

But it is the myopia of British managements as much as the shortage of supply that has prevented qualified scientists and engineers (QSEs) from permeating the functions of production and, above all, marketing, where their presence—if the American example is anything to go by—is essential to innovation. Basic research is but one part of the process of innovation, and is often the least significant financially, yet British industry seems to use only half as many professionally qualified people in production and marketing as does Germany. A recent survey showed that in large British companies (over £5 million capital value) only 8.5 per cent of directors have scientific or technical qualifications. There is, however, evidence to show that the profitability is correlated with the proportion of QSEs among the executives.

The Central Advisory Council makes a number of specific recommendations for redressing the imbalance of QSEs and promoting effective technological innovation. First, newly qualified scientists and engineers should be encouraged into production and marketing, as opposed to merely research and development. "This could be done partly through the negative measure of reducing the number of research grants made by Government institutions to new graduates, and by concentrating the support for work in Government establishments on projects which are related to foreseeable production." Second, Government establishments whose original purpose no longer justifies their present scale of effort should be further run down unless they can provide services for industry. "Any measure," the report explains, "which will help to get the pattern of our scientific, technological and manufacturing efforts into balance will pay in the long term." Government research establishments could also help by acting on a commercial basis as agencies for private industry, both in research and development and in the later stage of the innovation chain. The report also recommends that, where appropriate, royalty rights should be purchased from overseas in order to release scarce scientific manpower for production and marketing.

The Brookings report (see *Nature*, 219, 105; 1968) arrived at a similar diagnosis from a different approach. In the section on science and technology, Merton J. Peck of Yale University observes that Britain has traditionally operated the economy with proportionately fewer engineers than the United States. The shortage of engineers has to some extent been remedied by the substitution of scientists and non-professional technicians, which is one reason why the demand for engineers, as expressed in the salary structure, is less than would be expected.

#### BRITISH SCHOOLS

### Yet Another Examination

THE debate on ways of improving the sixth form course continued this week with a working paper from the Schools Council on sixth form examination methods and a view from the Headmasters' Conference of the sixth form of the future. The Schools Council has also announced the names of the thirteen people who will make up the working party on sixth form work for those not seeking higher education. First announced in March (see *Nature*, 217, 1199), the working party

will safeguard the interests of the not-so-academic sixth formers and will work in conjunction with the joint working party of the council and the Standing Conference on University Entrance which is looking into proposals for broadening the curriculum. The new working party, which has appointed Dr E. W. Briault, deputy education officer for the Inner London Education Authority, as chairman, will shortly begin to hear evidence from interested parties such as prospective employers.

The collected opinions of headmasters are easily accessible, in that *The Sixth Form of the Future* (Headmasters Association, 5s.) covers both the field Dr Briault and his colleagues will be studying and the overall pattern of sixth form courses. Although it does not claim to submit firm recommendations, the headmasters' report sets out the historical development of the present highly specialized sixth form and, bearing in mind the likely composition of future sixth forms and proposals already made, goes on to produce its "preferred solution"—yet another GCE examination.

Called the "Intermediate Level", this examination would come between O-level and A-level, and is conceived of as differing from A-level in the amount of ground covered rather than in the academic standard. The headmasters believe this new examination will allow for the inevitable development of additional curricula patterns and will provide a final examination for the increasing number of students who would not otherwise reach A-level. This very proposal was rejected by the Secondary Schools Examination Council ten years ago, but the headmasters' report suggests that circumstances have changed sufficiently for it to be reconsidered. Although the fine detail of the proposal has not been worked out—and this is admitted to be beyond the scope of the headmasters' resources—the headmasters want to add to the GCE examinations, with the proviso that new examining techniques would be an improvement. The Schools Council *Working Paper 20* (HMSO, 3s. 6d.) discusses the various possible reforms and includes a firm denunciation of existing methods from the Welsh Committee of the Schools Council. This is then appraised by the individual subject committees of the council and capped by an equally firm statement of faith in existing examination methods from two secretaries of GCE boards. The Welsh Committee seeks an alternative to the present external examinations, which lead to pointless cramming, hasty regurgitation of predigested answers and the resulting narrowing of the sixth form studies. More assessment by teachers is at the centre of the Welsh Committee's proposals, with oral tests in most subjects. The problem of external moderation in examinations for university selection would be assisted by aptitude tests if these were found to be acceptable by the vice-chancellors' investigation now in progress. The *Abitur*, an internal school examination in Germany, is held up by the Welsh Committee as an example of the way in which a pupil's ability to think can be tested, but the subject committees are more sceptical of its qualities. On the other proposals, the views of the subject committees vary, with scientists and mathematicians seeing no need for oral tests. The suggestions for more examination aids (such as books) and more time for answering the papers had a mixed reception from the subject committees. The craft, applied science and technology committee of the

Schools Council did, however, consider the Welsh proposals directly relevant to engineering.

