Associate Degree ChE Technology Programs

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Programs that lead to an associate degree in Chemical Engineering Technology have developed predominantly since World War II. A major factor in the establishment of most programs was the report of the President's Commission on Higher Education and Manpower Needs For The Post-World War II Period. This report was released in 1944-45.

The findings of the Commission led to the recommendation that two-year post-high school educational institutions set up programs to train personnel to fill the manpower gap that existed between the engineers and/or scientists and the skilled craftsmen. This gap was to be filled by the engineering technician, a sub-professional, who would have enough theoretical background and laboratory experience to do the benchwork or hands-on work that engineers and scientists were doing because the skilled workers could not do it. There was also the feeling that such a growth in science and technology would develop that there would not be enough people to train at the four-year and graduate levels and that too much time would be required to educate B.S. and graduate students. Technicians could be turned out in one-half to one-fourth of the time needed to produce B.S. and graduate school diploma recipients.

The Commission's report felt that optimally there would be a multiple number of technicians under the supervision of a scientist or engineer. The technicians would free the scientists and engineers from bench work to devote more time to thinking about and designing projects.

The recommended two-year colleges or technical institutes would be located in a geographical area with enough industry that could use technicians. New York State established five experimental institutes at Binghamton, Buffalo, Brooklyn, Utica, and White Plains in 1946. Only Utica did not have a program to train chemical technicians. The Ag and Tech colleges at Farmingdale and Canton also instituted similar programs. The institutions opened in September 1947. Other states followed and the number of programs increased as well as the geographical distribution. Not all the initial programs or present programs were or are E.C.P.D. approved. Many would not provide funds for equipment or manpower to meet E.C.P.D. standards.

EARLY PROGRAMS IN CHEMICAL TECHNOLOGY

The early programs were set up with the aid of advisory committees composed of technical and scientific personnel from area industries. An attempt was made to satisfy as many industrial needs by including appropriate subject matter as was possible. Most curricula included the standard courses in general chemistry, quantitative analysis, organic chemistry and chemical engineering (stoichiometry, unit operations). Satisfying industrial wants required the inclusion of courses in metallurgy, strength of materials, photography, plastics, pharmaceuticals, and physical chemistry. Some curricula contained only one or two specialty courses; some had three. An early curriculum at Broome Technical Community College (originally the New York State Institute of Applied Arts and Sciences) follows.

FIRST YEAR

Subject	Credit Hours
1st Quarter	
Mathematics	5
Electricity	4½
General Chemistry	5½
Engineering Drawing	2
English	3
Modern Society	3
	23
2nd Quarter	
Mathematics	4
General Chemistry	5½
Qualitative Analysis	4
Electricity	4½
English	3
Economics	3
*Health	2
	26
3rd Quarter	
Mathematics	4
Qualitative Analysis	3
Quantitative Analysis	6
Organic Chemistry	6
English	3
	22

SECOND YEAR

Subject	Credit Hours
1st Quarter	
Quantitative Analysis	6
Organic Chemistry	6
Mechanics	4½
*Metals and Alloys	4½
	21
2nd Quarter	
Organic Chemistry	6
Industrial Chemistry	6
Instru. Methods	3½
Sociology	3
Human Relations	3
*Health	2
	23
3rd Quarter	
Industrial Chemistry	6
Instru. Methods	3½
*Physical Chemistry	4½
*Strength of Materials	4½
Non-tech Elective	3
	21½

*To satisfy specific industry needs.

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The quarter terms were 12 weeks long. The half-credit hours are the result of giving a 1½ credit hours for a three-hour laboratory. The students had 28-30 contact hours. The credit hours and contact hours at Broom were very high but about the same as other two-year institutions. The curriculum contained the standard courses found in the first two years of undergraduate study in chemistry and then some. The humanities and social sciences were minimal.

The early two-year college graduates had a difficult time finding employment. The early graduates may well have been offered jobs so that industry would not be in the awkward position of not wanting what it had stated was desirable and necessary.

The work of the Broom graduates was followed closely and the result was a change in the curriculum during the middle fifties. The new curriculum had mathematics, physics, English, general chemistry, and a social science elective in the first year. Organic, analytical chemistry including instrumental methods, unit operations, and a social science course were in the second year.

