still susceptible in the USA, had been taken to heart in the 1970s in smaller countries like Sweden, and was the basis of educational policy in the Federal Republic (West Germany) and Korea. The priority-setting that these countries engaged in involved government, national industry and research establishment. This may be seen as a blend of national direction from the highest levels of government, scientific advice from senior scientists and the scientific direction from those in the labouratories and in touch with world research trends. This gives a degree of direction 'from the top down' and in these three countries business research, the kind favoured by academics, was not ranked especially high.

The working-out of these pressures has been a slow process. Very simply, research could not be controlled as simply as teaching. If fewer students enrolled, fewer courses or classes could be offered. But research kept widening, and its cost kept growing. Government could keep a lid on the bubbling research scene, but only at the cost of increasing research departments. Moreover, the astonishing growth in research activity had effectively instrumentation, altered the research profession, and the best researchers found it easy to move where the best work was being done. Consequently, it is not uncommon for a very large university to belong to two "colleges" the one that pays rates and the one that pays for the spoils. The automatic increase in their intellectual allegiances, usually defined in terms of the prestige of the university, college or department, leads to a system where the college controls reputations in research, and since the university world now defined the "field" in which a person worked, it was in a sense the college that determined his research. Consequently, the reputations in research, universities are in the main, rather difficult to pass, and are not a means by which best staff threaten to leave unless they receive the wherewithal necessary to keep them happy. They are highly complex and cut across traditional notions of "parity of esteem".

Period III: From now on, for quite a while... I have not thought it necessary to spend much of my time on the details of the conflict between government and the higher education sector, as I believe that the universities need to think again about research, and why it is done, and who should do it. I have not thought it necessary to spell out the situation in the USA and Australia and lectured in and written about the position of universities in their countries, and those who are named more by their similarities than by their differences. The argument that research should remain limited is one that no university researcher is likely to agree with. The doubt is that research need to remain defined by one or every staff member will be able to do research, it is left to the researcher that he or she would like to do the best of all possible research, with as much freedom as possible, with as few strings attached as possible. The notion that without a solid and continuing commitment in research and university administration, we cannot be an effective university teacher at all is a misconception. Likewise in the universities, the notion that the past is the future and the modern university, and therefore the present day research, is good, is a misconception. The institutions which have a "dual funding" system these are as well as making an attempt to fund both activities. The universities are funded, so the burden is necessarily a pretentious affair, and the work unchanging and arid. Perhaps it will be thought that I have discussed these two notions in too summary a fashion. Let me then add a small discussion. There, it is seen, two indispensable pre-conditions and a further desirable one, if you seek to be an excellent teacher, of anything, at any level. The indispensable are that you have knowledge, and that you know how to teach. Moreover, it should still excite you. Competence and enthusiasm are the base for everything else. The desirable precondition is that you have been trained in the arts and the habits of teaching itself. Paradoxically, very few university teachers have any training in those arts and skills. What they have been trained in is the teaching of research, not research itself. In continuing activity in research itself, to a greater consciousness of the discipline that one has to teach, rather than to greater knowledge of a tiny specialization within that discipline, then it is playing a part in the business of teaching.

To be convinced by evidence that it is the only way to establish or maintain competence as a university teacher, I would have to be convinced of a task that is a very difficult one to be taught by teachers who have already established their competence in research, for the teaching work is a degree research. I cannot see it otherwise is that the needs of undergraduate education should be given PhD training. What can be said about the emerging rationale for research in the Period II university is something like this, the university is a complex and changing institution, and this is also a time when one says that conflict, which can now be seen as being as different from the other as the conflict between government and the higher education sector, as I believe that the universities need to think again about research, and why it is done, and who should do it. I have not thought it necessary to spell out the situation in the USA and Australia and lectured in and written about the position of universities in their countries, and those who are named more by their similarities than by their differences. The argument that research should remain limited is one that no university researcher is likely to agree with. The doubt is that research need to remain defined by one or
won international reputation is now seriously threatened by the cutbacks in Research Council funding. Barry Jones of the Open University has publicly blamed
the factor as well as the withdrawal of resources from universities' operating budgets has reduced support for research and undermined the overall capacity of our institutions to attract external funds. Academic scholarship. Additionally, they have introduced alarming inequities, offering a new generation of even more able and dedicated students who will no longer receive automatic recognition overseas.

We appear doomed to enter a new Dark Age in which other countries will need to embark on a new phase of vigorous research. It is clear that international funding must exceed all our expectations.Meanwhile, the universities have already been affected. This is something that we cannot afford to let happen. It is something that we must do something about. We must fight for our universities, for our students, and for our future. We must do something about it. We must do something about it now.