#### METRICATION

## Slow Change for Schools

THE most important questions raised at the Royal Society's conference on metrication in schools on September 19 were those of responsibility—who should be responsible for deciding when metric and specifically SI (le Système International) units should be used in schools and in teacher training colleges? When should the examination boards set questions in SI units? Who should advise manufacturers of school equipment what to make and when, and publishers what to publish and how soon? The conference last week was a sequel to that held on March 20 (*Nature*, **217**, 1205; 1968) at which the delegates—chiefly school teachers and members of the examinations boards—recommended that SI units be used exclusively in public examinations in mathematics and science not later than June 1972, and that in primary schools there should be a change of emphasis in favour of the metric system of weights and measures from September 1969.

Some progress has been made since then. The Royal Society has prepared draft pamphlets on metrication in primary and secondary schools which are intended chiefly as guides for teachers. At the conference, the pamphlet for primary teachers was criticized for its unimaginative layout and general dullness. It will have to be revised, but both pamphlets should be ready for publication fairly soon. Meanwhile, the Schools Council has already published *A Teaching Guide for the Introduction of Decimal Currency and the Adoption of Metric Measures* (HMSO, 4s.) which discusses, somewhat coyly, a selection of relevant classroom experiences and gives some useful practical advice to teachers. Mr C. G. Nobbs of the mathematics committee of the Schools Council stressed that the council will act only in an advisory capacity and will not attempt to dictate policy.

The English examinations boards have still not finally committed themselves to the dates when they will be using SI units exclusively, but GCE O and A-level papers will probably be metric by about 1971–72. Most examinations boards will set alternative sets of papers in technical subjects for an interim period between about 1970 and 1974. The Scottish examinations boards are a step ahead. They intend that SI units should be used exclusively from 1972 in ordinary examinations and from 1973 in higher certificate examinations.

For the rest, a great amount of sporadic activity seems under way. Mr R. Jardine of the Ministry of Technology reminded the conference that the Committee on Metrication of which he is secretary has already asked for the setting up of a metrication board to plan for the next step after decimalization of the coinage. Then the Royal Society has prepared a draft report on the use of units and symbols in physics and chemistry, and the Association of Science Education is well ahead with plans to publish a simplified version for teachers. The biggest uncertainty is to know how quickly and fully the schools will be able to adopt these new proposals now that they have been asked to keep any increase in their budgets to within three per cent.

#### MEDICAL EDUCATION

## Students Echo Todd

from our Social Medicine Correspondent

WHILE the medical students in Paris continue to press vigorously for the postponement of examinations and the right to work in hospitals, medical students in Britain are quietly spelling out the changes they would like to see in medical education. The latest publication of the British Medical Students' Association (to which 95 per cent of medical students belong) is a welcome addition to the literature of this subject, for until now it had largely been the teachers and administrators who have decided what direction these changes will take. To be sure, the report sometimes criticizes certain aspects of the current syllabus without suggesting workable alternatives, but it will be welcomed, if only because it reflects a genuine desire of students to infuse and re-kindle an aspect of medicine which has remained virtually static over the past 100 years. Nobody should be put off by the Marcusean reaffirmation of the belief of the International Federation of Medical Student Associations that "the opportunity for medical students to contribute actively in bringing reform and change in medical education is a fundamental right in any democratic system."

What the British students would like to see is a closer link between preclinical subjects and their clinical relevance in patients. They ask for more integration of subjects, less duplication in badly planned curricula and, most of all, an opportunity to feel that they are actively contributing to the care of patients. Planning and conduct of the medical curriculum should be entrusted to a Statutory Curriculum Committee similar to that proposed for the new medical school at Nottingham. This would include senior and junior members of staff from preclinical and clinical departments as well as student representatives. The chief objective of this committee would be the fullest integration of teaching material. The students also ask that more attention should be paid to the general principles of science with the objective of encouraging an understanding of scientific method and technique which can be applied later in medicine. This ideal of an undergraduate course designed to produce "educable" young people able to keep on learning echoes one of the conclusions of the Todd Commission on Medical Education (*Nature*, **218**, 121; 1968).

The students' report says, for example, that the number of hours devoted to anatomy could be reduced. Practical work would be done with greater enthusiasm if it were related to practical medical problems and if less time were spent on repetitive experiments of the "cookery book" type. The emphasis in the report on the importance of research is encouraging. The general feeling seems to be that the second MB in its present form should be abolished and replaced by several examinations placed periodically throughout the course, with continuous assessment of the standard of the students' work between examinations. This problem of assessment is not, of course, peculiar to medical students, and the solution may well come from outside the medical profession.

To ease the load in teaching hospitals and to give clinical students a chance to see some of the more common complaints, it is suggested that students