CURRENT ASPECTS OF GRADUATE CHEMICAL ENGINEERING EDUCATION

The following remarks were presented at the 1963 ASEE Annual Meeting in Philadelphia as part of a panel discussion on "Current Aspects of Graduate Chemical Engineering Education". The session was moderated by R. N. Moddox of Oklahoma State University. The panelists were Alan S. Foust, Dean of Engineering at Lehigh University; Brage Golding, Head of the School of Chemical Engineering at Purdue; Harold S. Mickley, Professor of Chemical Engineering at M.I.T., and David H. Morgan, Director of College Relations for the Dow Chemical Company.

Remarks By Alan S. Foust

In offering my opinion on the present status of graduate education in Chemical Engineering, I will state in advance that I do not offer a panacea for the present situation. In my opinion, graduate education in Chemical Engineering is at the crossroads, with the field flowing across us under very high gradients. It is impossible to say now if the field is linear or non-linear; whether our parameters may be lumped or distributed, or whether the boundry conditions can be describable by linear equations.

In this situation, it is not surprising that we as educators have up to now been unable to optimize this system which is our challenge for delivering today's graduate-trained Chemical Engineers.

Before we proceed very far on this, we must decide how many of these men we are training for research, and how many we are training for design and other true engineering activities.

I hope there is not any universal decision among the alternatives we face in planning our graduate programs of the future. We shall probably continue to need some training in refinements and expansions of the Unit Operations techniques, since it is highly probable that the time devoted to them in the undergraduate program must shrink. Whether or not the old name disappears is inconsequential. The pedagogical advantage of looking at each of these operations in a fundamental framework must not be lost. Some departments will doubtless concentrate on the proper design of catalytic reactors, rather than a simple specification which is usually done now, and will illustrate the integration of this into a total system. Some other departments may wish to concentrate on filling the gap between established and usable knowledge in Chemistry and other basic sciences beyond the amount which is normally taught in the undergraduate years to Chemical Engineers. All of us are going to have to face some nonlinear mathematics which may provide the eventual clue to rigorous modeling of chemical systems in toto.

These assumptions indicate that we are not likely to find much room in the typical Chemical Engineering graduate program for the necessary physics of the solid state and the materials with which we work. Neither will there be time for training men in the intricacies of the electronic gear necessary to tell us how a process is behaving. They will make it even more difficult than at present to stimulate the student who has been trained largely by exposure to existing and thoroughly solved problems for which there is some reasonably definite answer under described boundary conditions toward the creativity necessary in addressing a new situation and exploring beyond the frontiers of the material he has gotten from textbooks. This will be absolutely necessary in the graduate education of the design engineer.

There is serious consideration being given to the question of whether or not the broad subject "Design" can actually be taught. This does not refer to the routine selection and synthesis of known components on the basis of available information and handbook formulae. My concern is in the synthesis of totally new systems, requiring projection beyond available information.

Experience in such a synthesis during a doctoral dissertation will probably raise conflicts with purists who insist on some new information or new concept as constituting the research we normally expect. If we had a degree designation of prestige equal to the Ph.D. awarded to these men who have demonstrated the ability to synthesize available information into a new system, we would probably find it easier to satisfy in graduate school the need of industry for expert designers of sophisticated systems.

So long as the most available money for supporting graduate students is closely held for fundamental research, and as long as the majority of our Chemical Engineering faculties are youngsters who have just completed a similar program of research and have never done any design, a solution will be elusive.

We must search not only for our contribution to stimulating the creative capacity of our graduate students, but we must devise some procedure or label which will retain prestige for design engineers, comparable to the Ph.D. for research engineers.