

I take it we mean manufacturing enterprises as contrasted with trade, commerce, finance, insurance, etc. The mere statement of this situation raises the question of the relative value of the two types of courses for the purpose intended.

It may be said that in nearly all institutions the type developed depended upon the type of the institution establishing the course (*i.e.*, academic or engineering) and not upon an attempt to evaluate the relative merits of the two types.

In our present discussion of the subject we are naturally inclined to seek for reasons to justify the type of course with which we happen to be connected, and while this may provide an interesting debate it is not a scientific approach to the problem. It is useless to quote examples of successful careers of those taking one or the other of the two types of courses for we can also find examples of notable achievements in industry with other types of preparation in institutions of higher learning, and innumerable cases where successful individuals have had no formal educational training beyond the elementary grades.

There is one phase of educational training, however, which the authors unite in endorsing and which is supported by a considerable body of experience. This is the superior value of the cooperative type of training whereby the students spend alternate periods of approximately the same length in industry and the classroom.

For the development of the best curriculum and the planning of the content of the courses we have virtually nothing to guide us outside of reasoned considerations, and it is clearly in the interest of efficient management of both educational and industrial enterprises that we should attack the problem from a scientific standpoint.

In this situation it would seem particularly appropriate for the Taylor Society to become one of the leading agencies in the study of the whole problem of education for industrial management.

If the members of this society who are directing industrial enterprises will individually undertake to employ graduates from different types of courses, who otherwise seem to have equal potential capacity for industrial leadership, we will have available, in the course of time, a body of data which will enable us to give something approaching a scientific answer to the problem presented by the paper under discussion. Comparisons, such as are now not infrequently made, between a graduate from one type of course in one

company with a graduate from another type of course in another company are of practically no value.

Somewhat more difficult for scientific analysis are other phases of education for industrial leadership but they constitute, as a whole, a problem of major importance and worthy of our best efforts in working toward an adequate solution.

J. O. Keller¹⁰: Under the three methods suggested for setting up a college curriculum, no mention is made of consultation with alumni. This would most likely be classified under heading two, namely, opinions of industrial leaders. Our Dean last year sent out a questionnaire to all our engineering alumni; I should like to give you some data taken from the replies of the industrial engineering alumni.

The course in Industrial Engineering at Pennsylvania State College was established in 1908 by Colonel Hugo Diemer, but we did not graduate anyone until the year 1910. Sixty-four replies to the Dean's Christmas Letter were received from men who graduated in Industrial Engineering, three from men graduated before 1914. Of these 64, 48 are following industrial engineering, 12 mechanical engineering, 2 civil engineering, and 2 are in non-engineering pursuits.

I give below their answers to the questions concerning the value of the various courses. Only those subjects which received a goodly number of votes are included.

I. What subject or line of study has proved of the greatest (least) professional value?

<i>Greatest Value</i>	
Industrial Engineering Subjects	38
Mathematics	11
Mechanics	4
English	4

<i>Least Value</i>	
Language	23
Chemistry	6
Mathematics	5
Machine Design	5
Industrial Engineering Subjects	3

II. What subject has been of greatest (least) cultural value?

<i>Greatest Value</i>	
Economics	31
Literature	17
History	10
English	5
Language	5
Psychology	5

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<i>Least Value</i>	
Language	28
History	6
Economics	5
Literature	3

III. What subject contributed most (least) to your success?

<i>Greatest Contribution</i>	
Technical subjects of our own course	31
Mechanics	8
Miscellaneous technical subjects of other courses	5
Mathematics	4
Economics	3
Heat Engines	3
Psychology	2
Electrical Engineering	2
Machine Design	2

<i>Least Contribution</i>	
Machine Design	12
Heat Engines	6
Language	6
Technical subjects of other courses	5
Technical subjects of our own courses	4
Chemistry	3
Electrical Engineering	3
Mathematics	2
Mechanics	1

I do not pretend to know the quantity and quality of engineering subjects most needed by students majoring in the commerce field, but I do have decided opinions as to what the industrial engineering student should take to prepare him for an executive position in the technical side of industry.

In the first place, he should have a thorough training in those subjects which are classified as engineering fundamentals. In addition, the engineering student cannot receive too much English. I do not mean commercial English, business English, or so-called engineering English, but simply good courses in ordinary English composition and literature. A man well grounded in English can easily adapt himself to letter writing. But he must have an appreciation of what is good, clear, concise English. Technical courses should of course be included which have to do with the engineering problems of industry, following substantially the classification as given by Professor Roe and including Industrial Organization and Management, a thorough course covering purchasing, stores, materials handling, wage systems, and so forth.

Who shall teach this course in organization and management depends not so much on what we think, as upon who started to teach it first in any particular college. Since the industrial engineering course was established at Penn State prior to our commerce and

finance course, we handle this work here. I think that the engineers in general are to blame for not handling such courses in more institutions than they do, because of their early antagonism to such work. Now that they wish to handle such courses, they must suffer for their lack of foresight in general.

Of the purely commerce subjects, I believe fundamental courses are essential in economics, both elementary and advanced; psychology; elementary and advanced accounting including cost analysis; and industrial relations and personnel administration. There are other excellent commerce courses covering such subjects as statistics, selling, finance, and commercial law, but beyond this it does not seem possible to crowd more into the four years. I am not altogether in favor of a five year course, although there are some advantages, I admit. The most we can hope to do is to draw out the student; teach him to think for himself, so that after graduation he can continue his studies for himself.

I am greatly in favor of the problem or project method for some courses, and as much cooperative work as it is possible to have under the conditions governing each college. Penn State is so situated that we must obtain our cooperation through summer work requirements. I believe that this could be better regulated than it now is.

As mentioned in the paper under discussion, our colleges do not pretend to turn out finished executives, and if we can turn out men of good character, well grounded in fundamentals of their particular field, who are willing to learn after they have been graduated, we have about accomplished the ultimate.

R. H. Lansburgh¹¹: It should be emphasized that preparation for manufacturing industry can be adequately given in both the engineering school and the school of commerce. Students who are mechanically inclined at an early age are likely to select the engineering school. However, many students who ultimately go into manufacturing industry and win places of leadership therein are likely to be found in the school of commerce. In many cases these students will have selected the school of commerce because they did not feel that they were mechanically inclined, or because their preparatory training was such as to preclude admission to some of the engineering schools.

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