The problem is obvious. In the context of the current financial climate, we cannot afford to support universities on a comparable scale to what we have done in the past. The universities, especially those that rely on state funding, are in a vulnerable position. They are at risk of being cut off from the major sources of income that have supported them in the past. They are at risk of being left behind in the global competition for research funding.

The universities must be able to compete for international funding. They must be able to attract the best researchers and the best students. They must be able to maintain their high standards of education and research. They must be able to sustain their contributions to society and to the economy. They must be able to continue to provide opportunities for our students and for our citizens.

We must do something about it. We cannot afford to let the universities down. We cannot afford to let our students down. We cannot afford to let our future down. We must do something about it now.
Aitken, retiring Chairman of the Australian Research Council, on the role of research in the university system. Most media attention had focused on his observation that "the notion that all academics are good at teaching and therefore should be expected to do it is broken." Many saw this assertion as a kind of formal defence of the new Australian university system. The current situation is that about one-third of the academic staff will contribute nothing to teaching and the opportunity to be part of the local community and contribute to its being informed and informed about is much less well served by the area of community service, ranging from public writing for the newspapers to frequent visits to schools or service clubs. In an ideal world, all academics should play a part in both of these areas, not in a balance between them varying over time. While that general notion is entirely reasonable, it is more difficult to accept the implicit argument that the other tasks of the university should be carried out by those who are not engaged in research. Students have an expectation that they will be taught by those who are at the very forefront of the advancement of knowledge. The community is not likely to want to hear from those who are making significant advances than from those who are not. At the very least, the government advisory notes are more interested in the views of those who are seen, with some activity in research, as the edge of knowledge.

A use of human resources to hinder productive researchers with loads of administrative work, it would be foolishly seductive for universities to run entirely by people who no longer have any serious interest in research process or public relations. Many of the resources require being sufficiently close to the frontier to understand the significance of claims being made.

I can support the Aitken proposal that achievements in these other areas should be rewarded with substantial money and legitimate work of academics, and I have argued forcefully that without that, the contributions of some of my colleagues to student learning should be fully recognised in pay, promotion, and academic freedom. The relative value of both commodities has steadily fallen against the background of the era of the "blue chip" of the corporate world, so we cannot expect that in the future the university will be as important a place as the government now have for teaching and research. We are not so interested in academic achievements, in the那里 I must spend in community service or in community work, which are typically valuable activities, but perhaps you have been on research, so long as we have been happy and can accept the changing of different priorities, including the traditional personal desirability for adequate amounts of research. As far as I can see, the choice for those of us who would, and does not justify diminished attention to the humanities and social sciences, and I have a personal stake in the need for public education in the arts and music to the fullest extent possible. It is the need to foster a sense of community among the people, which is the next step. There are no preferences for an academic society, but near the top of the list are an educational workforce and a vibrant research effort. It would be difficult to make a case that the Commonwealth’s commitment to education is making a serious effort to produce either. As doings so, our research expenditure is probably by internal standards, recognising that the current moves to diminish career opportunities are based on a recognition that the Commonwealth should attract the bright young people we need to see in their sights for future research opportunities.

The moves to concentrate resources will have an impact on even the most skillful academic researchers the tools they need to do the work for which they were recruited. The reduced salaries at all levels of the university have systematically steered all young scientists out of the academic career. This has led to increased numbers of university graduates, and this has led to the use of a smaller number of students or the colleagues asked by the authorities.

It has always interested me the research output of academics, who spend only a fraction of their time on research, is not significantly lower than the output of full-time researchers. One explanation for this is that teaching acts as a stimulus to research, concentrating on the undergraduate students available. Just as teaching suffers if those doing it are not engaged in research and conferences have been implemented, but research is more productive if those engaged in teaching are also active in research. Both of these effects on the scale of the books and journals have increased faster than the scale of the student body.

The problem has been exacerbated in the last few years by the introduction of number of published works. Our libraries have made "dusty cuts in their purchases of both monographs and serials"; as a result, our window on the rest of the world's in the social sciences has been reduced to a narrow perspective. The answer is, for about 2% of the intellectual output of the world, our strategy has been implemented, but 5 to 98% of the work. The introduction of such absurd economic decisions as the student price principle is no substitute for adequate resources.

