HIGHER EDUCATION FUTURES

The Royal Society

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Report of a Royal Society Study Group

The Royal Society
of London

FOREWORD

This report was prepared by a study group of the Royal Society's Council under the chairmanship of Professor Sir Eric Ash, C.B.E., F.Eng., F.R.S. It outlines the steps to be taken by the higher education sector to achieve a high-quality mass participation system: a system through which the broad scientific and technological needs of society as a whole are met, as well as the needs for the future of science and technology.

Higher Education Futures is published as a statement of the Council of the Royal Society to encourage debate among practitioners and policy-makers of higher education. The Society's Council hopes that all in the education system will read and comment on the report, and use its ideas as a basis to develop their thoughts and actions further.

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Professor J.H. Horlock
Vice President and Treasurer
The Royal Society

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PREFACE

The idea that people should be educated to the highest level permitted by their ability has an ancient history and a wide current acceptance. It is an ideal that has its roots in the belief that developing innate gifts is of inherent value—a vital element in the quality of life. It also derives impetus from our evident need for national wealth creation, a task at which nations succeed the better if most members of society have been allowed to achieve their educational potential.

The fact that, in the UK, we are still far from attaining this ideal is accepted by all who have taken even a little time to examine the problem. It is now high on the agenda of all political parties, a circumstance that we recognize as progress; it was not always so. There is a new determination to solve the problem of under-education of large segments of our population—*at least* to the extent that it has been solved in some other European countries.

Bearing in mind that everyone is an expert on education, there is a reasonable measure of convergence on the educational agenda up to the age of 16. Beyond that the opportunities for controversy expand. The Royal Society's report *Beyond GCSE* (1991) was a bold attempt to devise a framework that would encourage a much larger fraction of the population in the age span 16–19, to continue in full-time education, and that would provide a fully stretching educational challenge for students having a very wide ability range. We shall have occasion to refer to this report, and to some other models that have been suggested for this age group. Our task, however, is to advance the debate for the next age group from 19 up to second childhood. We have been asked to paint on a very large canvas! Because the Royal Society wanted us to make some recommendations in reasonable time – and in any event before members of the study group reach the above mentioned age limit – we have restricted our discussion in many respects, some of which may seem arbitrary. Thus we have been concerned primarily with undergraduate taught courses; and have specifically excluded any discussion of research training, of training for the professions such as medical or teacher education, and of continuing education.

As this is an initiative of the Royal Society, it is not surprising that we have had science and technology primarily in mind, though, with the benefit of a past President of the British Academy among our number, we have remembered not only that science is a subset of human culture but also that its pursuit should be seen as contiguous with studies in the humanities and the arts. Yet there has not been any great rapprochement between the two cultures, a situation which for all its apparent recalcitrance should not be allowed to foster the view that nothing can be done.

As in other sectors of education, higher education will attract students with a broad range of interests and abilities. We believe therefore that there is at least as much need for diversity in higher education as in the earlier phases. The need to provide a broad range of educational opportunities will be the greater the more we succeed in what is generally regarded as a prime objective—an enlargement of the segment of the population which participates in higher education.

We begin with a discussion of the purpose of higher education. This question probably needs to be readdressed in every generation, but is

particularly urgent when, as at present, major changes are advocated. In Chapter 2 we consider the routes of access to higher education, asking specifically how one might engender a wider participation.

Chapter 3 is devoted to a discussion of the various higher education structures, and how they might be modified and enhanced. There are current debates about whether 'More Means Different' or 'More Means Worse'. Our aim should be, of course toward the former. However, there is no doubt that, in straining for expansion, particularly in the face of tight financial constraints, the danger of veering to the latter cannot be ignored.

The system needs to be staffed. Proposals for changes in the size and structure of higher education imply a need to consider the staff required to breathe life into the system. This, and a discussion on the ways of ensuring a maintenance of quality, are the themes of Chapter 4.

The financial implications of an enhanced educational system are discussed in Chapter 5. We are particularly concerned with the key question of how the financial load should be distributed between those who benefit directly and those who benefit indirectly.

In a final section we assemble some of the conclusions that we have reached.

Our report is selective not only in subject matter: it is also circumscribed by geography. Scotland is, educationally, a different country*.

Finally, it is important to note that we have not sought 'originality' in the conclusions that we have reached. Not infrequently we shall point to other countries – the USA, EC countries, and Scotland – and advocate the adoption of some elements of their educational policy. It cannot be denied that 'foreigners' sometimes get things right.

* The recent decision to set up separate Higher Education Funding Councils (HEFCs) for England and Wales, seems to us a decision arrived at within the art of the possible, rather than implying a need to segment our conclusions further.

CONTENTS

1. THE HIGHER EDUCATION MISSION

1.1 BACKGROUND

Educating individuals to the highest level that their abilities and interest can sustain, is a duty that society owes to its members. A better informed electorate will improve the quality of life in the UK. A highly educated work-force is essential if a nation is to succeed in the competitive business of wealth creation. And an adequate degree of success in wealth creation is needed, *inter alia*, to sustain the expanded educational system implied by these aspirations.

So far there is wide agreement. Beyond this point we encounter splendid terrain for controversy. The nature of education sought, and the level to be achieved, must depend on ability and on interest. But should 'interest' be an over-riding criterion? Should society be wholly unconcerned with how many of its young members wish to study archaeology, medicine, nursing, physics or software engineering?

There is a market argument that suggests that, even though society provides a large part of the bill (and will continue to do so), not much harm is done by an oversupply of talent in one category or another. It suggests that the resulting difficulty of finding satisfying occupation will become widely known and discourage others from attempting to enter that profession. The system will be self-regulating.

Such arguments, however, ignore the time constraints involved. They can easily extend to half a lifetime. They can even lead to instabilities, in that, just when the knowledge of the difficulty of entering a profession is appreciated in the schools may be the moment when a true shortage has already started. The teaching profession has, probably by the action of this mechanism, experienced successive alternations between years of plenty and of extreme shortage.

Recognition of this situation does not tempt us to recommend a régime in which Government would rigorously control the entry streams to different professions. Quite apart from the fact that this would represent total flight from open society, we believe it unlikely in the extreme that governments would get it right.

Nevertheless it seems reasonable that, in exercising responsibility for the use of taxpayer resources, Government does have a role in gently modulating the flow of talent in different directions. Government has for long played the key role in determining the number of doctors to be trained. They have not infrequently attempted some fine-tuning in other professions, for example by adjustment of the fees received by specific subject areas in higher education. Provided that such changes arise from wide consultation with industry, commerce and Higher Education Institutions (HEIs), and provided that the changes are not made too frequently or too abruptly, such intervention by Government can be helpful.

There is a further problem in putting sole emphasis on the professed interest of a potential student. An expressed interest in following a particular direction of study will stem partly from natural disposition, but also from advice, overt or implied, proffered by teachers,

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parents and others. This advice can be helpful, illuminating, or desperately wrong!

THE HIGHER EDUCATION MISSION

Both interest and advice are significantly affected by cultural assumptions about the nature of science and engineering and their role in our society. In comparison with Germany and Japan, science and engineering are marginalized in British culture. Not only is there a lack of appreciation and understanding of science and engineering and their role in our society, but people are almost proud of this gap in their general knowledge. Science and engineering are rarely perceived as cultural activities to be studied for their intrinsic interest and value, like the arts and humanities. Nor are they accorded the social status of specialisms such as law and medicine. More seriously still for our economy and welfare, scientists and engineers are under-represented in company boardrooms, the upper echelons of the Civil Service, and Parliament. While the prevailing attitudes reinforce suspicion, marginalization and limited status, the probability of young people being attracted towards careers in science and engineering will remain low. The market is itself influenced by these prevailing cultural assumptions; and we believe that both Government and institutions should be taking more positive steps to redress the balance. At the very least, greater attention should be given to attracting and enhancing students' interest in science and engineering, both within specialist, including vocational, courses and through the provision of general education modules at higher education level for students whose main focus of study lies outside science.

It is not easy to predict the development of the various strands of higher education. What is agreed – across the body politic, by almost all who are engaged in secondary, further and higher education – is that there has to be a substantial increase in the number of participants. Figures released by the Polytechnics and Colleges Funding Council (PCFC) and the Universities Funding Council (UFC) show that full-time student numbers have already grown by 44% between 1988/89 and 1992/93. Continuing expansion will imply a much wider diversity of student, and a wider diversity of the missions for individual institutions. It will also extend the expectation that employers hold for the products of institutions and indeed extend the range of organizations that will seek to offer them employment.

Higher education in the UK has, since its earliest days, fulfilled a diverse set of aims, from the development of intellectual and vocational skills to the furtherance of scholarship and learning. Modern higher education finds itself meeting an even broader set of targets, defined more fully below, in terms of the larger groups of those seeking to benefit from higher education, the types of educational institution providing higher education, and the more complex requirements of employers. In this report we have considered how best to provide a firm base for the future of higher education. We have looked especially at the ways other countries have addressed very similar problems, and at the results of experiments in higher educational provision, both in the UK and overseas. In a study of this nature, there will be issues that, although deserving attention, fall outside the Study Group's remit. This study has focused mainly on undergraduate and postgraduate taught courses. Higher qualifications by research are generally excluded, although many of the recommendations will have implications for research-based education. Education leading to professions such as teaching and medicine, is specifically excluded as is continuing education in science and technology. These areas are also of concern to the Society, and merit separate consideration. Again, many of

GRADUATE ENTRANT COMPLETION RATE AND TYPICAL LENGTH OF SCIENCE DEGREE BY COUNTRY, 1988

Country	Entrants*	Typical length of science degree	Completion rate (%)
UK	37	3	90
Australia	57	5	62
Belgium	49	4	86
Canada	59	5	92
Denmark	48	6	87
France	44	4	n/a
Germany (West)	32	6	94
Italy	30	5	33
Japan	37	4	92
Netherlands	36	5	69
Spain	38	5	92
Sweden	47	4	n/a
USA	65	4	86

Source : Hansard, 8 December 1992.
: OECD, *Education at a Glance*, 1992.

* Entrants includes both young and mature, full-time and part-time students defined by the OECD's New Entrant Index. This is not similar to the Age Participation Index used in the UK projections for the HE participation, which is based primarily on young full-time students. In 1982 the UK New Entrant Index had risen to 52%, which when calculated using the Age Participation Index gives a figure of 23.3%.

Figure 1. Higher education new entrant and qualification rates.

the recommendations will have implications for professional education, particularly teaching. Finally the report focuses mainly on provision in England and Wales. There are differences in Scottish higher education but many of our general concerns may also reflect the debate in Scotland.* However, our specific recommendations focus on England and Wales.

1.2 NATIONAL NEED

In terms of the percentage of 19-year-olds entering higher education, Britain lags behind all OECD countries except Turkey and Luxembourg, and rises only to the average at graduate levels. Britain's fortunes have relied, and

*   At the time of going to press, the pronouncement of the Scottish Office on the way forward following the Howie Committee's Review of the curriculum and examinations in the fifth and sixth years of secondary education in Scotland, is imminently awaited with interest. At present in the Scottish schools system, academic examinations are taken under the auspices of the Scottish Examination Board (SEB) at the end of one year post-16 and at the end of two years. The courses and assessment have increasing emphasis on skills and processes and the required skills are defined. Students often take five subjects at age 17 and further subjects (and/or more in depth) examined at the age of 18. A free choice does not prevent specialization. At the same time, there exists an extensive and coherent modular vocational award system under the Scottish Vocational Education Council (SCOTVEC) which is increasingly being used by 17 and 18-year olds to complement their other studies. In the higher education sector, honours degree programmes are generally of 4 years duration, but there is already a wide range of access and credit transfer (CT) possibilities operational within the system.

will increasingly rely upon, the intellectual contribution of its population, not just to the science and technology of products and processes, but to the arts and humanities and to cultural and political thought. The transformation of British industry to new technologies demands a more skilled workforce, able to transfer skills quickly to new areas. There is, arguably, inadequate recognition of higher education in industry. Industry should be encouraged to recognize in tangible ways the higher education achievements of individuals. Better management and decision-making requires intellectual abilities sharpened by the educational process.

