CLOSING THE UNIVERSITY - INDUSTRY GAP

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In the interest of promoting a closer relationship between universities and industries, certain programs of the Department of Chemical Engineering at Texas A&M University are described. Only those cooperative programs between industry and the university which are of an unusual nature and not in general practice are reviewed. The programs described provide certain specific ways in which universities and industries may cooperate, and it is hoped that these examples will lead to the generation of other means of cooperation.

In general the Department of Chemical Engineering at Texas A&M University accepts the responsibility for providing educational opportunities for people in three general classifications: (1) the undergraduate student, (2) the graduate student, and (3) the practicing engineer. A summary of some of the interactions between our department and industry in these general areas follows.

FRESHMAN FIELD TRIP

Shortly after our freshmen arrive in September, we meet with them and arrange for them to take a one-day field trip during the second week of classes. The trip is scheduled at an early date in order to avoid conflicts with major quizzes. The trip consists of a visit to a nearby industry (or industries) within a radius of 100 to 150 miles of the university.

The primary purpose of this first field trip is to motivate our students toward wanting to make something of themselves. In general, most of our entering freshmen have the ability to handle the program in chemical engineering, but they may not necessarily have the desire and will to do so.

Thus far, we have taken four classes of freshmen on trips of this type, and we are still following the same general format that we worked out with Dr. W. B. Franklin (of Humble Oil and Refining Company, Baytown, Texas) for the first trip. To provide the necessary transportation, we rent two large buses. We leave the campus at about 6:30 a.m. and arrive at the plant site (or sites) around 10:30 a.m. The remainder of the morning is usually spent in a general session in which the plant manager or someone well along in the organization covers several general topics such as why industry needs engineers, some of the things engineers do, and usually a brief description of their plant facilities.

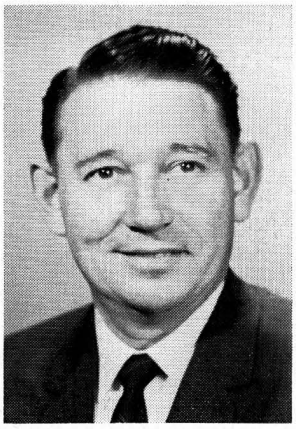
Before lunch, about two or three freshmen are assigned to each engineer. They remain with this particular engineer for the remainder of the day. First, they eat lunch with him, and then he shows them some of the things he does in his job and describes some of the responsibilities of other jobs that they might have at some future date. The precise program for each engineer is left up to the respective engineer.

By arranging for our freshmen to become acquainted with practicing engineers, we provide them with examples of men who have successfully completed a degree program in chemical engineering. Also, for each freshman, the practicing engineer that he meets represents a goal or an example of what he can make of himself in four years, provided he applies himself.

Since we have made several changes simultaneously in the operation of the university, it is difficult to evaluate the effect of any one program; however, our present senior class is almost twice as large as any one of our senior classes of recent years.

SOPHOMORE FIELD TRIP

Thus far we have taken our students on three of these trips. The objective of these trips is to give the student an over-all picture of the industry in our area. This trip is scheduled for one day during the first week after classes of the fall semester begins. Last year Phillips provided the buses and made all plans for the trip. They followed the course of events from the produc-



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Editor's Note: This department recently received an award from the AIChE for its efforts in improving university-industry interaction.

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tion of oil at the well-head, through a gas plant, a refinery, and a chemical complex at the Phillips' Adams Terminal in Pasadena. This was a very efficient trip. As soon as we had finished visiting one facility, the guides for the next facility met and rode in the buses to the next facility. During this time, the guides discussed briefly the next process that the students were to see. In this way, most of the time at each facility could be spent viewing the actual equipment.

We still have a conventional three-day field trip for the juniors, but we have eliminated the senior field trip. In addition, we have a cooperative program in which the student works in industry and attends the university on alternate semesters.

GRADUATE PROGRAM

Only one phase of our graduate program is described here. The remainder of the program is conducted in the usual way.

The following research program does, however, constitute somewhat of an innovation in engineering research, and it is anticipated that this approach will result in a better understanding between educational institutions, industrial organizations, and federal supporting agencies.

Briefly stated, it makes use of industrial equipment at the plant sites as the pilot plant to study each of several processes. The particular processes under investigation include packed absorbers, packed distillation columns, adsorption and desorption processes, evaporation, and liquid-liquid extraction.