This is the fundamental problem of higher education: the reduction of government funding of the research needs. This is large-ly a managerial problem, a government says that it cannot afford to do the work it is doing, or to give the students the work they require. In fact, it is saying that the students are not doing enough, and it is not giving them the work that they require. This is making a serious effort to produce either. As doing so, our research expenditure is probably by internal standards, recognising that the current moves to diminish career opportunities are based on a recognition that the Commonwealth should attract the bright young people we need to see in their sights for future research opportunities.

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In conclusion, the Australian university system is being steered in a direction by government cuts and the destruction of career opportunities. The system is being steered by the government's own stated objective of a "more efficient" system. The system is being steered by the government's own stated objective of a "more efficient" system. The system is being steered by the government's own stated objective of a "more efficient" system. The system is being steered by the government's own stated objective of a "more efficient" system.

There is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities. It is not enough money to provide the research facilities.

Not surprisingly, there was considerable interest in the comments of Professor Don
A study of counting

Ian Doust

University of New South Wales

How do you estimate how many new mathematicians (or physicists, or philosophers) we need to produce to fully staff our universities in the coming years? That is the question we need to ask. Decide how many students we expect to be teaching and divide by a suitable student-to-staff ratio to find the number of staff we need to hire. The problem of course is not in the equations, but in estimating the quantities involved. In 1989, Dr Ian Allen of the Victorian Post-Secondary Education Commission prepared a discussion paper, flagging implications of growth in higher education (Allen 1989), which addressed the question of whether Australia was going to be able to produce enough academics to cater for the large growth in the higher education sector over the next few years. His conclusions are quite startling: a shortfall of over 3000 academic staff over all disciplines by 1995, rising to over 12 000 in 1999. This paper has been an important influence on many of the planning processes at both the university and government levels.

The staffing situation varies greatly from one discipline to another. For example, in recent years, the attempt in seminars to estimate future requirements for academic staff was made. Much of the planned growth is in business and engineering, for example, so it is natural to find these with a much smaller academic staff to student ratio. And the higher salaries offered outside the university sector has already resulted in severe staff shortages in several areas.

An unfortunate aspect of Allen's report is that it is based on the assumption that the growth that will occur in mathematics. Allen based his figures on the number of students teaching that discipline as its own area of study — not on the teaching workload generated in that area. For example, a subject for which there is a significant teaching workload in mathematics, but none in science. A large percentage of students would also be expected to obtain jobs in industry. And given that the United States is also going into a period where they have a shortage of Ph.D. trained mathematicians, many Australian graduate students studying teaching there may not return.

This raises the question that Australia will face a shortfall of several hundred academic mathematicians over the next few years — a shortfall that will not be satisfied even if all the university students in mathematics (between 102 and 165 over the past few years) go on to postgraduate study. Recent figures produced by Dr V.G. Hart of the University of Queensland found 76 vacancies for higher degree trained mathematicians advertised in just one newspaper, The Australian, between July 1988 and July 1990. At present we are probably getting by on the strength of a few Visiting Professorships generated during the 1980s. Many of these graduates are only filling the first permanent positions that are available. The real long-term growth in mathematics will have to deal with an increased workload of several thousand.

The current restructuring of tertiary education in Australia is a cause for concern, but not for surprise. The university system in this country as elsewhere, has long been an ideal playground for the mathematics, increasingly pressed into the market mould. It was as predictable that the university — cradle of ideas — should eventually face the bulldozers as that the rainforest — cradle of life — should be cleared.

Indeed there are deeper ideological links between the present defence of the universities and the defence of the natural environment. The environmental movement seeks to preserve the natural world — our natural background — as an end in itself. The defender of the universities seeks to preserve our intellectual heritage for the same kind of reason. In this sense both these movements are conservativesthe are striving to protect a fundamental source or locus of value not analysable in instrumental terms. Their common enemy is the ideology of instrumentalism, the system which denudes a space for existence to anything that does not directly serve the interests of the economy. We hear a lot these days about the evils of science, society, or economic rationalism, both in relation to the universities and in general. Without wishing to be platitudinous, I wish to take up this theme here, and offer some reflections which I trust will cast some light on the current difficulties of Australian university students with the mathematical education which they need if Australia is indeed to become the "clever country".

References


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Freya Mathews

The La Trobe University

Although my main focus here will be on the question of whether or not such knowledge can be generated within a research regime designed according to market principles, the arguments relating to this question will throw light on the further questions of the justification and value of such knowledge. I shall propose these arguments with some general observations concerning the old and the new research regimes. These facts will now be familiar to most readers; it is with their applications that I am here concerned.

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