The national requirements which higher education must meet are many and complex:

- Higher education must ensure a well-qualified workforce able to respond to the needs of the worlds of industry, commerce, Government service or academia. UK post-compulsory education,

including higher education, has traditionally been characterized by a relatively low rate of participation. To address this, National Training and Education Targets, shown in Figure 2, have been adopted by Government following the CBI report *Towards a Skills Revolution* (CBI, 1989). In addition to these targets, the 1991 White Paper *Higher Education, a New Framework* outlines the Government expectation that one in three young people will enter higher education by the year 2000. There has already been an expansion in student numbers. To reach the Government's one in three target, and therefore to provide a more well-qualified work force, institutions will have to widen entry further to those groups who have not traditionally taken part in higher education. Our work reflects the wider demands that the student body will make of institutions.

- Higher education must ensure the development of an appropriate balance of knowledge and skills.

NATIONAL EDUCATION AND TRAINING TARGETS

In 1989, the CBI Vocational Education and Training Task Force defined the following national education and training targets for 16–19-year-olds:

- Immediate moves to ensure that by 1995 almost all young people attain NVQ Level II or its academic equivalent.

- All young people should be given an entitlement to structured training, work experience of education leading to NVQ Level III or its academic equivalent.

- By the year 2000 half of the age group should attain NVQ Level III or its academic equivalent.

- All education and training provision should be structured and designed to develop self-reliance, flexibility and broad competence as well as specific skills.

Source: *Towards a Skills Revolution*, report of the Vocational Education and Training Task Force, CBI, 1989.

Figure 2. National education and training targets.

Higher education must transmit a coherent body of knowledge and develop its conceptual understanding and application. This knowledge will be relevant to its subsequent use in employment and provides a firm base for further study. All those who receive a higher education would also benefit greatly from the development of a range of personal skills, which would enhance their ability to work as a member of a team, and to convey the results of their work to colleagues and from time-to-time to a wider audience.

- Higher education must provide opportunities for updating knowledge and skills for further professional development.

- The higher education system must be able to respond to all of the aspirations of society over a very wide spectrum of needs and expectations.

- Institutions must educate the most able students to a level that compares favourably with other national higher education systems, and ensure that sufficient numbers of the most able are attracted to the most demanding professions and to careers in research and development.

First we shall seek to define the various aspects – student, institutional and customer diversity – that will make up the nature of higher education into the next century.

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1.3 STUDENT DIVERSITY

WHO ARE THE STUDENTS?
The past 25 years have seen a significant broadening of the range of motivations, aspirations and achieved levels of knowledge and understanding which characterizes a new student. Progress towards the Government's one in three aim has been rapid as funding regimes have encouraged institutions to recruit increased numbers of students. While recognizing the achievements that institutions have made in accommodating more students, the major expansion has been in Arts and Humanities subjects. There is still a major difficulty in science recruitment. Clearly, the demand for higher education has yet to be satisfied. However, the Public Expenditure Survey of 1992 indicated that numbers of young people entering higher education were to remain level over the following three years, and then by renewed growth from 1996.

Higher education will need to embrace those groups who have not before taken part in it by broadening socio-economic background, entry qualifications and, for science and engineering disciplines, gender ratio. These factors interrelate. There will also be increasing participation by mature students, on a full-time and part-time basis.

WHY DO THEY WANT HIGHER EDUCATION?
The motives that lead students to seek higher education will vary. Science education in particular will embrace several distinct groups. We recognize that there will be students wishing to become professional scientists in industry, academia or teaching. Secondly, there will be students who are not committed to a specific career path but who value the advantages that a scientific education offers, and therefore wish to follow a broad science course. In

addition, some students, as is common in the USA, will wish to include some scientific study within a broader programme both to enhance their knowledge of certain aspects of science and to gain from the critical reasoning skills developed that are valuable in a wide range of other careers.

To satisfy these very different student requirements, at least some institutions will need flexible curricula, which allow students to select the programmes they study, from the narrowly focused, to those which offer a more general education with different levels of qualification. It will be essential to provide both for those students who may not have the need or ability to study to degree level, while continuing to challenge intellectually those students who currently do well on traditional honours courses.

1.4 INSTITUTIONAL DIVERSITY

DIFFERENT INSTITUTIONS

A higher participation rate will lead to a broader range of student needs and aspirations. In other countries attempts to cope with this diversity have taken one of two routes: an 'integrated' approach whereby each HEI attempts to cater for a very broad, cross-section of the student population and a 'diverse' approach reflected in the missions of individual institutions.

The first approach seeks a higher education sector which will provide education and training for all types of entrant, with some institutions covering many needs, whereas the other concentrates on a narrow part of the whole.

Our conclusion is that the second 'diverse' approach is the most practicable for the UK. The very different histories and emphases behind the wide spectrum of universities and colleges that make up the UK higher education sector, and the autonomy of its institutions under the Higher Education Funding Councils, provide a basis for a strong and effective system of this type. In a diverse system some institutions will wish to pursue a mission of broad access for students, exploiting the opportunities presented by new student groups, and novel course structures; others will continue to recruit from more traditionally prepared student groups; yet others may concentrate on post-graduate and/or post-experience courses. Information that explains institutional and departmental mission statements should be available for potential students and their future employers. This material must be clear and coherent to the outside world. It should also allow each institution to be recognized and respected for the service it provides. At the same time the opportunity should exist for students to transfer from one type of institution to another as their needs and aspirations develop.

In addition to the universities, several colleges in the further education sector are already delivering higher education, in full or in part, both under contract to partner institutions in the higher education sector and in their own right, and this provision is likely to increase. The Higher Education Funding Councils have a major role in encouraging and maintaining diversity through financial incentives, and may need to deter 'mission drift' which might move institutions increasingly to offer a more 'traditional' higher education.

WITHIN INSTITUTIONS

Full-time, term-based attendance is not attractive to many groups. Part-time education or distance learning, or both, will increasingly be the preferred choice. These modes should be seen as mainstream higher education options, not as 'bolted-on' options to a system designed around full-time study. We may expect more students to seek higher education locally for personal and financial reasons, notably students unable through family, work, finance, disability or 'cultural resistance' to leave home to attend more distant institutions. For those students it is important that there is a wide geographical spread of institutions with broad access policies. As we discuss later, the further education sector also has a part to play in higher education through partnership activities with HEIs.

Recent announcements of expansion of the number of students in further education by 25% could present enhanced opportunities for these initiatives.

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1.5 CUSTOMER DIVERSITY

The greater part of the higher education system will continue to be aimed at providing students with the knowledge, skills and training required by employers. The higher education sector will remain the provider of the highest quality skilled manpower in the UK and will play an increasingly important role in updating and maintaining the knowledge and skills of an ever more sophisticated workforce throughout its working life. There is increasing emphasis on personal skills, such as the ability to communicate effectively and the ability to engage in teamwork—skills that have not always received very much attention in higher education. Science and technology courses, in particular, have concentrated on the development of scientific skills and understanding, with regrettably little emphasis on personal transferable skills. Closer collaboration between academia and the wider world of work must be sought to encourage a greater understanding of each others' requirements.

1.6 POPULARITY OF SCIENCE, MATHEMATICS AND ENGINEERING

Science and engineering are not recognized as part of our cultural inheritance in the UK in the same way as arts and humanities subjects. Science and engineering courses are usually studied, at least initially, to pursue related careers. Conversely, few of those pursuing arts or humanities courses see their career determined by the subject content of the course. It is intellectual skills and concepts that they seek. They see no value in continuing any study of science, and the concepts and processes of science studied at higher level are denied them. This divide – no less than in C.P. Snow's time and, before that, A.N. Whitehead's – greatly disadvantages UK society and is reflected in the relatively lower number of applications for engineering, physical sciences and mathematics (Figures 3 and 4). The recent expansion of students entering higher education has not been reflected in entry to science and engineering where the proportion entering has shown a significant decline.
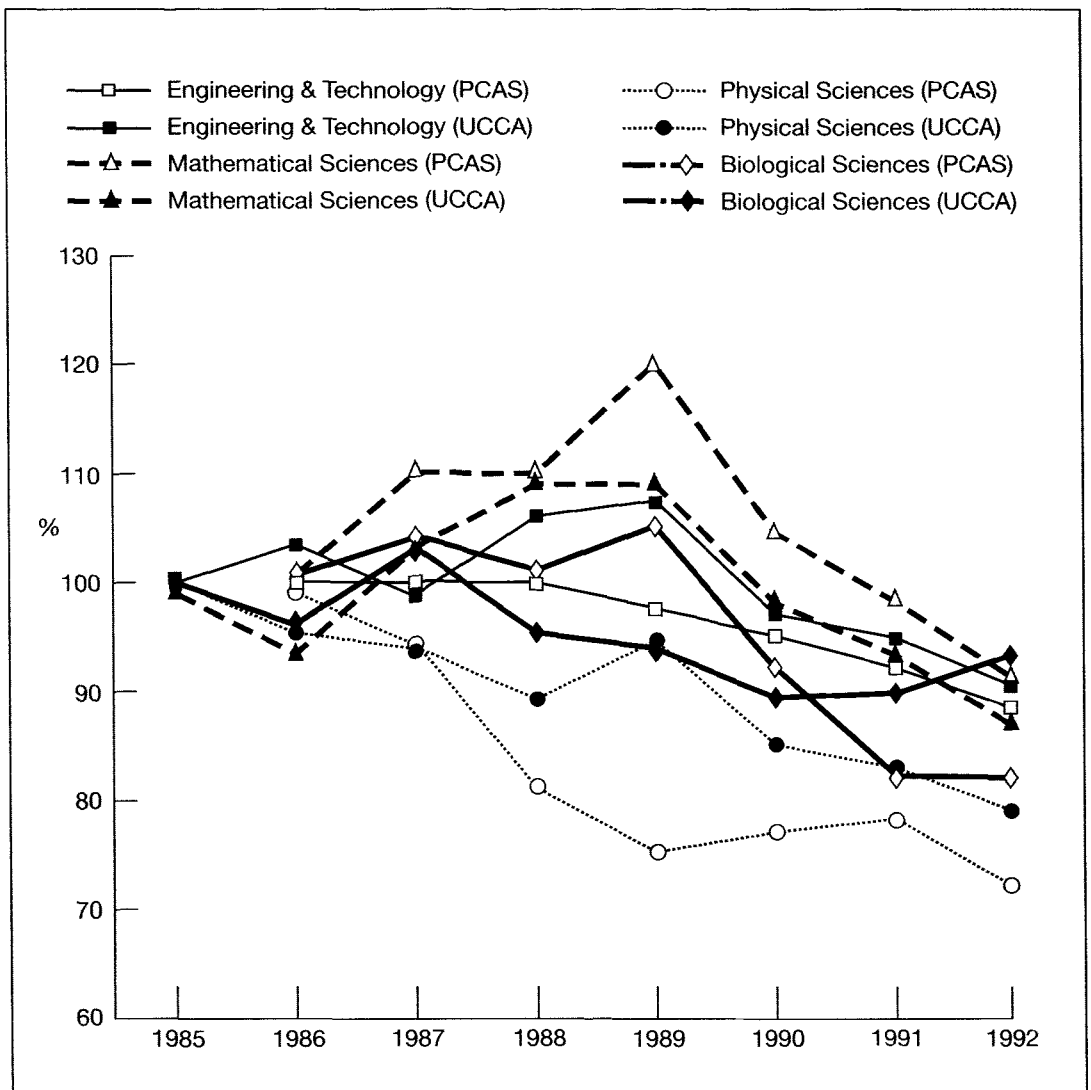
Figure 3. Decrease in the proportion of students entering science and engineering courses since 1985 (1986 ACAS).
Source: UCCA and PCAs supplements to Annual Reports, 1985–1992.

