Institute of Tech.
Terre Haute, IN 47803
877-1511

Kim L. Smart
Training Supervisor
Bell System Center for Tech. Educ.

Lisle, IL 60532
(312) 983-2521

William R. Smith
Director of Cooperative
Educ. & Placement
Illinois Institute of Tech.
Chicago, IL 60616
(312) 567-3637

Joseph M. Sharponis, C.E.T.
Director of Education Services
National Society of Profes. Engineers
Washington, D.C.

George A. Sold
Employment Director
Detroit Edison Company
Detroit, MI 48226
237-48226

Eugene G. Stone
President
American International Open Univ.
7710 Carondelet
St. Louis, MI 63105
(314) 727-6100

Mr. Raynold A. Svenson
Dean - Planning, Methods & Results
Bell System Center for Tech. Educ.
6200 Route 53,
Lisle, IL 60532
(312) 983-2370

Thomas F. Talbot
Prof & Dir.
Continuing Engineering Education
University of Alabama
Birmingham, Alabama 35294

Bill Thornton
Co-op Coordinator
College Relations & Placement
Milliken & Co.
P. O. Box 1926
Spartanburg, SC 29301
(803) 573-2808

Robert C. Thornton
Assistant Dean & Chairman
Engineering Technology
Northrop University
Inglewood, CA 90306
641-3470

James P. Todd
Chairman
Engineering Tech. Dept.
Calif. State Poly. Univ.
Pomona, CA 91768
(714) 598-4322

Harris T. Travis
Associate Professor
Purdue University
West Lafayette, IN 47907
493-8410

Dr. Francisco A. Trevino
Vice President of Monterrey Campus
Monterrey Institute of Tech.,
Monterrey, Mexico
582626

Walter R. Turkes
Associate Dean
School of Engineering
University of Pittsburgh
Pittsburgh, PA 15261
(412) 624-5262

Richard J. Ungrodt
V.P. for Academic Affairs
Milwaukee School of Engineering
Milwaukee, WI 53201
(414) 272-8720

John R. Van Horn
Assistant Director
Corporate Tech. Educ. Planning
Westinghouse Electric Corp.
Pittsburgh, PA 15222
(412) 255-3918

Anise Whiteman
Coordinator, Women in Science Programs
Mills College
Department of Mathematics & Comp. Sci.
Oakland, CA 94613
632-2700 x309

B. J. Whitworth
Vice President
Product Reliability
Hughes Tool Company
Houston, TX 77001
(713) 924-2600

Ronald J. Young
Provost
Wentworth Institute
Boston, MA

Vladimir Yackovlev
Chairman
International Division
Central University
Caracas 105, Venezuela

ANNOUNCING
AN INTERNATIONAL CONFERENCE ON CONTINUING ENGINEERING EDUCATION
APRIL 25—27, 1979
UNIVERSITY OF MEXICO
MEXICO CITY

The Continuing Engineering Studies and International Divisions of the American Society for Engineering Education, along with the University of Mexico and UNESCO, are sponsoring an International Conference on Continuing Education for the professions. The conference will be held in Mexico City, April 25-27, 1979. MARK YOUR CALENDAR!

WHO SHOULD ATTEND?

The conference is designed for continuing education directors in business, industry government installations, and universities who are interested in developing, promoting and conducting continuing education programs. It will be of particular interest to those people working with engineers and scientists. Those who work in technician education and other professional areas would also find the topics of interest.

SPEAKERS

Presentations will be made by people actively working in the field from all parts of the world. In addition to several invited papers, the organizing committee will consider and is responsive to anyone who wishes to present a paper at the conference. Please submit a 300 word abstract to Professor John Klus, University of Wisconsin, 432 North Lake Street, Madison, Wisconsin 53706, U.S.A.

TOPICS

The topics to be discussed include needs analysis, adult learning, marketing programs, participant motivation, program costing, unique programs around the world, etc. Ample time will be given for discussion of each paper presented. In addition, one day will be spent in small groups discussing topics of individual interest with your professional colleagues.

