

Virtues of small universities

SIR — The continuing shortage of funds for research in science (and engineering) and the undoubted need to be selective in the distribution of those funds that are available has raised again the idea of a super-league of 'research universities', establishments that are alone able to pursue research across a wide range of subjects.

But I should like to mention some of the hazards, particularly in view of the impending transition of the polytechnics to university status and the transfer to research councils of some of the funds for research in universities previously handled by the Universities Funding Council (more than £100 million per annum). These changes will certainly increase the competition for research funds.

Of the research councils, the Science and Engineering Council has by far the biggest budget and its chairman, Sir Mark Richmond, is a strong proponent of the idea of "a cohort of research universities" (see, for example, *Nature* 353, 379; 1991).

Although in some branches of some subjects very large groups and infrastructures are required and these can perhaps best be provided by large universities, most research is not in this category and small groups (even single individuals) are more the norm. Such groups can flourish in universities of very different sizes.

A relevant and very obvious reason for distributing much of our research effort is the importance of at least some of each undergraduate's teachers being exposed to research. Although all researchers are by no means good teachers, the enthusiasm shown by a committed researcher is invariably contagious, not to mention the value of teachers of advanced courses being up to date.

Even in the areas of big science where big supporting facilities are required, these are often being provided outside individual universities. No doubt this trend will continue. A prominent example is in astronomy, where the necessary large telescopes are provided nationally, or more often internationally, on remote mountain tops. Research groups in small universities are just as likely to succeed with their research projects using these telescopes as those from larger institutions. Peer review of applications for observing time, or for the construction of the necessary sophisticated instrumentation, ensures that quality is maintained.

A crucial point of growing importance in scientific research in general relates to the analysis and interpretation of ex-

perimental data and to the related area of 'theory'. To achieve a sensible scientific return from the effort devoted to the collection of data from the big 'machines', whether accelerators, synchrotron sources, telescopes, satellites or whatever, wide dissemination is vital. Ease of communication means that even small groups need not feel isolated. Indeed, small groups may be superior in this area to those whose resources are inevitably stretched to provide the hardware. A balance is surely called for.

Another reason for setting our face against over-concentration of research in a small number of universities is the resulting stagnation that would occur. 'Selectivity' by all means, but let us have competition — group against group. The virtues of large universities, where they exist, will shine through automatically in their groups having the stronger case for support.

What, in fact, are the perceived advantages of the large universities and how valid are they?

(1) Large universities have better facilities in the form of workshops, computing, libraries and so on. This is partly true but the increasing specialization of workshops (which means that small establishments with important research groups can have matchless facilities), the increasing general availability of powerful computing networks and the increasing use of easily accessible databases nullify many of the advantages.

(2) Large universities have stronger interdepartmental connections. Administrators like to think this but the facts are often otherwise. Interdepartmental rivalries often militate against really effective collaboration. The efficiency of Interdisciplinary Research Centres where the constituent departments are drawn from different (not large) universities shows that associations of small institutions can be very effective.

(3) Large universities can offer 'economies of scale', the most important of which probably relates to the question of the competition for an academic researcher's time. In big universities, unless there has been undue fragmentation of undergraduate courses, big departments have staff who spend less time on non-research activities. In small universities, or more particularly, in small departments, teaching and administrative duties can make excessive demands on an academic's time. The remedy is straightforward: small universities with research aspirations should endeavour to concentrate their teaching on a limited number of well-structured courses. A plethora of 'options' should be eschewed. With undergraduates being

educated over a wide base, on entry, but to less depth than hitherto, fewer options rather than more should be the order of the day.

The requirements for a healthy research effort in a small university appear to be the following:

- (i) Choice of research topics to fit the criteria of departmental and group size;
- (ii) Concentration of resources on departments/groups that demonstrate their ability and suitability;
- (iii) A realistic attitude to the need to secure adequate time for research.

If these conditions are met, I can see no reason why a small university should not have almost as big a fraction of its staff actively engaged in front-rank research as any large university.

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Text readability

SIR — What Donald Hayes says (*Nature* 356, 739; 1992) about the relative readability of texts is fallacious. The purpose of language is to convey meaning and this is not related to the number of words used but to the precision with which the symbols convey meaning.

The definition of a mathematical concept such as a vector space is the same in all languages and is extremely precise. It does not have the multivalent meanings attached to words. Once the barrier to entry is passed, the mathematical expression is very much simpler than the confused discourse of philosophers and journalists.

In the *Times Literary Supplement* of 8 May 1992, page 12, the mathematical term 'parameter', to which mathematicians assign a one-valued meaning, was used by a cabinet secretary in several impenetrable different senses, possibly as meaning 'limits', 'criteria' or 'considerations'. In the medical literature, the word is used for 'variables', 'constants', 'conditions' or for 'just damned fate'.

Another factor in readability of texts is what one inserts from outside sources. The specialization of knowledge makes reading a cryptic art for those outside. In other words, readability cannot be measured because it is a function of transference from other sources than the particular text. Obvious examples occur in law. The opinions of the judges are replete with reference such as: "the ratio decidendi of Dickson C. J. in *R. v. Martineau*."

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