We believe that an element of general education should be experienced by most students, particularly in the initial phase of study. Higher education particularly has a responsibility to demonstrate the benefits of a broader education, and of the intellectual skills to be gained thereby. Higher education should recognize its role in redressing the balance between science and the arts and play its part in promoting the public understanding of science and technology. This will not be easy. Many people are not engaged by science and engineering, and some are suspicious or hostile towards these areas. This contributes to the relatively low regard by the public for jobs in science and engineering and by how much they should be rewarded. And this, in turn, deters people from pursuing careers in these areas. Higher education can help to break this cycle, but it will require imaginative and well-resourced initiatives.
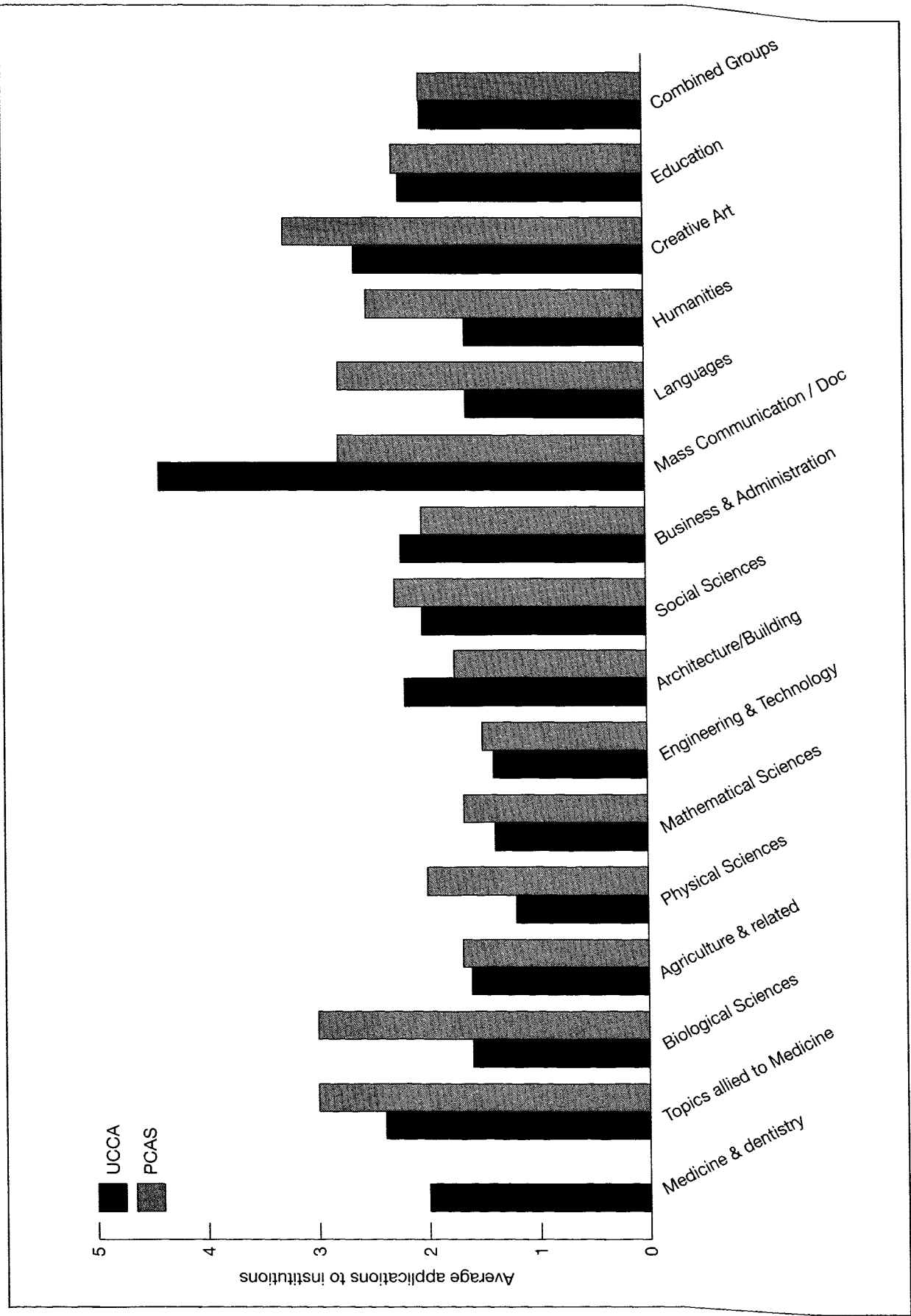
Figure 4. Ratio of applications to acceptances (number of applications divided by five (UCCA) or four (PCAS) to indicate average number of applications to each institution, rather than to the application system as a whole).

Source: UCCA and PCAS Annual Reports, 1992.

1.7 KEY POINTS

- It is in the national interest that all those capable of benefiting from higher education should do so.

- Higher education must be able to:

(i) ensure a well-qualified workforce able to respond to the needs of the worlds of industry, commerce, Government service or academia;

(ii) ensure an appropriate balance of knowledge, skills and understanding;

(iii) provide opportunities for updating knowledge and skills and offer professional development;

(iv) respond to all of the aspirations of society through to the highest level of education over a very wide spectrum of needs and expectations;

(v) educate the most able students to a level that compares favourably with other national higher education systems and ensure that sufficient numbers of the most able are attracted to the most demanding professions and to research and development.

- Student, institutional and customer diversity will be key to the nature of higher education into the next century.

- If participation rates of one in three are to be achieved by the year 2000, the catchment for higher education will have to be widened. The widening will reflect a better balance of social classes, genders and ages.

- Institutions will need to adopt flexible curricula, which allow students to select the programmes they study, from the specialized, to those which offer a more general education with different levels of qualification.

- Material that explains institutional and departmental mission statements should be available for potential students and their future employers.

- The HEFCs have a major role in encouraging and maintaining institutional diversity through financial incentives, and may need to deter 'mission drift' which might move institutions increasingly to offer a more 'traditional' higher education.

- Part-time education or distance learning should be regarded as mainstream higher education options, not as 'bolt-on' options to a system designed around full-time study.

- It is important that there is a wide geographic spread of institutions with broad access policies to cater for students who prefer local institutions.

- Science and technology courses have placed little emphasis on personal transferable skills. Closer collaboration between academia and the wider world of work must be sought.

- Most students should continue to experience an element of general education in the initial phase of study. Higher education should play its part in promoting the public understanding of science and technology.

2. ACCESS TO HIGHER EDUCATION

2.1 TOWARDS MASS HIGHER EDUCATION

The changes that higher education now faces are greater than those of the Robbins era. Changes in primary, secondary and post-compulsory education, a greater demand for higher education, changes in the structure of higher education (especially the removal of the binary line), and new funding mechanisms from new funding councils have all contributed to what is perceived as an unprecedented rate of development. Institutions have responded well.

There are several social, structural and financial barriers to entry to higher education. A social barrier is the general lack of awareness of the objectives and benefits of higher education and of the increasingly diverse opportunities of study. Attitudes are formed early so attitudes towards higher education that prevail in the home will be very influential. Structural barriers include an application system which to some seems complex and even daunting, and certainly shows massive variations in procedure in different segments of the higher education system. Institutions will need to define more clearly the knowledge and skills which they require for entry to particular courses, and how student attainments will be assessed against these criteria. HEIs will need to respond to innovation in compulsory and post-compulsory education, both in the mechanisms for entry to courses and in the nature of the education they provide. With a greater range of qualifications on offer to students, it will be increasingly less appropriate for all routes of entry to higher education to be governed largely by the accumulation of A/AS examinations.

Higher education in the UK, with the exception of the Open University, is characterized by early selection of its potential students through rigorous admission procedures. This selection leads to a far higher survival rate in higher education than many of our industrial competitor nations enjoy and in this sense the system is efficient. We remain convinced that entry to higher education should be primarily governed by the probability of eventual success. But there must be a wider definition of success. This definition would encompass a wider range in the level of qualifications offered by higher education, and greater opportunities for more broadly based study, matching students aspirations and the needs of employers. It is salutory to note that there is no qualification requirement nor prior learning assessment (except for course exemption) required for those 10% of UK first degree students who graduate from the OU.

2.2 POST-16 EDUCATION

Higher education should not be considered in isolation from other sectors of the education system. In particular it will affect, and be affected by, the structure of post-16 education. In this area, more than others, the arguments are tightly bound up with the nature and structure of the existing
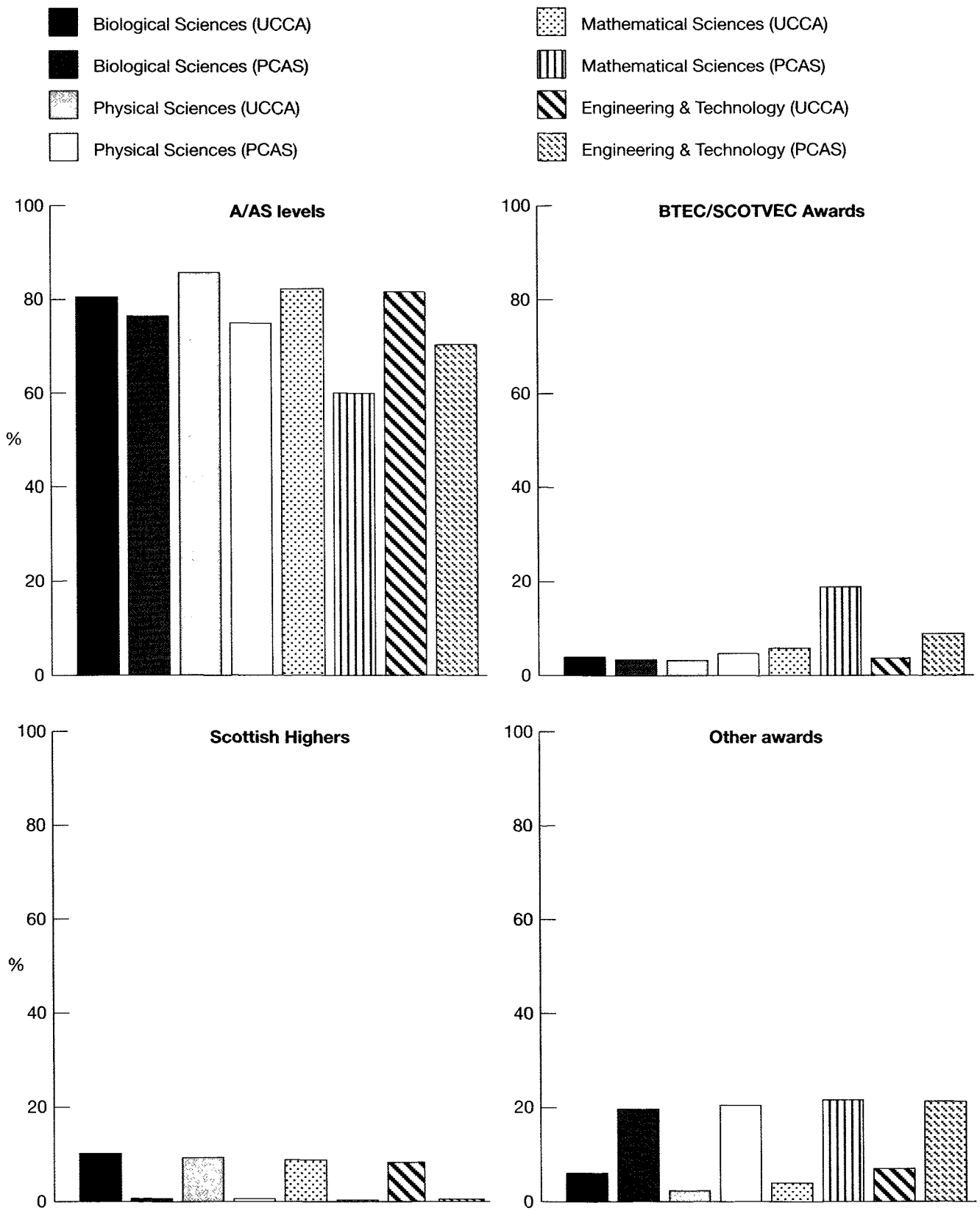
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Figure 5. Entry qualifications by subject of acceptance, 1990.
Source: UCCA and PCAS Supplements to Annual Reports, 1989–90.

education system, and are thus limited to the situation in England and Wales. Examples from other countries (including Scotland) are of little assistance, except to suggest the proportions of young people potentially able to partake in higher education.

