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# Educating our Future

When the Finniston Report[1] was published it was greeted with enthusiasm by most engineers, both for its own sake and for the opportunity it presented for a radical re-organization of the engineering profession. Implementation of 'Finniston' has largely had to await the formation of The Engineering Council, which recently has taken over some of the activities of the Council of Engineering Institutions, in particular the Board for Engineering Registration, and is clearly intended to be the 'engine of change'.

The Engineering Council and its initiatives are attracting widespread attention because on them depend the well-being of Engineers and Engineering in this country for the foreseeable future. If the present opportunity of reform is not seized and used wisely there will be no second chance for the next decade at least.

One of the important statements recently issued by The Engineering Council is that relating to Undergraduate Engineering Degree Courses.[2] This indication of the policy that the Council intends to follow has been widely disseminated in the press and public media and will be no more than summarized here. Briefly the two main recommendations are that: (a) the main body of professional engineers should be educated on enhanced degree courses of three years' full-time duration (or the equivalent) and (b) a smaller proportion of engineers (for the time being 20% in universities, 10% in polytechnics) should undertake extended courses lasting four years (four and a half or five years for sandwich courses).

How these proposals will be put into effect has not yet been decided but the problems posed are not easy ones to resolve. For example, the enhanced courses are to be technologically broad, multidisciplinary, and are to include the engineering applications elements EA1 and EA2 described by 'Finniston'. How, and where, are the facilities for EA1 and EA2 to be provided? One estimate of the likely cost for the university sector alone is £20,000,000 p.a.—but will the necessary financial support be forthcoming? Obviously the various changes needed will not be introduced overnight, but even over a period of, say, five years the additional resources required for the applications elements are considerable.

Another question arises over the definition of what is meant by 'broad and interdisciplinary'. Should the enhanced courses be of the broad engineering science nature, with elements of civil, mechanical electrical and electronic engineering, including some design, manufacture, construction and maintenance—as well as EA1 and EA2—all to be covered in three years? I hope not, since the coverage will inevitably be so shallow as to be of little value to any but the most able of students. In my view the majority would quickly lose motivation and opt for more clearly constructed (and therefore non-accredited?) courses, possibly outside engineering. The greater number of engineering degree courses in this country, indeed in any country, are in one of the major disciplines. The strength of student preference (and even educators must pay some attention to marketing their products) is reflected in the figures for the university sector of 23,500 students on major disciplinary courses and 2000 on engineering science courses. Let us take science as an example. Whilst there is a discipline and attitude of mind characteristic of scientists, undergraduate courses are nevertheless mainly in physics, or chemistry, or biology, or geology and so on. There are none in 'Science'. Engineering also has its own viewpoint and attitude of mind which is quite different from that of science. Similarly there is no discrete unified subject but a whole variety of them encompassing electronics, civil engineering, aeronautical engineering and the like. It seems to me that, above all, a professional education must provide experience in tackling challenging and difficult problems. This can best be done by studying a subject in depth but that does not imply the exposure needs to be limited to a narrow blinkered front.

The situation has been eloquently and forcibly expressed by Lord Ashby[3] who wrote—

'The habit of apprehending a technology in its completeness: this is the essence of technological humanism, and this is what we should expect education in higher technology to achieve. I believe it could be achieved by making specialist studies (whatever they are: metallurgy or dentistry or Norse philology) the core around which are grouped liberal studies which are relevant to these specialist studies. But they must be relevant; the path to culture should be through a man's specialism, not by-passing it. Suppose a student decides to take up the study of brewing: his way to acquire general culture is not by diluting his brewing courses with popular lectures on architecture, social history and ethics, but by making brewing the core of his studies. The *sine qua non* for a man who desires to be cultured is a deep and enduring enthusiasm to do one thing excellently. So there must first of all be an assurance that the student genuinely wants to make beer. From this it is a natural step to the study of biology, microbiology, and chemistry: all subjects which can be studied not as techniques to be practised but as ideas to be understood.