ECPD ACCREDITATION

E.C.P.D. entered the technician education picture decisively in the mid-fifties with its set of guidelines. The mathematics level was upgraded to include teaching of the calculus and its use in problem solving. Industry had learned to use the graduates effectively and now wanted them upon graduation. The compliance with E.C.P.D. guidelines led to the upgrading of instruction so that many four-year institutions granted considerable transfer credit to graduate technicians. The move by technicians to transfer to B.S. programs was encouraged by people in industry and existing personnel policies with regard to promotion.

New Chemical Engineering Technology programs instituted during the sixties were structured to meet E.C.P.D. guidelines. Essentially they contained mathematics, physics, English,

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general chemistry, and an elective in the social sciences in the first year and organic chemistry, analytical chemistry (including instrumental methods), chemical engineering (stoichiometry and unit operations), physical chemistry, computer programming, and a calculus course in the second year. Engineering drawing also was and is a basic first year course for two credit hours.

E.C.P.D.-accredited programs in Chemical Engineering Technology now exist in fourteen institutions. There are four in New York, three in Connecticut, three in Pennsylvania, three in the midwest (Ohio, Wisconsin, Iowa), and one in South Carolina. Non-E.C.P.D. accredited programs are located in four New York institutions, one in Pennsylvania, and one in Massachusetts. Most non-accredited programs usually lack courses and facilities in the chemical engineering areas.

SURVEY OF PRESENT PROGRAMS

To obtain up-to-date information on curriculum and enrollment, eleven schools where chemical engineering associate degree programs are offered were contacted. A response was received from eight. The names of those responding are: Iowa State; SUNY Ag and Tech College at Farmingdale; Hudson Valley Community College; Midlands Technical Education Center at Columbia, South Carolina; Hazelton Campus of Penn State University; Norwalk State Tech College, Norwalk, Connecticut; Waterbury State Tech College, Waterbury, Connecticut; Broome Technical Community College, Binghamton, New York.

The programs reported show some change from previous programs. Physical chemistry has been deleted in most cases. It has been replaced by a nontechnical elective or no substitution has been made and contact and credit hours have been reduced. Most programs offer more calculus as an elective or as a requirement. The credit hours vary from 96-120 quarter credits or 64-80 se-

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mester credits for the A.A.S. degree and can be summarized as shown below. Not all institutions require all the courses shown.

FIRST YEAR

Subject	Quarter Credit Hours Minimum	Maximum	Majority
x Math (Alg, Trig, Analyt, Calc)	10	15	12
x General Chemistry	12	15	12
x Physics	12	16	12
xx Drawing	1	4	2
x English	9	9	9
xx Computer Programming	0	3	3
xx Stoichiometry or Tech Calc	0	5	3

SECOND YEAR

Subject	Quarter Credit Hours Minimum	Maximum	Majority
x Organic Chemistry	4	15	12
x Analytical (including Instr. Methods)	8	15	12
xx Math (Calc)	3	4	3
(Stoichiometry or Tech Calc	0	5	4
x (Unit Operations	0	15	10
x Social Science	9	15	9

x Year-long sequence
xxOne quarter course

The Chemical Engineering Technology program has a counterpart, the Chemical Technology or Technician program in chemistry. The non-engineering programs usually do not have engineering drawing, engineering calculations (chemical engineering stoichiometry), or unit operations. They may include more non-technical courses and a non-chemistry science. These programs are generally structured after the first two years of B.S. programs but contain more analytical chemistry than is normally required for a B.S. degree and more lab time.

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	Freshmen	Graduates
1967	254	106
1971	145	66

Some colleges have had such poor enrollments that their programs have been phased out. The outlook is not bright. Three or four E.C.P.D.-accredited programs are or will be phased out by June 1971, and two non-accredited programs are now being phased out or may soon be phased out.

PLACEMENT

The placement of graduates has been very good until 1971 when recruiters have been looking and hiring technicians in restricted numbers. This restriction is not due to a lack of job opportunities but to the management-dictated freeze on employment.

The largest number of graduates has gone into chemistry areas rather than into the engineering areas. In some colleges most graduates have gone into engineering-type positions. One deterrent to engineering-type work by graduates has been the union bargaining settlements that include most positions in the production areas. Management and the graduates usually have not cared to have the technician subjected to union regulation of rank, pay, and promotion. The laboratory route to production supervision has by-passed the union problem.