The debate on the reform of post-compulsory education has been intense. AS examinations were introduced partly to redress this with the aim of broadening the experience of students studying at this level. But the Society has argued previously that AS examinations do not provide a long-term solution to broadening. AS courses in subjects similar to those studied at A-level tend to increase not decrease specialization. Very few schools have the resources to be able to run AS courses*. It is also widely accepted that the A-level course does little to encourage the development of personal transferable skills. A-level courses, in any case, represent an option for only some of those that we believe should participate in post-compulsory education.

The need for radical revision of the A-level system has been a common theme of the many recent studies devoted to the subject, starting with the Higginson report (*Advancing A-levels*) of 1988. The key proposal of 'leaner and fitter' A-levels, with able students taking five rather than three, was rejected by the Government (which at the time was keen to maintain A-levels as the 'gold standard'). Since then a wide range of bodies has put forward proposals†.

In May 1991 the Society published its report, *Beyond GCSE*, which put forward proposals for the reform of post-16 education. The objectives were to improve participation and achievement rates, to increase flexibility and breadth within the curriculum, to rationalize and to harmonize the academic and vocational sectors, and to give entitlement for all students to a balance of disciplines, skills, knowledge and understanding. We remain committed to these principles. The proposals were based on a single modular curriculum with each student's curriculum based on three domains of study: social, economic and industrial; scientific, mathematical and technological; and creative, linguistic and aesthetic. A single qualification structure would be used to assess each student, leading to a Diploma or (at a lower level) a Certificate of Advanced Education.

Despite widespread support, the Society's proposals have not been accepted by Government. However, the structure of post-compulsory education is undergoing substantial change. The Government outlined its own proposals for the reform of post-16 education in the White Paper *Education and Training for the 21st Century* (HMSO, 1992), and the subsequent Further and Higher Education Act (1991). The White Paper outlined a post-16 sector based on the retention of A and AS examinations, the extension of the National Vocational Qualifications framework to cover 80% of the working population by 1992/93, and the development of new, less vocational-specific, vocational qualifications.

* The key problem is that AS courses were not constructed as the first half of an A-level, so that its provision requires additional teaching resources.

† (CBI (1989, 1993), Secondary Heads Association (1990, 1991), Association of VIth Form College Principals (1991), Institute of Public Policy Research (1990), Centre for Policy Studies (1991), and the Policy Studies Institute (1990)).
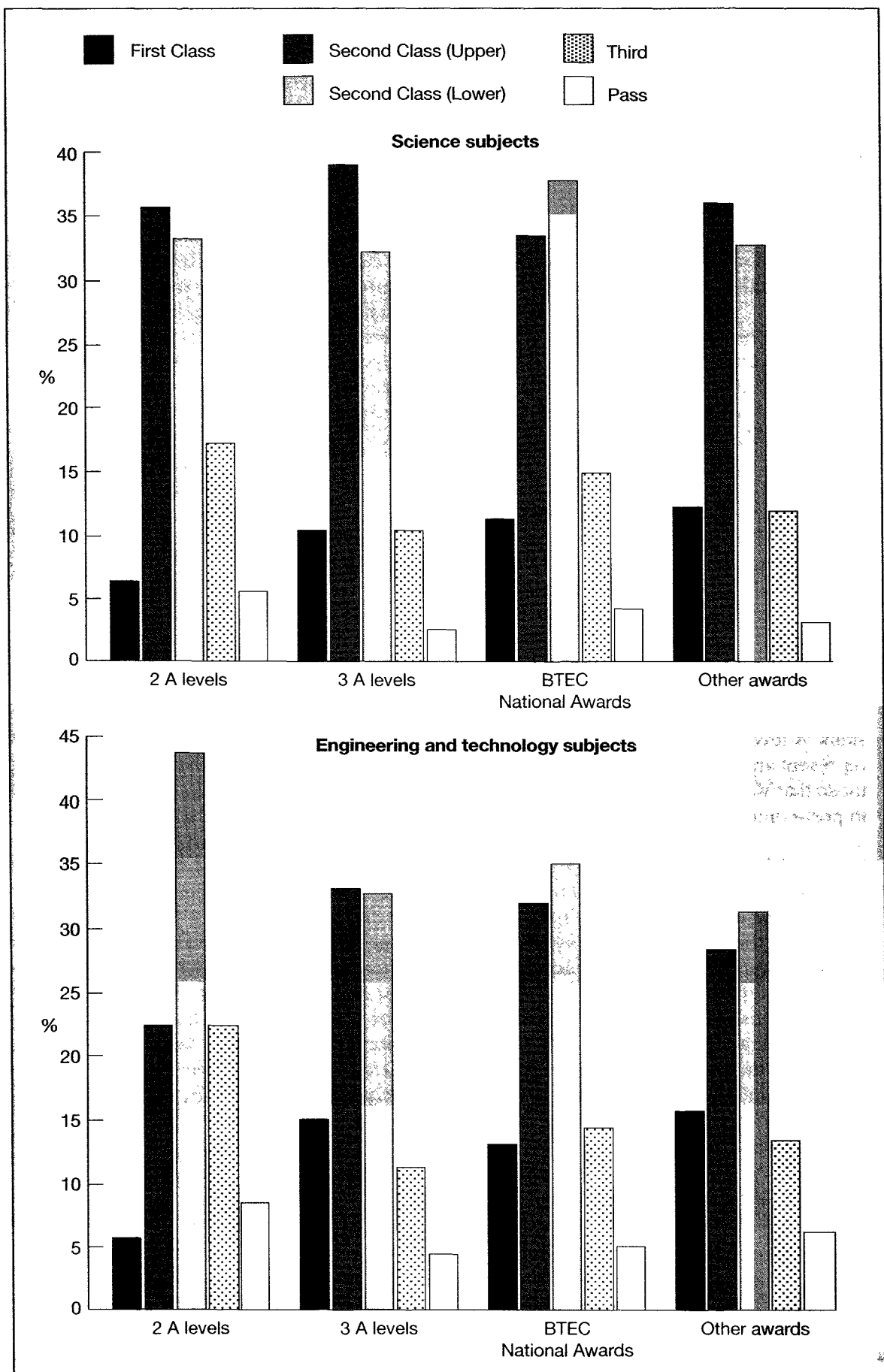
Figure 6. Entry qualifications and higher education success rates, 1991.
Source: BTEC.

The first five of the new General National Vocational Qualifications (GNVQ)* were introduced in September 1992, with a further three areas, including 'science', starting their pilot in September 1993. The Society has welcomed in principle the concept of GNVQs, as a first step towards the model outlined in *Beyond GCSE*, particularly if there is some modular commonality between GNVQ and A/AS level courses. However, the development of GNVQs is in a very early phase. The first five have only recently completed their first year. The GNVQ that is naturally of greatest direct interest to the Society – science – has only just started its pilot. Any attempt to assess the extent to which they will provide a solution to the perceived need is therefore premature. We hope that the GNVQs will earn the approval of the education community and of employers as a real step towards breaking the academic/vocational dichotomy. It is particularly critical that the GNVQ in science commands the respect of both higher education and its customers if it is to be widely accepted as a credible alternative to A and AS examinations. (A commentary on the development of the GNVQs, and their possible relationship to higher education is included at Annex A).

In addition to this threefold division of qualifications, the White Paper proposed the establishment of Ordinary and Advanced Diplomas, awarded to students achieving the equivalent of four or five GCSEs or two A-levels respectively. However, there are no indications that there has as yet been any development towards creating these diplomas since the publication of the White Paper.

2.3 ENTRY TO HIGHER EDUCATION

Current entry to higher education can be broadly classified into several groups: 18/19-year-old entrants with either 'traditional' entry qualifications such as A-levels or BTEC awards, 'non-traditional' entry qualifications (including a wide range of other vocational awards); and mature students either with recognized entry qualifications or choosing to enter via other routes, including access courses or by the individual assessment of prior learning or – in the case of the OU – with neither previous qualifications nor the assessment of prior learning.

18/19-YEAR-OLD ENTRANTS
Traditionally HEIs based their entry requirements on A-levels (Figure 6).

More recently, they have welcomed the introduction of AS examinations and most will accept BTEC qualifications. There is still a bottleneck, however, in the number of candidates who offer these qualifications and apply. This leads to the impression by students that BTEC qualifications and AS examinations are not equally valued with A-levels even though it is not in fact the case. Figure 5 outlines the increasing success rates of those students who have followed BTEC programmes before entering higher education.

In a diverse system, institutions will adopt a range of entry criteria suitable to their defined target audience, with many embracing the recent developments in

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* The first five GNVQ areas were 'Business Studies', 'Art and Design', 'Manufacturing', 'Health and Social Care', 'Leisure and Tourism'. A parallel system of GSVQs is also well advanced in Scotland with SCOTVEC building on its existing provision.
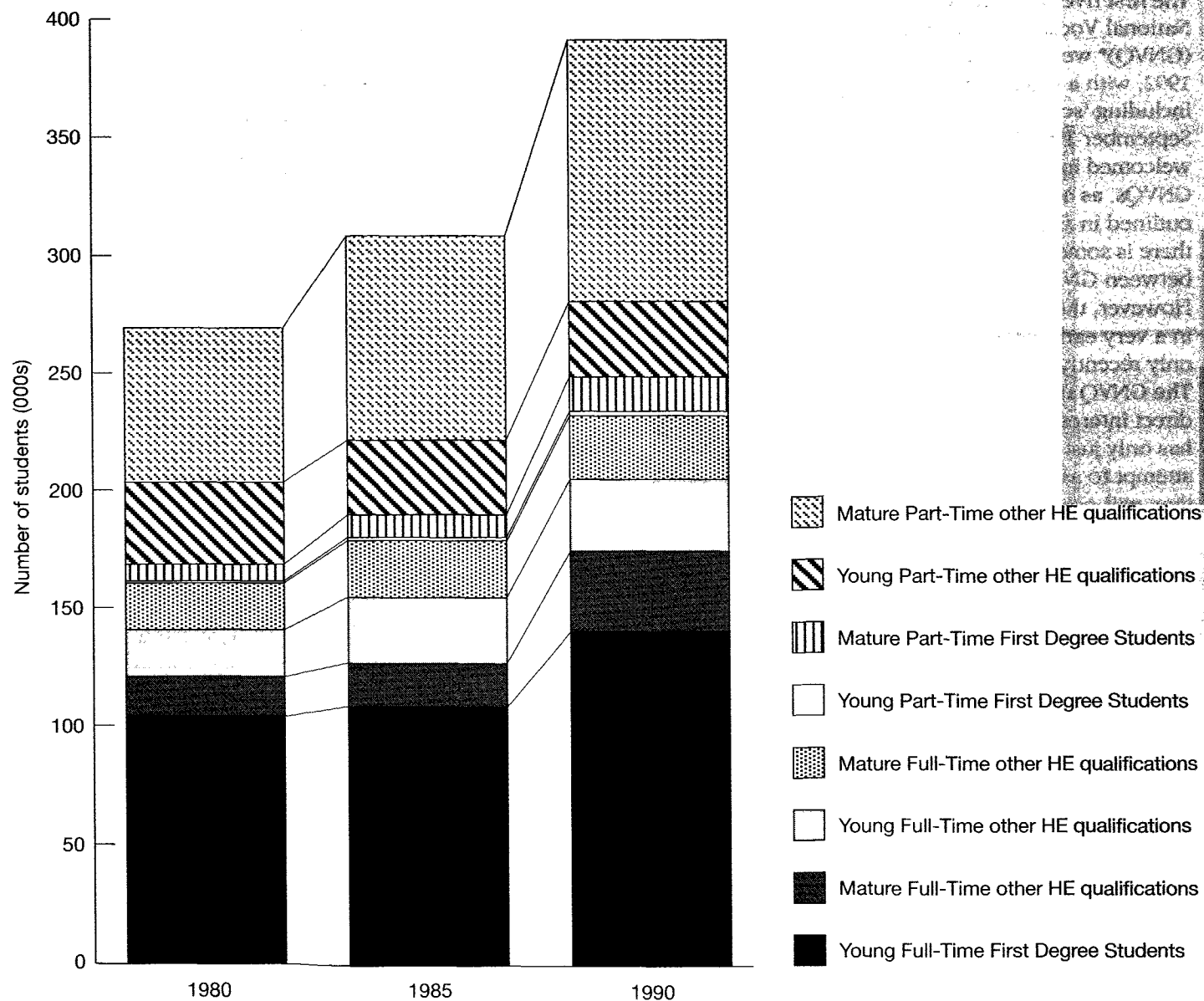
Figure 7. The number of mature students entering higher education, 1980, 1985, 1990. ('Young' is defined as under 21 at the time of entry.) Open University excluded.
Source: Department for Education.

the NVQ framework, especially the introduction of GNVQs. Regardless of the criteria adopted, it will be necessary for each institution to publicize its policy on appropriate entry qualifications. Over all institutions one will expect to see all types of entry qualification acceptable.

