DISCUSSION OF PAPER

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PLANNING FOR THE FUTURE
IN CHEMICAL ENGINEERING

I have had the privilege and pleasure of reading the manuscript of the address by Professor Lewis on the problems which lie before the colleges in the training of chemical engineers. These problems also confront us in the other fields of engineering but in a lesser degree since for them the intimate and extensive knowledge of one basic science, chemistry, is not required. The chemical engineering student must be an engineer and a chemist and the relative importance of these two aspects of his profession depends upon the training and bias of the one who assesses them.

The address suggests certain changes or additions to the present-day curricula in chemical engineering to meet the demands of tomorrow which we too believe are evident from world conditions of today. Further study of the social sciences is suggested even though many engineering students by training or from peculiar personalities have not been satisfied with the special techniques used in those fields. I think that teachers and engineers will all agree that this suggestion is most important and that the engineers of tomorrow must apply history, psychology, sociology, politics, and economics to their own activities if they are to aid us and the world in restoring the former conditions of possible progress where we may produce, in the words of Professor Lewis, "the material prerequisites of our civilization on a scale sufficient to meet all legitimate human needs, under conditions which will preserve and develop every creative potentiality of the individual."
Granting this, and I believe we are forced to grant it, the accomplishment of it becomes the great problem before us. With a larger and larger field of chemical knowledge, the fundamental principles of which, in my opinion, the chemical engineering student should know, as well as the elements of machine design, the fundamentals of electrical power applications, the fundamentals of thermodynamics and heat engineering, of hydraulics, of structures and of engineering administration, the matter of added time to this crowded program points to one thing and to one thing only, the lengthening of our four-year curriculum to five or six years.

Should the curriculum be increased, then some of the other subjects called for in the address, such as plant experience, could be added and it might be possible so to place the social science subjects in the later years after some period of work in industry, that the necessity of these studies would be apparent to the engineering student, and his aversions, which I also have noticed among certain of our students, would be overcome. After this human experience, the dependence of each one upon the cooperation of many others for the successful completion of a task becomes a real belief. It is also noted that the address has stressed the importance of connecting with the teaching of technical subjects the human contacts and relations arising out of the applications of technical study. In all of our work, the social, political, and financial implications of the solution of a problem should be brought before the student as well as the mere technical solution thereof.

I can not speak from experience on the effectiveness of work in industry under the direction of the faculty of a school, as recommended in the address, but it is my belief that this work would be of greater value if the student served as any other employee without the slightest faculty supervision. The realization of industrial demands would be made manifest by the employment free from the school influence. The meager requirements of
one summer's work in industry by the School of Engineering at Princeton has been met by the kind aid of so many manufacturers that I believe that it would not be difficult to continue this aid at the end of the third year of a five year course, making possible in the fourth and fifth years the presentation of the social science studies which are not elected at present by our students because of their lack of vision.

In my opinion, industry is willing to assume part of the work necessary for the better preparation of men for useful employment on graduation, so that industry in turn will need less time for the present industrial training which it must give for adjustment of new men.

I am pleased to note that Professor Lewis recommends consulting work for faculty members, provided this does not interfere with their most important work, teaching. We have encouraged this, with the consent of the administration at Princeton, and in planning each teaching schedule I have been able to arrange for one day each week free from University assignments. Our reasons for this have been those given in the address.

I believe that in the training of our engineering students, the general nature of fundamental studies should be stressed so that from a particular example the wider application to other problems may be appreciated by the student. Principles must be illustrated to make them real but, unless there is a comprehension of their broad scope, they are sometimes hidden by the examples chosen and are merely simple experiences to be used in the future.

The thoughts relating to thoroughness of teaching rather than extent of ground covered, as well as the presentation in our teaching of some of the complex conditions of practice in which judgments must be made and methods devised after careful consideration of the data at hand are appreciated by me. Our graduates must face such problems and unless their grounding is thorough
and they have been prepared by the solution of problems in which the answer was not almost evident from its statement, time may be lost in learning that practice is not made up of a series of simple, evident solutions of classroom tasks.

As stated in the address, some of the requirements of tomorrow are now evident and we, as educators, can change our courses of study to meet them.

I have read this address with much pleasure and add my comments primarily in commendation of it. I would be remiss if I did not express, at the close of my discussion, my felicitation and best wishes to the President, Trustees and Faculty of the University of Delaware on the completion of this newest addition to their facilities for the teaching of chemistry and chemical engineering. May the work in this building be not only a blessing to the state but to our own country and the world.