FUTURE TRENDS

Future curricula will include more transferrable courses. More calculus will be required or be made available to students as will more courses in the so-called general education area. The course theory will parallel that of similar courses given at institutions to which students will transfer. There will be a cut in laboratory hours to provide more math and non-technical courses.

This personally projected trend in the curriculum will lead to the demise of the chemical engineering technology programs. The initial intent of the programs was not to provide transfer credits for entry into the third year of engineering or chemistry programs. Some four-year institutions have set up special programs for two-year college graduates so they can graduate in two or three years after transferring. These two or three years

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are the minimum time for students who have completed the first two years at the B.S. granting institutions.

Most graduates of the E.C.P.D.-accredited programs do not go to work but transfer to B.S. granting institutions. The number has increased with time. Two colleges reported that 80% of the graduates aspire to or go on to four-year colleges. The colleges for the eastern part of the country show a spread between 50-80% going on to four-year colleges. The figures reported elsewhere are lower.

There is little question of the future need for engineering technicians. Industry has learned how to utilize their backgrounds. The question that arises is: "Will there be technicians to hire?"

SUMMARY

The preceding portion of this paper has covered the suggested topics that may be of interest to anyone connected or concerned with the Chemical Engineering Technology programs. It has probably raised some questions about the decline in enrollments, graduates, and number of institutions involved in these programs. These questions may include the following. The answers shown are those that have been developed in discussions with persons in the academic and industrial worlds.

Q. Does industry need the present level of education for technicians or does it desire this level now because it has been provided?

A. Industry is happy to get technicians as well-trained as possible and pays them according to their abilities. It would and could use technicians with lesser backgrounds but would have lower entry salaries than those it pays technicians with the current high level backgrounds.

Q. Has the B.S. degree syndrome of parents, industry, and society cut off applicants, and graduates from becoming technicians?

A. There is little question that there are persons enrolling in B.S. programs who do not complete the programs but who might have become good technicians. The A.A.S. degree is still not regarded as a sign of a quality education by too many people.

Q. Have the programs become too transferrable because of course and faculty requirements?

A. The graduates of chemical engineering technology programs are being accepted more readily by many institutions as third-year students. Options in mathematics lead to a good level of mathematical competence; the level of the chemistry texts and the treatment of subject matter approaches or equals that in many four-year institutions. A high point average is the key which makes the graduate acceptable to most institutions. Faculty may unconsciously or consciously be dividing their students into groups as technicians or as transfer candidates. The faculty requirements in courses have moved upward over a period of years so that potential technicians could not measure up to the higher level of instruction.

Q. Has industry's hiring and promotion policy required A.A.S. degree holders to get a B.S.?

A. Industry says that it pays its workers for performance of required work and potential. There is often similar work done by A.A.S., B.S., and B.A. degree holders with different scales. Since the technician cannot usually get the same pay for the same work because of his A.A.S. degree, he quickly decides to get a four-year degree and he no longer wants to be or is classified as a technician. But is he entirely happy? Perhaps. He is not if he is still doing technician work. He wonders why he had to get a four-year degree if his work doesn't require a higher formal level of education.

Q. Do faculty want to upgrade teaching effectiveness or upgrade the rigor of courses?

A. The hardest part of teaching is teaching to the average student fundamentals which he can understand and use. This is not glamorous or "exciting" work. Most faculty would probably prefer teaching at a level where they would be intellectually stimulated. This is a normal preference. Excitement and satisfaction can be obtained by devising and trying to teach more effectively at a level that the average technician can understand. The student who can pass rigorous course requirements does not become or stay a technician.

Q. What measures can be taken to insure that these programs will not fade out of the educational picture and leave the technician area again void of well-qualified people?

A. The measures needed to insure the continuation of the A.A.S. degree programs are manifold. Those who are concerned have their own varying views. Some are:

Lower the present rigor of courses.
Restructure programs.
Publicize the need for technicians.
Upgrade the "social status" of the A.A.S. degree.
Encourage closer contact with students to help them overcome difficulties or situations.
Make remedial work mandatory (?).
Develop better rapport with high schools to obtain students for the programs.

One cannot be at all optimistic about the future of programs in Chemical Engineering Technology as they are currently structured and implemented. There has to be a critical assessment made and change is mandatory for survival and regeneration or rebirth. □