

difficulties and the discussion will in all probability be carried over the heads of and beyond those who are supposed to profit by it.

Scholarship should be a prerequisite for teaching. Only one who is an up-to-date, first-hand authority on the subject he teaches can win and maintain the confidence of students. This necessitates a certain amount of research and writing. Through such activities the teacher not only extends his knowledge, but maintains a perennial freshness and interest in what is perhaps no more than a narrow specialty. Danger to the effectiveness of the institution as a teaching organization, however, lurks in the effort to carry on a great deal of research or writing. An eminent professor, upon outlining the various researches that he proposed to carry on during the approaching session of college, was asked what he would do with his students. "Neglect them," he replied. Little objection could be raised to investigations respecting the effectiveness of various methods of teaching and much of this legitimate form of research is now being undertaken by engineering instructors. An evil also exists in the practice, happily not widespread, of institutions urging young and immature instructors to write text-books with one eye on the advertising value to be derived therefrom.

No one should attempt to teach engineering subjects without enough experience in engineering to convince his students that he possesses more than book-knowledge of that which he teaches. As an adviser, he must have a knowledge of various fields, sufficient at least to give perspective. Much has been said concerning the engagement of practicing engineers as instructors on "part time." Engineering experience, as against a communicable knowledge of theoretical principles, as a qualification for effective teaching in a technical college, is losing its hold as a fetish. Directing a squad of draftsmen or keeping a contingent of contractors out of each other's way is not precisely the training that is most useful in enabling a man to impart a knowledge of the great fundamentals of engineering science. Teaching is a vocation requiring special fitness and special training quite as much as any other calling. An engineer of vast experience may be quite useless as an instructor. There is too great a disposition on the part of those who are called in from the field to teach to present the subject in a bewildering maze of detail. Their traffic with fundamental principles occurred so long ago that they have half forgotten that such exist. What they give to their students, therefore, are details, short-cuts, approximations and serviceable turns in the practical execution of work in office and field. The maintenance of a private practice of any considerable extent is, so far as its aid to teaching is concerned, of doubtful value. Not even the engineering professor can serve two masters. The advertising value to the institution does not compensate for the loss of personal contact with students inevitable with such an arrangement. So long as the major interest of the teacher is his students, the college will profit by allowing, or perhaps encouraging, private practice, but when academic duties are performed in time not otherwise occupied, the college is the loser.

Personal qualities of a high order are rightfully demanded of a teacher. His sympathies must be wide and his appeal to the student must be many-sided. In enthusiasm, however, is found his greatest source of power. Without it, he will be a failure, no matter what his other qualifications may be. Dean Orton, of the Ohio State University, has expressively put it in his remark that "About all a teacher is good for anyway is to 'enthuse' boys."

Good teachers can neither be obtained nor retained without inducements other than the opportunity for service—compelling though that may be to an idealist. The desire for a salary adequate to the position should be pardoned. Reduction of clerical and routine work to a minimum is highly desirable for one whose chief asset is his freshness and enthusiasm. Appointments, promotions and rewards must be based on capacity for the particular service required. If teaching is the service desired, let rewards be governed by ability to teach and not by demonstrated ability as an engineer, an original investigator or a writer.

Co-operation among teachers will profoundly minister to the effectiveness of instruction. Without it, the results achieved by one may be offset by another. There must be "give and take" in the matter of inter-relation of courses. Mutual help in faculty seminars and conferences is desirable.

Administration.—Since we teach not as individuals but as institutions, constant direction of both staff and students by a central authority is a necessity. For the good of the college and the effectiveness of its teaching no teacher should be permitted to carry an overload. His personal power with students depends, to a remarkable degree, on his enthusiasm, freshness and elasticity, and these cannot be maintained under a burden of overwork. Leisure is the one thing that the teacher should not be permitted to forego. There is, too, such a thing as a student load. The administrative head should assure himself that it, as well as the staff load, is not excessive. Much attention is now being given to such matters as the length, inter-relation and balancing of courses, the length and frequency of lecture, recitation and laboratory periods, the size of classes, the part of the day utilized, and allied problems vitally affecting the student. A halt has been called in the institution of graduate courses in engineering as a result of the indifferent success of the Harvard graduate school, and the action of the Johns Hopkins University in the establishing of a four-year undergraduate course with the provision for graduate work later is indicative of the tendency in this matter. A pronounced reaction against specialization is now in evidence. But little election is allowed in the new course at Johns Hopkins, and many educators are inclined to favor the attitude of such institutions as the University of Pennsylvania, which, for example, requires all students in civil engineering to take the same course.

Indications of Change.—Indications of profound change in the methods of engineering education are not wanting. Dean Gardner C. Anthony, in his presidential address to the Society for the Promotion of Engineering Education at Princeton, declared that the pendulum had reached the extreme position in its swing toward vocational training. The committee on Entrance Requirements of this society put themselves on record as deprecating the acceptance by engineering colleges of more than two Carnegie units of time devoted to manual training. The Johns Hopkins University designedly omitted shop work, foundry work and manual training from the curriculum. The University of Washington has completely revised its courses in the direction of greater attention to cultural studies. The three-year preparatory course for entrance to Columbia has already been mentioned. There appears to be, on every hand, ample evidence of a coming liberalization of engineering education. The ideal of ex-President Charles W. Eliot is more generally accepted than ever before: "Education for efficiency must not be materialistic, prosaic or utilitarian: it must be idealistic, humane and passionate, or it will not win its goal."