MATURE STUDENTS

Percentage growth in the mature student intake has outstripped that of all other student groups in recent years although figures show that not all of these students will be following degree level courses (Figure 7). Mature students will either be those entering higher education for the first time or people returning to higher education for refresher or update courses or postgraduate work. The increase in the participation rates of

mature students is to be welcomed. For too long in the UK, formal education has been seen to stop at a particular age or when employment begins. Employers and the higher education system must encourage adults to return to further and higher education to continue their studies and to update their professional knowledge.

To encourage mature students to embark upon higher education, sometimes for the first time, institutions will need to ensure that entry procedures fully recognize and credit the range of experience mature students bring. Bridging and induction courses may be necessary to align each student's prior learning experience with the needs of the programme of study he or she proposes to follow. Experience with mature students who have entered higher education via such access and foundation courses, indicates a high level of motivation with many achieving excellent results.

2.4 INCREASING THE DEMAND FOR HIGHER EDUCATION

Data on participation rate by socio-economic group (Figure 8) show that simply expanding the number of places available in institutions will not be effective in attracting those groups that traditionally have not participated in higher education. The old university sector in particular has not been very successful in broadening the social spread of applications, from lower socio-economic groups, despite increases in the overall rate of participation achieved over the past 20 years. Participation by these groups will need active encouragement both by institutions and by the exercise of national policy.

ACCESS COURSES
There has been considerable success in widening entry to higher education through the use of specific access courses, delivered either by further education colleges or by higher education institutions (Figure 9). These can be either single exit arrangements, where successful students are guaranteed entry to one particular course at one institution, or multi-exit schemes where entry to a range of institutions is enabled through a national accreditation scheme. However, despite their success generally, there are still relatively few access courses in science, mathematics and engineering because these have been less successful in attracting new students.

OUTREACH ACTIVITIES
Institutions, particularly those that seek a wider student profile, should consider ways in which the educational opportunities they provide can be portrayed and explained to the local community. This can be achieved in all sorts of imaginative ways. University open days, the Open University regional centres, and information and advice centres, all provide opportunities for getting the message across to those seeking advice. But HEIs will have to reach out more widely to those not already seeking out information. Possibilities include placing articles in local free newspapers, cooperating with local supermarkets to put on appropriate displays (tried successfully by the Vice-Chancellor of the University of Sunderland), liaising with journalists from national tabloid newspapers, forging closer links with local authority careers services, and placing more user-friendly material in the community (e.g. libraries, job centres, Citizens' Advice Bureaux, and other public places). In addition to attracting

applications from a wider student population, this will substantially improve the institution's image and links with local communities, to the benefit of both.

ACCESS TO HIGHER EDUCATION

PUBLIC RELATIONS

It is vital that media – local and national – do more to project the advantages of higher education. Above all there is a need to get more coverage for higher education in those newspapers that have the largest segment of the lower socio-economic market among their readership. They cannot be expected to do it out of some sense of altruistic duty. It is the responsibility of the HEI sector to present them with material (e.g. human interest stories) which is usable on their terms. This will need someone with enthusiasm and imagination in each HEI to develop such links with the media.

Direct advertising of the overall advantages of participating in higher education could also play a role, but it is one which is best performed by Government. There are precedents such as the advertising carried out by the Department for Education: Teaching as a Career Unit (TASC).

Almost all of the national advertising currently undertaken by higher education is concerned with last minute filling of courses, and does little systematically to address the public image of higher education. Indeed most of the coverage of higher education policy concerns financial cuts, student dissatisfaction and squabbles over higher education achievements, giving a predominantly negative view of its role and the benefits accruing to the participants.

PARTNERSHIPS

Partnerships in higher education are not a new phenomenon. For many years the External Degrees of the University of London were provided in scores of colleges across the country and abroad.

In this way access to higher education was extended to many people for whom the normal mode of full-time study away from home was impractical.

Today many universities validate courses, at degree level, offered by other colleges of further and higher education and this is important for providing the widest possible geographical coverage. It enables further education colleges, themselves significant providers of higher diploma and professional courses, to offer a wider range of opportunities to their local communities. Several Training and Enterprise Councils (TECs) also facilitate partnerships between higher education and employers.

A more recent development, which has extended the concept of partnership, is that of 'franchising' (Figure 10). This is an arrangement by which a university agrees with another college, that the first part of a course, or a whole course, will be provided by the college, subject to the quality assurance procedures required by the university. Students are registered for a qualification of the university or of a national validating body such as BTEC. Usually there will be a financial agreement between the two partner institutions to cover the division of tuition fees and any funding council grant between the two providers.

A franchise arrangement enables students to study at least the first part of their course at a location closer to their home and this can be particularly important for mature students or for those who might feel intimidated by the prospect of studying at a large and distant university. In some cases, the local college offers the first year of a university degree course, perhaps in modular form and capable of being studied part time. Transfer to the university itself is necessary for the later stages of the course; alternatively, the credit accumulated may enable the student to continue at another institution

or at the Open University, taking advantage of CATS arrangements.

In another variation, students may enrol for a two year Higher Diploma course with the prospect of transferring, if successful, into the second year of the partner university's degree course, producing a 'two plus two' pattern of study.

Franchising has demonstrated the flexibility universities are willing to show in the interests of widening access. The key to successful franchise schemes is the close collaboration of the
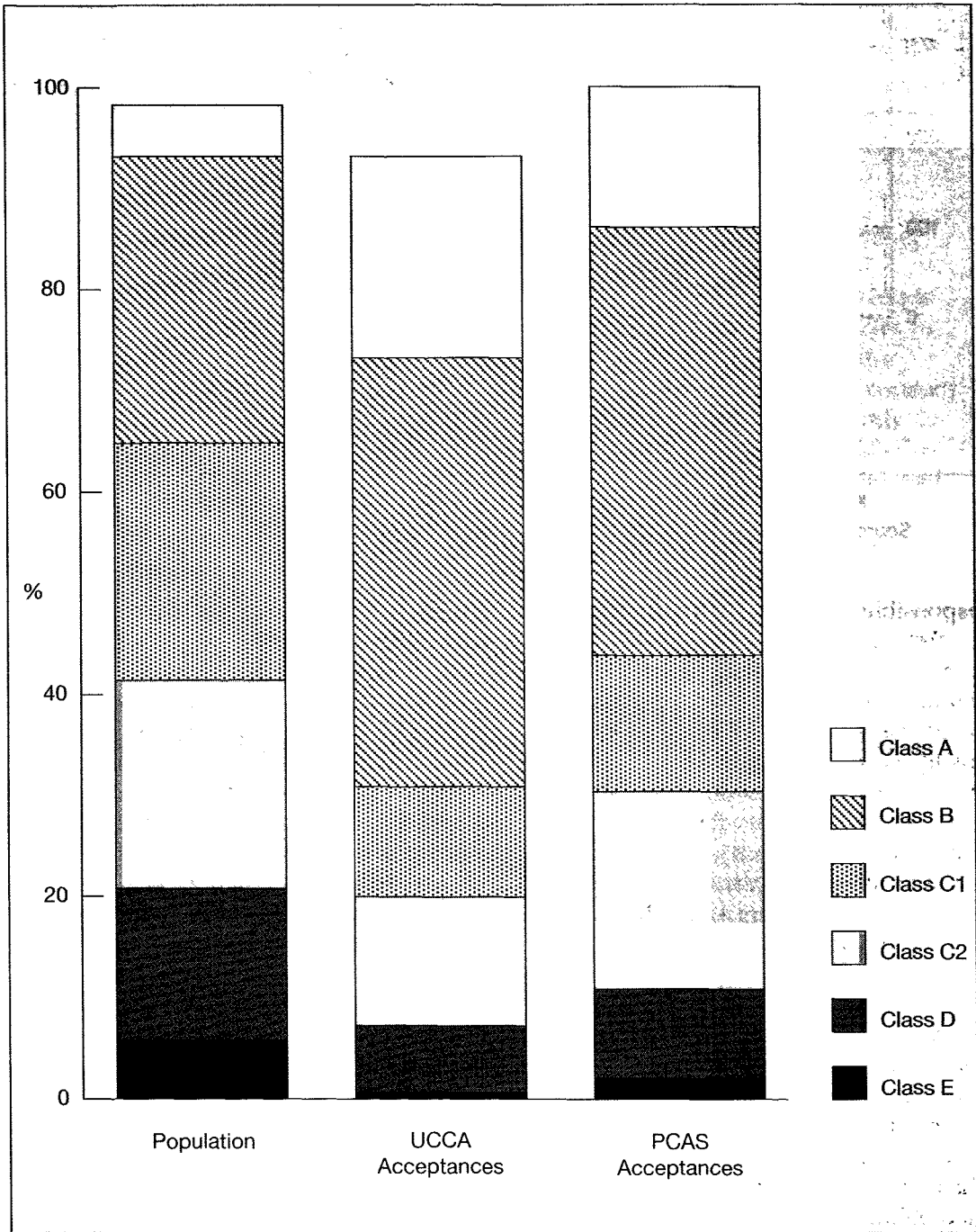
ACCESS TO HIGHER EDUCATION

