

The studies in group A are fundamentals common to both the engineering and commerce type of curricula. Many of the commerce schools and some of the engineering schools are upon a graduate basis. In such schools some of the courses in Group A will have been taken in undergraduate courses, in which case they need appear here only as required prerequisites. The second group, B, covers intermediate studies more or less general in nature. It is divided into two columns, first, those in the general commerce or economic field, and, second, those in the engineering field. Group C shows specialized studies, similarly divided, most of them clearly defined as to the field in which they belong.

All students in both types of the course should take the studies in Group A. Students in the commerce courses would have practically all of B and C in the commerce field, together with some in the B engineering list. Students in the engineering curricula would take most of those in the B and C engineering groups together with some or most of those in the B commerce group. Of the engineering studies to be taken by the commerce men, those most useful would be B2 to B8. Of the B commerce studies taken by the engineering men, B3 and B5 are the only ones which can be omitted.

Students of both types should have a thorough, comprehensive course in Industrial Organization and Management, B19. It is listed here on the commerce side, but it really belongs no more to one side than the other. Into this course may be gathered and correlated a considerable number of the elements in Table 1 which do not justify separate courses. Calculus, B10, for the engineering may not be essential, but we feel it is desirable for its analytical training. In general it will be found that more of the commerce type courses are taken by the engineering students than the reverse. Mr. Burleigh points out as the reason for this that most of the B commerce courses are *essential* for the engineering schools, while engineering courses are *desirable* for the business schools. It is therefore natural to find more business type courses in engineering curricula than the reverse.

You will note that we refrain from outlining specific curricula. We are both familiar with faculty meetings engaged in this occupation and do not wish to turn this into a faculty meeting. There must of necessity be variation between the curricula of the various schools, even of the same type, i.e., commerce

or engineering, owing to different constituencies and different economic conditions. The needs of the territory served by the University of Colorado, for example, differ materially from those of M. I. T. or the University of Georgia. The fundamentals, however, are the same in all cases.

As to methods of teaching, with which this paper is not especially concerned, we feel that outside lecturers should be used as far as possible, certainly in the more professional parts of the field. These lecturers should be men of experience either in business or engineering practice in the particular subject covered by them. Furthermore, if an engineering school undertakes the teaching of business subjects, that teaching should be conducted by men of the business school group, and vice versa, so far as the facilities of the school make this possible. Text books are, of course, necessary in many courses and they form an excellent background for any course, even though the problem method of teaching be used. Their special field is in courses where the subject must be covered briefly and comprehensively. Where there is time and opportunity, we feel that the problem method is far superior. The law and medical schools have used this to great advantage. Commerce and engineering schools have only begun to use the method, and we feel it can go much farther.

The engineering type of curriculum should provide a *thorough* training in the planning and execution of effective production methods. By far the greater proportion of our industrial enterprises now involve engineering and this proportion is steadily increasing. Many industries, which have been hitherto more or less empirical, have by sheer increase in the scale of their operations come to involve engineering. The commerce curriculum would furnish the natural training for those going into financial institutions and merchandising organizations, where engineering either does not appear at all or only in a secondary way.

Both writers of this paper feel strongly that whatever else engineering and commerce types of courses may have in common, some form of cooperative work in industry is vital in preparing for executive work in either field. Whatever the technical requirements may be, the executive's major job is to work with and direct men, and to coordinate their efforts toward some common purpose. This involves knowledge of human nature, and of working and operating conditions. These cannot be taught in college. There is no text

book on human nature. The only way such knowledge can be acquired is under actual working conditions, working for real pay, among real workmen. Only in this way can a student learn what workmen really think and how to speak their language. This contact with workmen can be had after formal education, as hundreds of cases show. It is much more effective, however, when it is acquired during, not after, the educational process, as it gives a meaning to the studies, vitalizes the student's interest, helps him to find himself, gives a realization of the limits imposed on theory by practice, and obviates much of the painful readjustment so common after graduation. Furthermore, it offers opportunity for developing material for the case method of teaching.

The essentials of the cooperative method are, first, that the experience should be acquired during and not after the college course, and second, that the practical work be directed and properly coordinated with the college work. The exact length of the period is not of major importance. Enough applications of the cooperative plan are now in operation to show that it can be applied to widely varying conditions. The University of Cincinnati is now applying it in its School of Commerce with the same success obtained in connection with the College of Engineering. The writers both feel strongly that it should be an essential part of both the engineering type of course and the commerce type of course, and that it is no more important for one than for the other.

#### Discussion.

H. S. Person,<sup>5</sup> Chairman: It is a pleasure to preside over this session; it helps me to believe that my leave of absence from the teaching of management has not compelled me to forfeit all of my earlier status and contacts.

The subject we are considering is not a new one—it is as old as is the teaching of management. But there is something new in this particular consideration of it; it is the first time that teachers of management from schools of commerce and from engineering schools have joined in discussion of a common educational problem.

The Taylor Society is happy that it has been able to take the initiative in inaugurating joint consideration of this and, we hope, of other common problems.

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Each group of teachers represented here has something of value to contribute to the other. Engineering schools are beginning to add to their original curricula courses which were once assumed to belong exclusively to the school of commerce; and schools of commerce are beginning to believe they should add to their curricula courses once assumed to belong to the engineering schools. If state universities having departments both of commerce and of engineering the problem of division of labor is becoming acute, for educational institutions are feeling the pressure of high costs and becoming interested in the elimination of the waste of duplication of effort.

Is there not promise of large constructive results if we approach the problem of content of the management curriculum, and the problem of who should give instruction in the elements of that curriculum, from the point of view of the university having an engineering school and a school of commerce, each teaching management and each under the necessity of working out its specialized but coordinated and economical effort toward one common purpose? Then any school of commerce not in juxtaposition to a school of engineering, and any school of engineering not in juxtaposition to a school of commerce, can define its particular purpose and organize for achievement in terms of deviation from a standard of engineering-academic cooperation which has been established under most favorable conditions.

Industry is a large and complicated social institution with many and diverse elements; but elements which, however diverse, are functionally related and more or less in functional balance. And in this diversity of elements any medium-size enterprise is an epitome of the whole of industry. Within the range of elements in enterprise are the design of product, the invention and utilization of technical processing equipment, the control of processing, the determination of market requirements and tendencies, the utilization of social instruments such as transportation and banking, the problems of taxation, political influence, and human relations. Among these elements are constants which may be brought under control, and also many variables which cannot be brought under control, but with respect to which, perhaps, probabilities may be established. There are elements emphasizing knowledge of things, others emphasizing knowledge of human nature, and still others emphasizing knowledge of social customs. Surely the range of diversity