In 1946 Mr. K.S. Lennie, of Sydney Technical College, conducted a survey of opinion on Professional Engineering Education in Australia. He submitted a questionnaire to 200 representative individuals concerned with engineering including graduate and non-graduate engineers, senior and junior engineers, university and technical college teachers, and industrialists, government and private, representing both civil and mechanical engineering. Replies were received from 41% of those approached, and from an analysis of those replies the conclusions were reached which are presented in Mr. Lennie's own words in the following pages.

The full text of Mr. Lennie's report, including the detailed analysis of the replies, may be referred to at the A.C.E.R. offices, or by direct reference to Mr. Lennie.

MARCH, 1947.
THE DESIRABLE SYSTEM OF ENGINEERING EDUCATION.

If we were to base our future system of engineering education on the desires of the respondents to this Questionnaire, that system would not involve some new and dramatic departure but would be a modification or refinement of our existing system. Let us suppose these opinions have become future realities and let us see what kind of education system will then be available.

The boy, then, who in future years aspires to become a professional engineer, must realise that as well as becoming a specialist in a particular branch of engineering there is an even chance of his becoming an administrator also at some period of his professional career. His studies and education must therefore be so fashioned that he can adopt either of these habits.

Whereas some students will adopt such specialised branches of the profession as chemical and aeronautical engineering, the vast majority will do either mechanical, electrical, or civil engineering as their basic course.

(a) Pre-Engineering Education.

In future years, an engineer will begin preparing for his engineering studies by attending a secondary school full time, transferring to the engineering school at the 5th. or possibly the 6th. secondary year. As a second preference he might do a trade apprenticeship before starting his engineering course.

The compulsory subjects in his school course will be mathematics, English and science, together with some electives from among drawing, (or art), a modern language, geography, history, commercial principles, or trade theory and practice. He would probably NOT do a classical language.

Before starting his engineering course he may spend a period gaining practical experience (probably without studying), but for preference he will throw his full energies into his engineering education as soon as he leaves school. Although he may get a job and tackle a part-time evening course he will be best advised to do a "sandwich" course consisting of alternating periods of study and work in Industry.

(b) Engineering Schools.

In that future desirable system of engineering education the prospective engineering student will be offered, as at present, two types of initial engineering schools: the Technical College and the University. His choice will depend largely on the type or grade of engineer he wishes to become, always remembering the fact that good (and bad) engineers will always be turned out in varying proportions by both schools. If he is to be a tradesman or foreman, a technical assistant, or design draftsman, then he will preferably attend the Technical College, but if he is to be an engineer-scientist, a senior administrator, or a manager, he will generally attend the University.

In future years a new type of institution which we may call a "Regional Technical College" or perhaps an "Institute of Technology" will appear. Its purpose will be mainly to carry on above the Technical College and the University to higher studies in technological applications. This institution will not encroach on the Bachelor degree course of the University and will leave the latter to cover scientific principles of engineering. It will, however, allow Technical College diploma to carry on and get a degree and will also cater for an amount of applied research of a high standard. Scientific research will still, of course, be the function of the University. Professional and semi-professional grades of engineers of all categories will attend this institution but tradesmen and foremen will rarely take its courses. (It is interesting that 82% of those who answered this question held the view that such an institution should be established --- surely a formidable weight of opinion!)
According to the respondents to this survey these future engineering schools will all possess libraries, picture projection facilities, typed lecture notes, student societies, and an appointments board. Travelling and post-graduate scholarships and groups of professional engineering institutions will be found at the University and "Regional Technical College" but will not necessarily be found in a Technical College. Museums and vocational guidance facilities will be available in limited measure at all three types of engineering school.

(c) The Staff.

The staff of these future engineering schools will all have some professional qualification: for Technical College, a Bachelor degree or a Diploma; for the "Regional Technical College", a Bachelor or higher degree; and for University a higher degree with perhaps some of the staff merely Bachelors. Most of these lecturers will have some degree of training in "education" and will be in close contact with the "profession", by virtue of their membership of a professional institution. Previous experience in Industry will be an essential qualification even at the University level and a regular return to Industry for refresher experience will be desirable but not essential.

Part-time lecturers in our scheme will be men experienced in Industry. Those at Technical College will have a Diploma and some will have a Bachelor degree, while those at the "Regional Technical Colleges" and at University will be Bachelors with a sprinkling of men holding higher degrees. Most part-time lecturers will have some training in "education" and will be members of a professional engineering institution, showing that they are interested in their profession.

(d) The Length and Nature of the Courses.

There is an even chance that an engineer will become an administrator at some stage of his career. Accordingly the college or university of the future may have some alternative courses for engineer-managers and for engineer-scientists. The curriculum will also be broadened by the omission of some of the specialised work and some of the higher aspects of mathematics and science at present included in the engineering course, to allow for the inclusion of the subjects of management, engineering economics, English expression, and engineering ethics, with perhaps a little time spent on research principles and practice, economics, and sociology. Political and military science would have a negligible place in the courses. We might even find that the length of the future courses will have to be extended by one year to include these subjects. As an alternative they might be provided as post-graduate courses or as discussion courses during the academic year or during the summer vacation.

In general, the three types of schools of engineering will have basic as well as specialised training but the University will have more of the broad and basic training and the other institutions will cover more of the specialised work.

The length of courses will be at least as long as at present and in some cases a year or so longer. A full-time diploma will take 3 to 4 years and a full-time degree 4 to 5 years. A part-time diploma will take 4 to 6 years and a part-time degree (if such a thing is available) will take 4 to 7 years.

GENERAL

In recent years there have been a number of discussions and enquiries into engineering education at the professional level and perhaps those which represent the greatest area of informed opinion are those of The Institution of Mechanical Engineers (1), The Institution of Electrical Engineers (2), The Institution of Engineers, Australia (3), The Ministry of Education, London (4) and The Society for the Promotion of Engineering Education (5).
A perusal of this literature will reveal that, except in certain details, the views expressed by Australian engineers, industrialists, and educationalists as revealed by the present survey, are in general accord with the views of their counterparts overseas. We may further say that, "despite a wide range of criticism, comment, and suggestion, there was general agreement that no drastic changes were called for in the system of training, although there was considerable scope for improvement in detail". (6)

However, it is hoped that the results of this survey will have the effect of giving those engineers and educators who aim to improve our engineering educational system in these details, a confidence that their ideas are backed by a majority of interested and informed opinion, and will enable them to push forward more resolutely towards the achievement of their aims. It is also hoped that this survey will only be the beginning of a series of such enquiries carried out more extensively and with improvements when compared with the present one. These will have the dual effect of informing educators of the needs and wants of the educated and of increasing the amount of thought given to these matters by the respondents whose opinions will gradually carry more and more weight for this reason.

REFERENCE LIST


(5) Engineering Education after the War : "Mechanical Engineering" (June 1944) - being Report of Committee of the Society for Promotion of Engineering Education.