PROGRAM FORMAT

The program has been designed to allow for formal presentations, individual workshops on special topics, special interest groups discussion, and social events. The case studies that will be presented will be structured so that comparisons can be made within the workshops between the various programs.

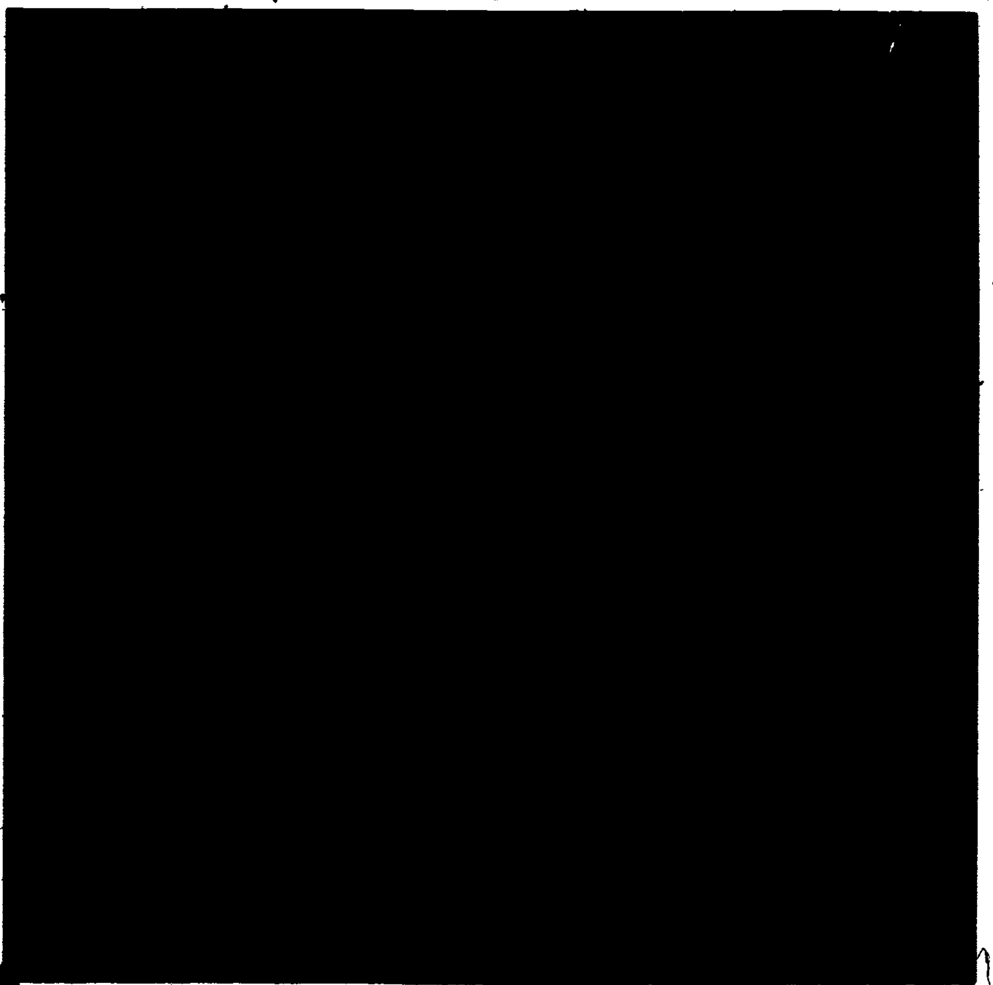
PARTICIPATING ORGANIZATIONS IN THE CONFERENCE

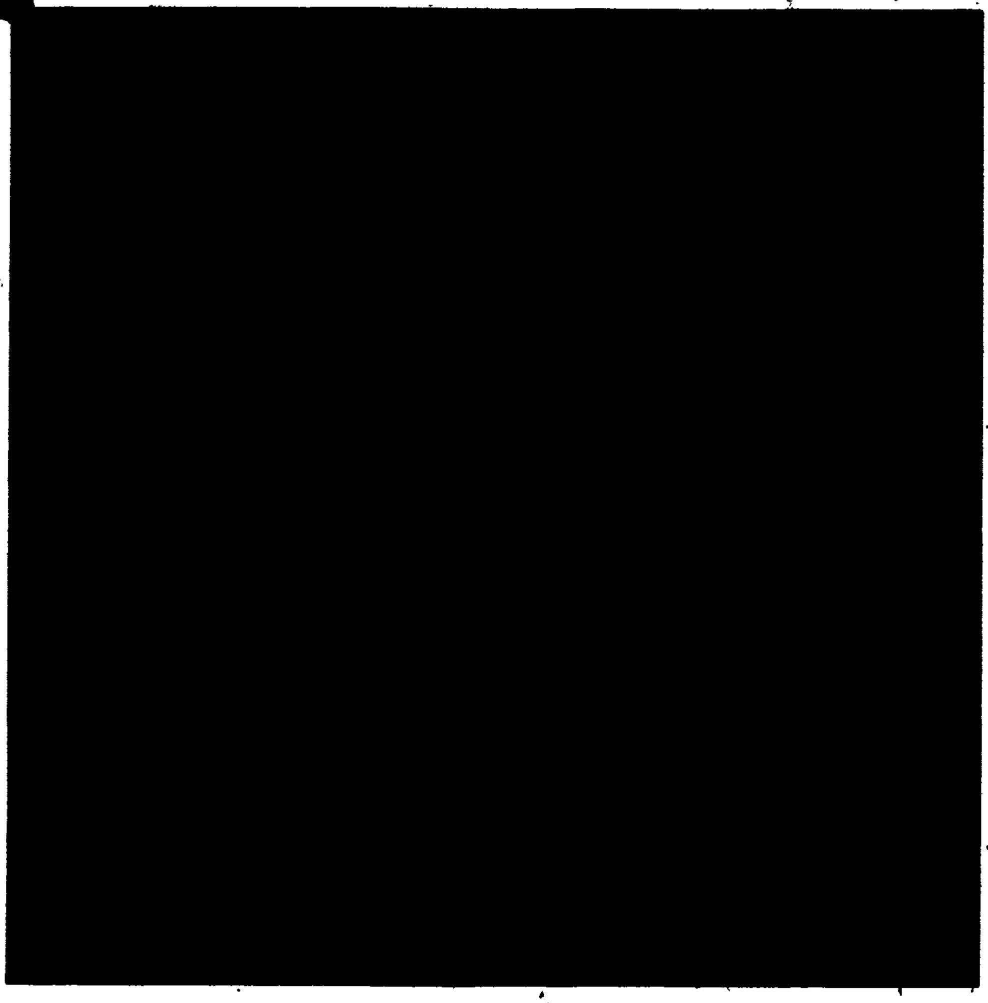
The following organizations are participating in the conference:

UNESCO
International Division/ASEE
Continuing Professional Development Division/ASEE
University of Mexico
UPADI
UPAHO

PROCEEDINGS

Proceedings for the conference will be pre-published in English for the participants. They will be made available after the conference from the American Society for Engineering Education.





About The Photos

The photographs on this cover are of four 12'2" by 12'6" murals entitled "The History of Labor in America." Painted by Jack Beal, with the help of his artist-wife and two assistants, the murals were installed in 1977 in the new Department of Labor Building in Washington, D.C. They are the first paintings commissioned for a government building since the WPA was discontinued in 1939

The murals depict the dynamism and evolution of labor in America, yet contain an implicit social commentary. "In the first painting, 'Colonization,' we are shown the young colonists of the 17th century establishing themselves in the coastal wilderness. In the second, 'Settlement,' the scene shifts to building a permanent dwelling in the 18th century, but the scene remains pastoral and romantic. 'Industry,' the third panel, focuses on the 19th century factory, the machine and child labor, and gives us our first look at the prosperous capitalist and at the industrial spoliation of the natural environment. The pastoral idyll is over. 'Technology,' representing the 20th century, enlarges the labor theme to include scientists and technicians, electronics and the hardware of the computer age. The figures are multiracial, and the theme of restoring the environment through scientific means sounds a note of quiet hope." — from Hilton Kramer, *The New York* January 7, 1977.