Figure 8. HE acceptances by social group. Sources: Census Report, 1991; Statistical Supplements to UCCA and PCAs Annual Reports, 1992.
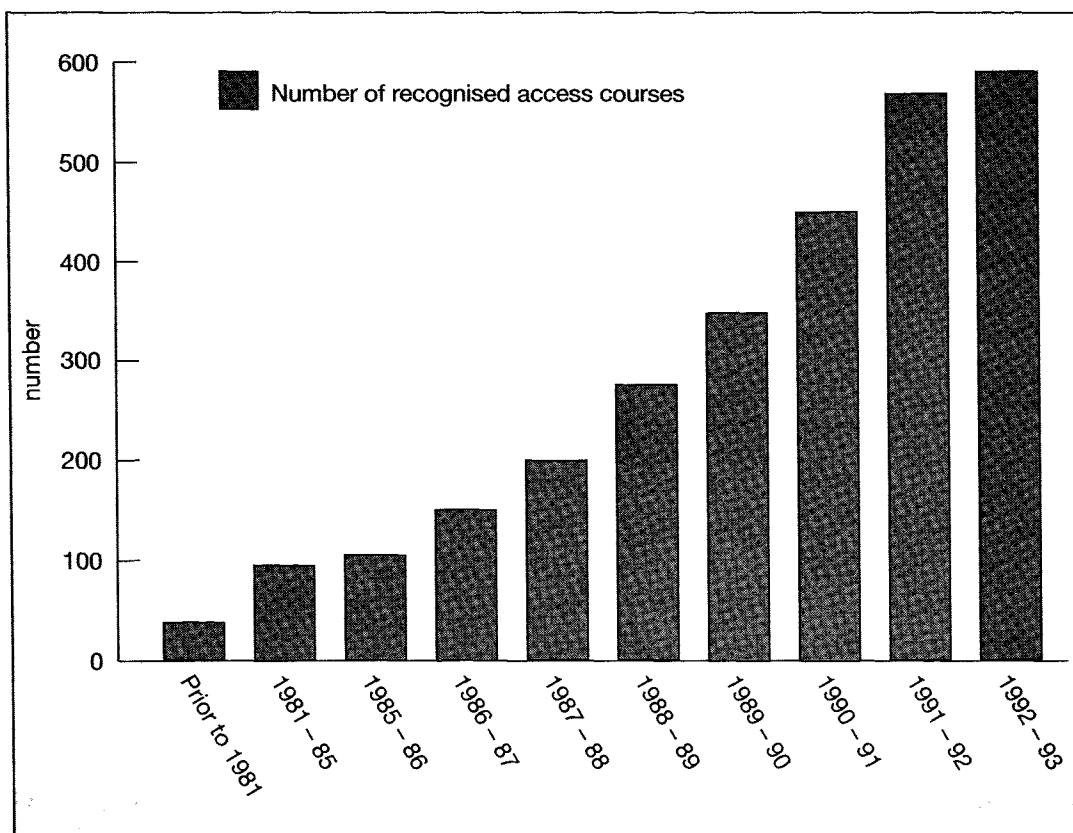
ACCESS TO HIGHER EDUCATION

600 ┌

■ Number of recognised access courses

500

400

number 300

200

100

0

Prior to 1981 1981–85 1985–86 1986–87 1987–88 1988–89 1989–90 1990–91 1991–92 1992–93

Figure 9. Growth of recognized access courses (all subjects).
Source: Register of Recognized Access Courses to Higher Education, CNNA, 1992.

responsible academic staff in the partner institutions, particularly in relation to curriculum development, course planning, teaching methods, the setting of standards and the implementation of quality assurance procedures. Difficulties may arise where the college cannot provide suitable library facilities or equipment, and this may mean that students also have access to such provision on the premises of the university partner.

Subject to the careful attention which is needed in the setting of standards and maintenance of quality, franchising offers a welcome extension of opportunity to mature and part-time students who might otherwise not enjoy the benefits of higher education. It can also offer a fruitful means of cooperation between UK universities and colleges abroad.

ROLE OF ADMISSIONS TUTORS AND REGISTRARS

Staff, in particular admissions tutors, must be fully aware of the range of qualifications that students might offer. The pace of change in post-16 education is leading to increasing numbers of qualifications, and it will fall to individual institutions to ensure that its admissions staff remain in close touch with the remaining scene. Support must be given to those staff who will be largely responsible for entry procedures, and we see merit in national bodies such as the CVCP and the new Universities and Colleges Admissions Service (UCAS) providing an information service and joint staff development.

None of these activities is wholly new; they are a development of existing practice. But, if the participation rate is to be further increased, they must be

embraced more widely. The task of widening access has many facets. All HEIs would wish to contribute to a more uniform distribution of their students related to socio-economic backgrounds. All would wish to correct the gender imbalance in the sciences and engineering. However, some HEIs will continue to plan their courses on the assumption that all their students, at entry, will have the prerequisite knowledge embedded in A levels or GNVQs, whereas others pursue a more flexible admissions policy. Their mission will be to seek talent and enthusiasm for further study without making such specific demands on academic attainment in particular subjects.

For many non-traditional students it is not only the educational provision, particularly in the initial phase of higher education, that must be flexible enough to cater for a variety of needs. Timetabling options and childcare arrangements to suit the needs of part-time and mature students are also examples of the flexibility required. The opportunity to negotiate course arrangements will be essential, particularly for those students who are returning to education with family or job commitments.

At a national level, a mechanism should exist to ensure that regional needs are satisfied. It is particularly important that there is a wide geographical spread of institutions committed to wider access. It would therefore be appropriate for the new Higher Education Funding Councils to encourage individual institutions to provide access arrangements to ensure that this criterion is satisfied.

Institutions must look to their funding mechanisms, and ultimately to Government, to ensure adequate funds are available to pursue their policies to widen access; these inevitably carry financial implications. There is a concern that performance indicators that rely heavily on completion rates, which then affect funding arrangements, could lead institutions to tighten their access policies to the detriment of national need.

ACCESS TO HIGHER EDUCATION

EXTENT OF FRANCHISING ARRANGEMENTS BETWEEN HE AND FE (1990–91)

- 47 Higher education institutions involved.

- 8–10 000 students in 1991–92

- Proposed expansion to 35–40 000 students over next three years

- Development of local regional collaborative arrangements

- Many franchised courses in business and manangement, combined studies humanities and social sciences

- Increase in engineering and science courses as a result of HITEC initiatives

Source: *Franchising and Access to Higher Education: a Study of HE/FE Collaboration*, J. Bird, G. Crawley and A. Sheibani, 1993.

Figure 10. Extent of franchising arrangements between HE and FE (1990–91).

2.5 KEY POINTS

ACCESS TO HIGHER EDUCATION

- Several social, structural and financial barriers to entry must be removed, including:

(i) a general lack of awareness of the objectives and benefits of higher education and of the increasingly diverse opportunities for study;

(ii) an application system that to some seems complex and even daunting, and certainly shows massive variations in procedure in different segments of the higher education system.

- Despite the substantial change in post-compulsory education, the opportunity for students to mix study from both the academic and the vocational sector still remains limited. The key recommendation of the Society's earlier report, *Beyond GCSE* (1991), still stands: we should move towards a single qualification structure for all students based on a modular curriculum, which entails a balance of study areas.

- In a diverse system, institutions will adopt a range of entry criteria according to their defined target population, many will use the recently developed NVQ framework, including GNVQs, to indicate their expectations. This diversity will make it especially important for each institution to publicize its policy on appropriate entry qualifications.

- To encourage mature students to embark upon higher education, institutions must ensure that entry procedures fully recognize and credit the range of experience that mature students bring.

- Policies aimed at widening student access include:

(i) specific bridging courses in science, mathematics and engineering;

(ii) outreach activities to local communities;

(iii) improving higher education public relations;

(iv) extending opportunities for mature and part-time students through franchising arrangements;

(v) ensuring that admissions tutors are fully aware of and up-to-date with the range of qualifications that students might offer.

- The opportunity to negotiate course arrangements will be essential, particularly for those students who are returning to education with family or job commitments.

- The HEFCs must, through financial arrangements if necessary, ensure that a range of individual institutions follow policies to widen access.

3. CONTENT AND STRUCTURE OF HIGHER EDUCATION

3.1 BACKGROUND

Higher education should be seen as providing a level of learning, in which individuals can participate either as a continuation of their full-time education or at subsequent stages during and beyond their working life. Traditionally, the higher education system and its terminology have been dominated by the single honours qualification. A wider student population will have a diverse set of needs and aspirations, and therefore higher education will have to provide a variety of courses and structures.

Already many institutions are increasing the flexibility of the content and mode of study of their courses. We warmly welcome this. However, care must be taken to ensure progression and coherence of study within a clearly identified framework, balanced by sound quality assurance procedures.

3.2 STUDENT GUIDANCE

As we move towards mass participation, the role institutions play in offering educational guidance to students will become even more important than it is now if applications are to be enabled to make fully informed decisions. Student guidance is already well-developed in many institutions. Guidance at entry must take account of the applicant's prior learning and achievement. Students will need far more detailed information about progression routes, programmes of study and assessment régimes. This is important as, increasingly, students will enter and leave formal education at diverse times during their study. Once on a programme of study, students need to receive frequent guidance and counselling, as newer forms of assessment provide them with a wider range of data on which to base their choice of further study. Effective and on-going student guidance will take significant time.

3.3 SPECIALIZATION OR BREADTH?

In *Beyond GCSE* the Society argued that post-compulsory education should encourage breadth and balance, should develop appropriate programmes of study in both academic and vocational contexts, and should continue to develop transferable skills.

In higher education these arguments still hold true for most students. With a much greater participation rate, students committed to a career path requiring specialization (tomorrows professional scientists in industry or academia) will be increasingly matched in number by those committed to a career that requires

a broader education, and by those students who are undecided on a career, but who wish to continue a general education to a high level.

CONTENT AND STRUCTURE OF HIGHER EDUCATION

We support the recent moves initiated by the Institute of Physics, Standing Conference of Physics Professors and Committee of Heads of Physics in Polytechnics to reduce the content of physics degrees (*The Future Pattern of Higher Education in Physics*, IoP, SCOP, CHPP, 1990).* Students and employers, it argues, agree that present higher education courses are not satisfactory because they try to teach too much, and in consequence teach ineffectively. In the future, courses must respond to the needs of the student and the employer by aiming to impart a fuller understanding of the subject by teaching less, more effectively. This would allow students time to learn how to find out things for themselves, from a variety of sources, and time to give them some training in communication skills, in the problem-solving skills needed by industry and others and in learning, for

example, a foreign language abroad. We support this reasoning, and see it as more generally applicable to all branches of science.

Similar concerns have been outlined by the Engineering Professors Conference (*The Future Pattern of 1st Degree Courses in Engineering*, EPC, 1991), by the London Mathematical Society (*The Future for Honours Degree Courses in Mathematics*, LMS, 1991), the Geological Society of London (*Geoscience Education and Training in Higher Education*, Geological Society, 1992), and by the Advisory Council on Science and Technology (*Science and Technology: Education and Employment*, ACOST, 1991). We believe that the concerns outlined for physics, engineering and mathematics education are equally applicable to other scientific disciplines, and similar strategies of reducing content, to enable greater attention to the key concepts, will encourage a deeper approach to learning in all areas of science, to the benefit of all students, from the most to the least able.

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* In the report *The Future Pattern of Higher Education in Physics*, the Institute of Physics, Standing Conference of Physics Professors and the Committee of Heads of Physics in Polytechnics proposed that from the 1993 intake of students the content of single honours physics degree courses be reduced substantially, so that at a rough guide the courses now aim to teach in three years about two-thirds of the material they now cover, and in a way that will allow the students to achieve a markedly fuller understanding of the subject. This initiative was proposed to respond to the growing pressures to include more material in the curriculum with the growth in 'new' physics and to address the difficulties posed by the lower level of achievement in mathematics reached by some of the physics undergraduate intake. The report expressed concern that lectures had become largely an account of the theory of physics and little else, leading to the situation where a good deal more was taught than the average student could be expected to understand fully. The report stressed that a reduction in the factual content implied no reduction in intellectual content. Following wide consultation after the publication of the report, many university physics departments will offer reduced content physics honours degrees from October 1993.

3.4 PERSONAL TRANSFERABLE SKILLS

Developments in pre- and post-16 education, such as the implementation of the National Curriculum, GCSE examinations and GNVQs, are intended to give students broader capability on which to build their higher education, and a greater ability to apply their knowledge. These innovations in teaching and assessment aim to give students entering higher education a greater range of skills than previous cohorts, and lead to enhanced expectations that these skills will be further developed by higher education.

Increasingly, employees in all career paths need to develop skills such as communication, including foreign language competence, analytical and evaluative skills, and skills in information technology, leadership and teamwork, and the ability to adapt to changing working environments (learning to learn). We believe that all higher education provision should include at least some attempt at the development of such personal transferable skills. This emphasis on skills should not depend on the nature of the programme of study chosen by the student, whether specialized or more general, but should be a central part of higher education. It is possible that resorting to a more active approach to the learning process may allow some development of such skills without involving an unrealistic portion of the available time.

An approach that emphasizes skills development will, we believe, encourage some of those who have traditionally been turned away from science by its perceived arid nature. The Employment Department's Enterprise in Higher Education Initiative has done much to promote these issues, including highlighting the need for substantial staff training and development. To ensure effective learning, these skills must be fully and carefully integrated into courses and appropriately assessed. The resource implications of widespread development of this approach are substantial, although developing more independent learning may offset some of the costs.