In this program, graduate students go to the plant site and collect the data. On the basis of these data, the students develop mathematical models, which describe the steady state and unsteady state behavior of each of the processes. Simultaneously, the students develop suitable numerical methods for solving problems involving these processes by use of high speed computers.

This approach provides the opportunity for the staff and the graduate students to work with practicing engineers on problems that are of common interest. Recent experience with this method shows that the industrial assistance in solving hardware problems, in making equipment modifications, and in solving problems of various types associated with the research constitute substantial technical and financial contributions.

After it had been decided that experimental confirmation of the mathematical models of industrial processes was needed, the following considerations led to the formulation of the present program. First, the possibility of constructing large pilot plants at the university was considered and discarded because of the initial cost of construction, the long period of time required to go from the ordering of hardware to the correlating of experimental results, the cost of operating and maintaining such a facility, and because of a variety of other problems such as the source of a large feed stock and the disposal of the effluent streams.

These problems were virtually eliminated by making the decision to take advantage of existing commercial plants by using them as pilot plants. This idea was pursued, and a small natural gasoline plant that was equipped with packed distillation columns was found to be in operation near Refugio, Texas. This plant is owned jointly by the Hunt Oil Company and by Humble Oil and Refining Company. To make use of industrial equipment requires a great deal of advanced planning. Before taking data on two packed columns at this plant, thermowells and thermocouples were inserted in two of the col-

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umns—a packed absorber and a packed distillation column. Three students have used portions of this research work to satisfy the research requirements for their PhD degrees. One paper describing the results of this work has been published and three others have been accepted for publication.

Another graduate student is working on the modeling of systems of evaporators. He has made several test runs on a 17-effect evaporator system at Freeport, Texas. This plant belongs to the Office of Saline Water of the Department of Interior. A paper describing the preliminary results of this project was presented at the AIChE meeting in Los Angeles, 1968.

In another project, students are working on the adsorption process. At the present time there is renewed interest in the separation of ethane and heavier components from natural gas streams, which are relatively lean in these components, by the use of columns filled with an adsorbent such as charcoal.

One man has obtained laboratory data on adsorption equilibria, and the other is obtaining plant data through the cooperation of the Mobil Oil Company. The laboratory data will be used in the modeling of the commercial column. One student whose dissertation was based on the laboratory results and the correlation of these results has received a PhD degree. Two papers describing the results of this work have been accepted for publication.

Another student is working on the liquid-liquid extraction process. Arrangements have been made to use one of the extraction columns at the Baytown Refinery of Humble Oil and Refining Company.

The graduate research projects described above have been supported by the National Science Foundation, the Texas Engineering Experiment Station, and various industrial organizations.

CONTINUING EDUCATION PROGRAM

The continuing education program consists primarily of two parts which may be classified as Graduate Extension and One-Week Seminars.

The first course in our graduate extension program was presented at Freeport, Texas, at the Dow Chemical Company in 1954. In addition to the program at Freeport, we now offer graduate courses by extension at four other locations: Corpus Christi, Victoria, Texas City, and Kilgore. These courses are taught by professors who customarily teach the same graduate courses on the main campus. The professors go to the location and present one three-hour lecture per week. After the students have successfully completed a sufficient number of courses by extension, they may earn the Master of Engineering by spending one semester taking a full time load on the main campus. Of course, the student must satisfy all of the regular requirements for this degree.

Courses in the seminar program do not carry degree credit. This program has been in operation for about three years. It differs from the conventional seminar program in that it is of an instructional nature. In this program, we require a great deal of work at the blackboard. The general procedure follows. The instructor lectures for a few minutes. Then he formulates a problem and sends one-half of the class to the board to work it. After the participants have worked on it for about 10 minutes, the instructor works the problem. The instructor then lectures just long enough to present the fundamentals involved in the next problem, poses a problem, and sends the other half of the class to the boards to work it. This approach requires the use of simplified problems. However, this appears to have the advantage that the fundamentals are not lost in the arithmetic details. In this teaching method we take the view that the learning process is something like learning to ride a bicycle in that one learns most by participating rather than by watching. Also, since each man must try to go through each problem one time by himself, he becomes involved and develops a desire to see the correct solution in order to check his own solution or to clear up some troublesome point which prevented him from obtaining the solution.

One other program deserves brief mention. For the past 25 years the deupartment has sponsored a three-day symposium on Instrumentation for the process Industries. Formal papers are presented primarily by members of the user and seller industries. Last year over 500 engineers were in attendance at the symposium.