As his studies gain momentum the student could, by skilful teaching, be made interested in the economics of marketing beer, in public-houses, in their design and architecture; or in the history of beer-drinking from the time of the early Egyptian inscriptions, and so in social history; or in the unhappy moral effects of drinking too much beer, and so in religion and ethics. A student who can weave his technology into the fabric of society can claim to have a liberal education; a student who cannot weave his technology into the fabric of society cannot claim even to be a good technologist'.

The incentive for universities and colleges to modify their courses to the requirements of The Engineering Council will be that of accreditation. The details of the accreditation process have yet to be discussed but the professional institutions (or groups of them) which undertake the task on behalf of the Council will be expected to assess the practical (i.e. EA1 and EA2), as well as the educational, elements. A number of institutions already have considerable experience of accreditation, as do the CNAA and the relevant Industrial Training Boards. It is to be hoped, of course, that in defining the requirements for engineering applications the needs of electronic engineers will be recognized as being distinctly different from those of some other engineering disciplines.

The actual designation of courses is not in the hands of The Engineering Council but is decided by the universities and colleges individually. At present there is no commonly accepted title for an engineering degree, those used varying through the range, BSc, BSc (Eng), B Eng, BA and even MA. It would be convenient for all accredited degree designations to follow the Council's suggestions but not essential. Certain well-known establishments might be reluctant to change overnight the customs of 500 years!

Nothing is said in the Council's statement about ordinary degrees, which will not be automatically excluded from consideration for accreditation. Initially, at least, the Board for Engineering Registration is expected to implement the existing CEI standards. However as the criteria become clarified and (re)defined, the standards applied might well be raised. The first task of the Council is to ensure that the main structure is sufficiently sound to stand the strains to which it will undoubtedly be exposed. Nevertheless there is a strong intention also to make it flexible, providing the opportunity through 'bridges and ladders' for entry into the profession through non-standard routes.

Problems of accreditation have arisen in the past over multidisciplinary degrees. Thus some engineering science curricula have had to be modified to reflect the perceived requirements of particular institutions. The problem can be highlighted by posing the question—'Should a broad engineering science degree be capable of accreditation by all major institutions, or none of them? The situation will have to be handled with care and sensitivity. Whilst the Council will be cognizant of the requirements for corporate membership of individual institutions, some dialogue and modification may be necessary to reflect the Council's criteria for inclusion on the Register. This may apply as much to normal degrees as to multidisciplinary ones. It is anticipated that the Board for Engineers' Registration, with its overview of the five Executive Group Committees, will formulate appropriate guidelines for Chartered Engineer status.

It is generally recognized that in addition to the need for an increased number of qualified engineers a significant proportion of them should be educated to a higher level. Both the breadth of education (up to the age of 18), as well as the depth (post-18), of engineers in Europe, Japan and elsewhere puts ours to shame. The Engineering Council therefore recommends an increase in the number of four-year, i.e. extended, degree courses by initially a modest amount until the value of them can be properly assessed. An associated problem to be faced is whether all engineering schools should be able to offer extended courses or whether they should be restricted to a few establishments where adequate resources can be concentrated. The latter approach is being taken in the public sector but individual universities have so far been making the decision for themselves. The fear is that those schools not offering extended courses will be regarded as second-class institutions from which resources will gradually be withdrawn. Is it realistic, for example, to imagine a scenario in which the best students from a department not engaged in extended courses are transferred, after two years say, to one in another part of the country that is? I think not.

Clearly there are difficult problems ahead but good engineers are used to that. Equally clearly there are tremendous opportunities to be grasped if we can demonstrate the courage, co-operation and common sense to do so. It is essential to set our sights on UK Ltd., to abjure parochialism and to take the strategic view for the common good. If as professional engineers we fail there will only be ourselves to blame and our successors will not easily forgive us.

W. A. GAMBLING

**References**


1 'Engineering Our Future', Cmnd 7794, HMSO 1980.
2 'Statement on Enhanced and Extended Undergraduate Engineering Degree Courses'. The Engineering Council, August 1983.
3 Ashby, E., 'Technology and the Academics', p. 118 (Macmillan, London, 1963).



*Professor Alec Gambling, DSc, FEng, FRS, is a member of the Engineering Council and of its Education and Training Committee. He is British Telecom Professor of Optical Communication at the University of Southampton and was President of the IERE in 1977/78.*