3.5 MODULARITY

To provide greater flexibility of study many institutions are moving towards modular course structures. We welcome these moves. In *Beyond GCSE*, the Society recommended a modular curriculum for post-16 education, offering students possibilities for programmes of study suited to their needs, and providing opportunities for short-term targets and continuous assessment.

The modular curriculum is not new. Many universities, London being an example, have based teaching on Course Units for over two decades. Modularity involves identifying units of study within existing or planned programmes, which may or may not be of a standard size. If not of a standard size, a notional standard measure can be adopted, with modules taking fractions or multiples of that measure. Such modules can be studied in different orders, subject to identification of rules and prerequisites specifying progression to subsequent modules. The measure of specification will often depend on the nature of the

discipline, and on whether its development is sequential or not. This will satisfy many of the sciences where their study is based on linear development. However, whatever the arrangements of modules, the resulting programme of study must be organized and coherent to provide a satisfactory learning environment for the student.

The use of modular courses provides significant opportunities to reconsider assessment patterns. There is a good case for an assessment at the end of each module, as is almost universal in the USA, in order to provide both short-term goals and rapid feedback on a student's progress. But assessment procedures must also serve to underline the importance to a student of a coherent view of his or her programme of study.

The assessment of 'synoptic' modules can play an important role. These modules emphasize broadly-based skills (including those required for problem solving), and links between parts of a subject, thereby helping students to reach a broader and more mature view of their subject. The skills and understanding of a subject that are emphasized in a synoptic module should be assessed both periodically and at the end of the programme of study. Such synoptic elements also encourage the integration of otherwise separated packets of knowledge into coherence. Assessment should not dominate the course, however, and here as in specialized modules, a proper balance between teaching and assessment must be sought.

3.6 CREDIT SYSTEMS

Credit accumulation (CA) is long-established and in widespread use. In addition to providing a structure for the progression through a full-time course of study, it has the advantage that it allows people to achieve educational goals over an extended period. CA relies on staged assessment throughout a course, and the level of study is usually implied by differential weighting.

Credit transfer (CT) is also not a new feature, but it is less widespread. The Erasmus Scheme, for example, involves CA and CT and has been a feature of the OU since it started. CT operates when a student transfers either between courses in one institution or between courses in different institutions. CT within an institution provides valuable flexibility for students who want to study a breadth of subject areas or who want to change their choice of course. CT between institutions is more complicated and usually happens for personal reasons

when students need to relocate. A modular structure provides an ideal framework for CA and CT, which is why modular systems are often strongly associated with both.

CA is an integral element of course unit systems, which have for long been widespread in the UK and almost universal in the USA. In most cases they have also permitted a measure of CT, invariably so within an institution and, to a more limited extent, also between institutions. Fully developed examples are also seen in the SCOTCAT system and the procedures formerly operated by the CNAA, which have subsequently been taken up in part by the Open University. We would urge the development of a national system of CA and CT by participating institutions. Transfer between institutions relies on mutual recognition of relevant accumulated credit The system must command the confidence of those who

operate it. Universities are unlikely to accept credits from other universities without first going through the normal admission procedure. The transfer and recognition of earned credits is obviously easier between HEIs having reasonably similar missions.

3.7 TEACHING AND LEARNING

More students, with a wider educational background, and a growing emphasis on the development of personal skills will prompt significant changes to teaching within higher education. The formal lecture will continue to have its place, but an increasingly important role will be taken by other techniques such as supported self-study, group work and the use of new multi-media teaching techniques.

Aside from the part of the OU course material that is broadcast by, and the specialist subscription services, from the BBC, there are already many courses available in videotape format and an increasing number are in preparation by universities, professional institutions and commercial organizations. Videotapes, supplemented by group tutorial support, have been successfully used at graduate level in North America, but with less success so far than the UK. An even greater impact on the whole education field will come from the new interactive compact disk (CD-I) technology. This has the capability of handling not only text data, and still pictures, but now moderate-quality television pictures. The interactive nature of the medium is ideal for self-study programmes and to a large extent replacement of much material which is currently in printed form. At present, however, the production of interactive compact disks is very expensive. But in future the use of these techniques offer the prospect of savings over time and more effective use of teaching staff. It is a theme that urgently needs more educational research to characterize and quantify the contribution which such techniques can make. We have no doubt that in time they will be significant.

High technology can make a contribution. So can a liberal use of techniques that go beyond the transmission and a partial reception of lectures, and which can contribute to a more 'active learning' mode. Self study, group work, discussion classes, project work, interactive teaching techniques and other resource-based learning can all contribute. A variety of methods of continuous assessment – not all of which need to affect the final outcome – can also play an important role, in identifying strengths and weaknesses in performance.

A recent report by the Committee of Scottish University Principals (*Teaching and Learning in an Expanding Higher Education System*, CSUP, 1993) has argued the case for a national body to stimulate innovation in teaching and learning systems and to foster the large-scale production of shareable resources. We fully support these proposals. The Teaching and Learning Board would generate and support a research and development community in the field of teaching and learning support.

We would particularly emphasize the need for research to guide innovation in teaching techniques. As has been shown so often, common-sense is an inadequate guide to anticipating the efficacy of a new educational approach.

The resource implications of innovation in teaching are high. Funds will be required for resource production, for course design, and for staff development. The capital and development costs of implementing the widespread use of new teaching technologies will be considerable. Through a Teaching and Learning Board many of these costs will be offset by greater institutional cooperation. In the early stages of shareable resource development we see the Open University playing a substantial role. A further advantage, would be the pooling of resources, and of expertise in their use on a regional basis. This would allow wider opportunity than any single institution may be able to offer.

In addition to a review of the learning process taking place within institutions, the opportunity should be taken to examine and broaden the role of workplace learning. The skills and knowledge learnt in a work environment are an important complement to those learnt in a formal education environment. Sandwich courses, which allow a student a period in related employment, are commonplace in some disciplines. There are also several other projects, including those under the Employment Department's 'Learning through Work' programme, which are seeking ways of integrating work-based learning with study towards academic qualifications. The projects have demonstrated how HEIs can give greater academic recognition and credit for the learning that takes place at work. They range from closer integration of industrial and professional placements for students on undergraduate courses, to employee development programmes through which people can access relevant higher education provision to acquire qualifications.

3.8 ASSESSMENT

Assessment must ensure that learning matches the objectives set for the course. It must ensure that performance, in terms of both skills and knowledge, has reached an appropriate level, and it will be used to grade that performance. More students will need to be assessed, and evidence of achievement will need to be sought from a wider range of skills and knowledge than has been the case previously. It will be necessary to increase the effectiveness of assessment without a significant increase in the demands on staff time.

Assessment influences the learning styles, and the opportunities students have to apply their skills to new problems and in new contexts. We believe that it is vital that innovation in assessment complements innovation in teaching.

The Open University has demonstrated the way computer-marked multiple choice questions can play a major and cost-effective assessment role. It is obvious that multiple choice can be used for checking on the assimilation of factual knowledge. What is less widely appreciated is that multiple choice questions can also be used to test understanding. They can be exceedingly demanding and intellectually stretching.

The challenges of life do not of course usually appear in the form of multiple choice options. The ability to ask questions is at least as important as finding the answers. It is not easy to test such abilities in traditional examination papers. The tried alternatives such as open-book examinations, extended essays or projects play a role, but also suffer from problems. Among these there

is the need to guard against the danger of overloading the assessment of students, perhaps particularly in modular courses. There is also the danger of devoting too large a proportion of the total teaching effort to assessment. We have not been able to study these problems, though we recognize their key importance and the continuing need for educational research in this area.

3.9 LEVELS OF LEARNING

Currently undergraduate higher education provision is largely focused on honours-level degrees achieved in three years of full-time study. Other levels of qualification are available, but these options are not widespread.

Widening access may lead to increased demand for foundation or introductory level qualifications by those students who do not initially want to commit themselves to extended periods of study. The demand for highly skilled technicians will continue to grow. As noted earlier, several professional bodies in science and engineering have recommended a reduction in content of honours degree courses to allow a greater concentration on the understanding of key concepts. In parallel to these recommendations has been the recognition that those students
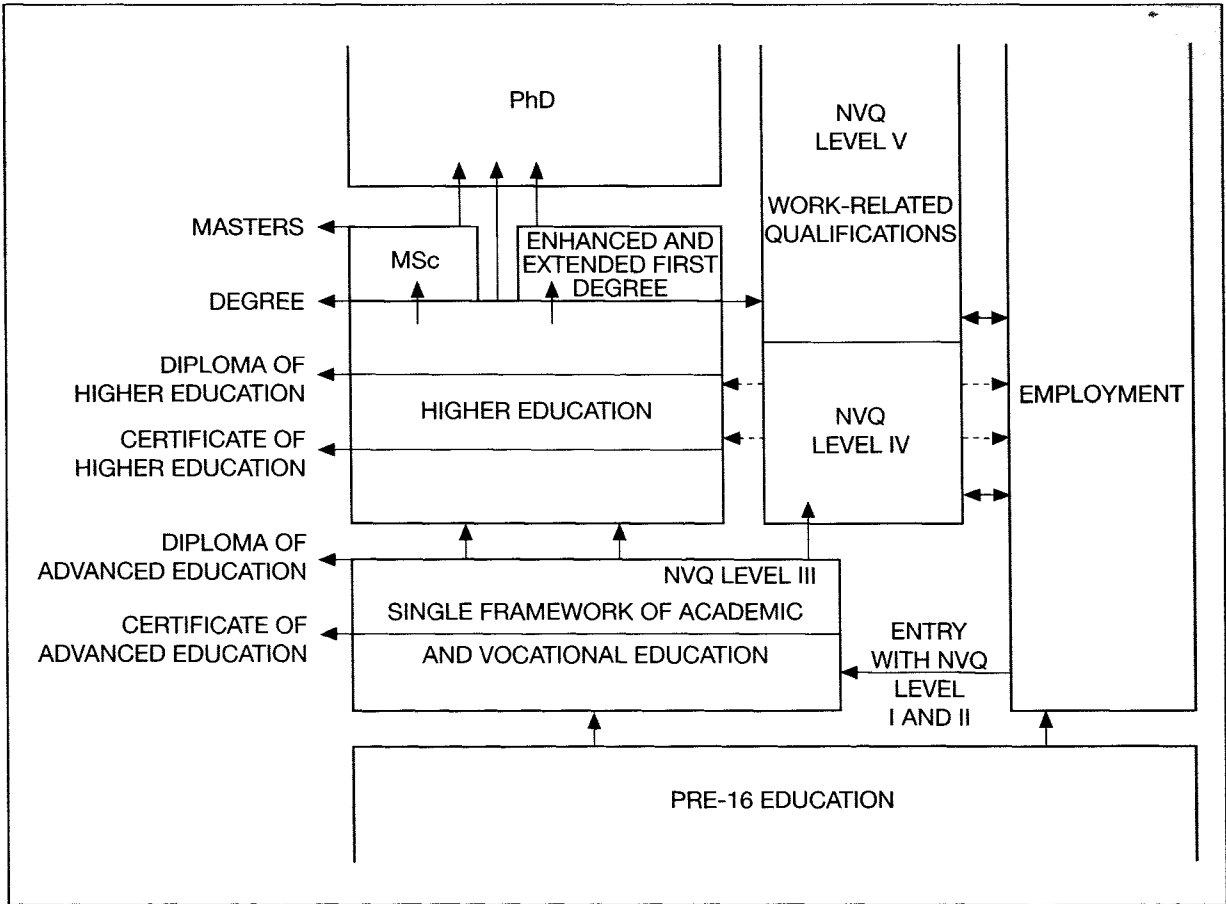

Figure 11. A revised framework for post-compulsory education.
Source: *Beyond GSCE*, The Royal Society, 1991.

who will become professional scientists will need to follow an enhanced first degree, as preparation for employment or research-based study.

We propose a qualification structure based on clear progression from certificate of higher education, through diploma and degree, to enhanced and extended first degrees similar to those proposed for physics. This is shown in Figure 11.

This range of qualifications will match the aspirations of students, and the needs of employers. The most able students, particularly those who will pursue research to the highest level, will face an appropriate challenge if they choose to study to enhanced and

extended degree level. Less able students may opt for lower-level qualifications within the higher education structure.

Qualifications that equate to this four-level structure are already offered in some institutions, although their use is not yet widespread. But if the increased demand for higher education is to be met with an appropriate range of qualifications, institutions are likely to recognize the benefits of this 'multi-exit' approach.

In a flexible system with a range of patterns of study including full-time, part-time and distance learning the level of qualification will equate with the nature of the programme studied rather than to a full-time course of fixed length.

3.10 RECORDING ACHIEVEMENT

Innovation in both teaching and assessment will lead to opportunities to change the method of recording a student's achievement. As higher education offers greater variety of course and patterns of study, employers will need more information on the content of study programmes that students have completed, and on the range of skills and abilities attained by the student. Current arrangements will do little to satisfy these needs, and a wider range of evidence of achievement must be produced. It will no longer be adequate to record achievement as a single classification, as in the degree system.

Historically, there has been much emphasis on the honours classification. With a greater demand for certificates and diplomas of higher education, in addition to degree and masters level qualifications, the honours system will no longer reflect the range of qualifications on offer. To replace the honours classification system with more

comprehensive records of achievement would allow students and their future employers to be more aware of an individual's skills and knowledge. It might also draw public attention to a wider range of qualifications.

Adopting The National Records of Achievement system would clearly be in line with certification practices in other sectors of the education system and in many other countries. All school-leavers are already issued with a National Record of Achievement. These are produced at the end of compulsory schooling (age 16) and are a portfolio of information about each student. They include a record of examination results and profiles of skills gained. The record can be added to by employers and by subsequent HEIs throughout working life.

But in the interests of a common system, institutions will need to discuss the timing and implementation of any move

from classification to Records of Achievement. In the form of individual action plans, such Records of Achievement will be valuable in stimulating students' study programmes within a modular curriculum.

3.11 FORMAT OF THE ACADEMIC YEAR

Most universities teach undergraduate students for between 30 and 36 weeks a year. We need to increase the number of students participating in higher education. Classrooms, laboratories and student residences are already full. The flow of capital from the HEFCs for new building has almost dried up and is unlikely, in the short term, to resume.

In this situation, it is natural to ask again – it is not a new suggestion – why the universities might not teach undergraduates for a larger part of the year, either to compress their studies into a shorter period, or to allow more than one entry stream in each year. It is a question that has been raised by Government, and the Flowers Committee has been entrusted with the task of exploring possible answers.

It is important to be clear about the quite different motives for embarking on an extended undergraduate teaching year. The better use of physical resources is one. Another is the convenience for students to be able to start and complete their studies at more than one point in the year, and the advantage for employers of securing a more uniform flow of available talent. We welcome the debate, and believe that the traditional academic year is no longer the appropriate model for all HEIs. It is also immediately clear that the best model will depend on the mission of a particular HEI. For an institution which concentrates on teaching and on providing new opportunities for a wider range of students, the extension of the teaching period makes very good sense, provided the additional teaching

resources implied by such an intensive teaching programme is recognized. So, for example, one institution represented by a member of the Study Group – Stockport College of Further and Higher Education – is moving to implement a 4 × 12 week teaching year. The case for a radical increase in the undergraduate teaching year for an institution which, in its mission, includes the fostering of world-class research, is less persuasive. Taught masters courses run over a 12-month period. So does research, day and night.

There are several factors that will enter into the debate of the optimum format of the academic year for any individual HEI:

(i) *Teaching and assessment.* In a modular system there are good reasons for suggesting that assessment should be more frequent than once per year.

(ii) *Guidance and management of modular courses.* Time must be allowed between semesters or terms to allow for the management of modular programmes including registration and timetabling, as well as guidance on study choice. The time allowed will vary from institution to institution, but will normally be of the order of at least two weeks.

(iii) *Multiple entry and exit points.* Mature and part-time students, among others, are not tied to one entry point. This will have implications for those disciplines

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which have a strong element of linear development, involve laboratory classes and may require duplication of teaching within the academic year. This, in turn, will be difficult to provide in smaller departments. It may be more appropriate for individual departments rather than whole institutions to offer more than one entry point. Increasingly there will be students who choose to leave higher education at different points; the system will need to cater for this.

(iv) *International developments.* Internationally, and particularly within the European Community, the exchange of students and staff is becoming rapidly more important. Many institutions now offer the opportunity to complete some part of study in a foreign institution. Although we would not expect a completely uniform pattern across member states, there must be sufficient commonality to allow opportunities for both students and staff to work in institutions in other member states. As Figure 12 shows,
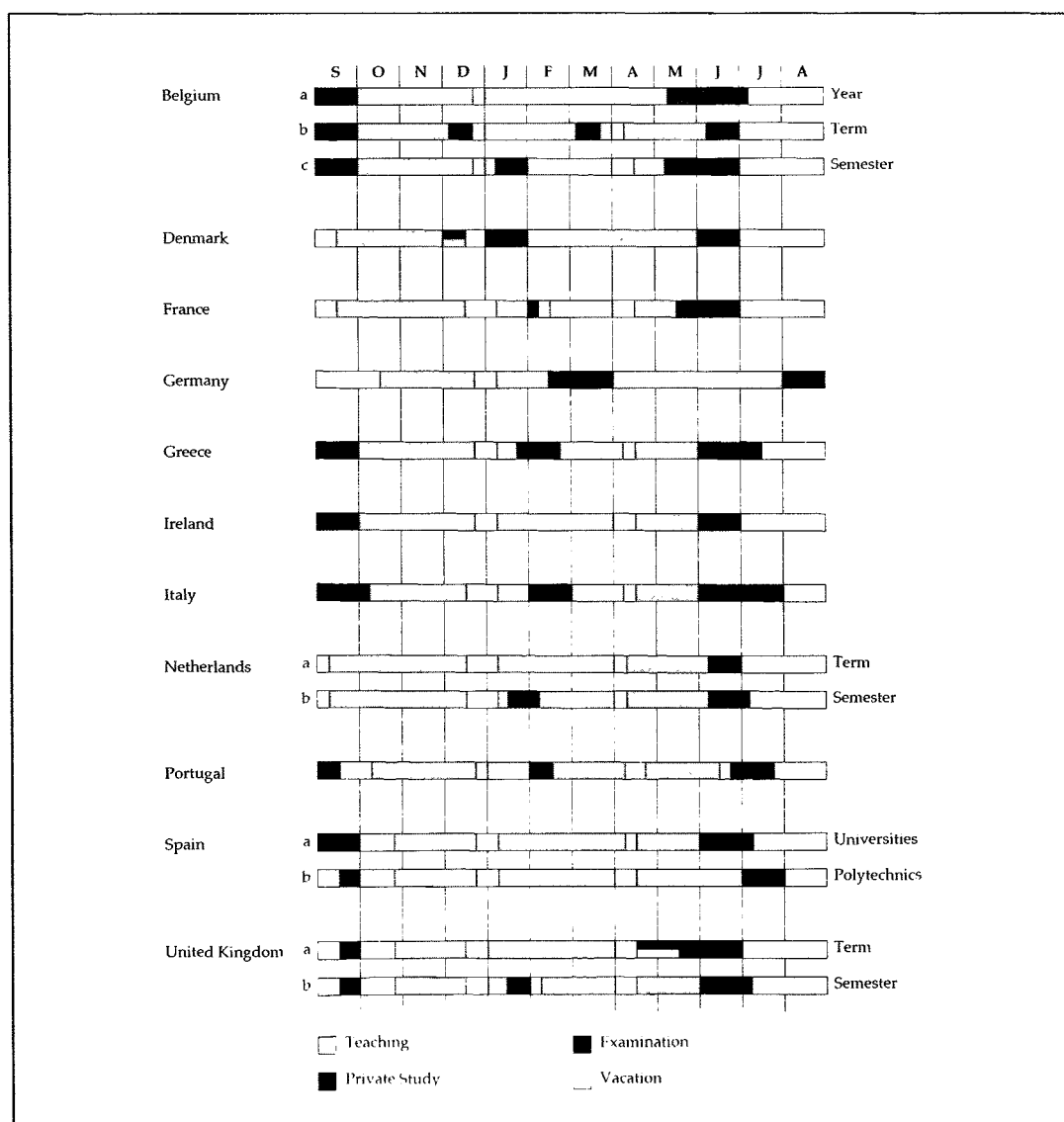

Figure 12. Format of academic year in European countries.

Source: *Review of the Academic Year: Interim Report*, CVCP 1992.

most EC states operate semester or trimester systems, with start dates varying from 1 September to 1 November. There is, however, substantial variation in the length of the academic year.

(v) *Use of resources.* The Pearce Committee has pointed to the possibility of accommodating more students, without major new investment in building, by an extension of the number of weeks of undergraduate teaching. We are in accord, in that we see an opportunity for such a development, particularly in those HEIs whose primary mission lies in teaching. However, it must be emphasized that this development implies the appointment of more staff not only for the direct increase in teaching load, but also for student guidance and administration. Any further increase in student:staff ratios must not reduce the time available for developing excellence in teaching, scholarship and research.

In assessing the resulting savings it is important to appreciate that 70% of the cost of HEIs takes the form of

salaries. Nor is the infrastructure lying fallow for long lazy summers. Much of it is used for postgraduate teaching and research; more for running conferences in support both of academic objectives and of increasing institutional income. There are, as we have seen, other reasons for extended undergraduate teaching years. But the potential benefit in reduced costs is one which needs very careful and rigorous analysis in each individual case.

(vi) *Pace of study.* If some higher education is to move away from traditional full-time fixed-length courses, the academic year must allow the pace of learning to reflect student ability. More able students may wish to progress more quickly, or to increase the amount of study to ensure a significant intellectual challenge. Less able students may wish to progress more slowly. Incorporating such flexibility should prove possible, albeit only in some institutions and for some courses of study. It represents a major administrative challenge.

3.12 OPTIONS FOR THE ACADEMIC YEAR

Institutions in the British higher education sector have adopted several differing formats for the academic year, including variations in start and completion dates, and in the length and division of the year. Broadly, institutions in the former UFC sector operate a three-term structure with ten or eleven weeks in each term, whereas institutions in the former PCFC sector operate a three-term structure, with terms of unequal length, within a 34–36 week academic year. There are exceptions to these patterns, such as the University of Buckingham's four-term year, the Open

University's February–October year, and several institutions that have adopted semester structures.

Other countries feature a variety of formats. Germany, for instance, works entirely on a two-semester system, which for a typical Diplom course extends over 10 semesters for the most able students, with most taking about 12 semesters to completion. The high standards attained, and the intellectual maturity that can be developed, must be balanced against the length of the course and its cost.

Many institutions in the USA adopt a more modular approach, with the normal undergraduate taking about five courses per semesters. A total of 40 courses over four years is typical.

Many institutions are considering the introduction of semester structures within the constraints of a 30–34 week academic year.

3.13 THE ROLE OF PROFESSIONAL BODIES

The reform of higher education will have implications for the accreditation function of professional bodies in science and engineering disciplines. Although the role of the professional bodies in science has so far been less crucial than that played by their engineering counterparts, European job mobility and recognition of qualifications, may before long give them greater prominence.

Developments in higher education will have an impact on the relationship with professional bodies. As certification practice moves away from the honours classification to a more comprehensive Record of Achievement, professional bodies will need to adapt their criteria for graduate membership.

3.14 KEY POINTS

- A wider student population will have a diverse set of needs and aspirations. Higher education will have to respond by providing a wider range of courses and structures.

- Continuous and comprehensive guidance to students must remain a central feature of provision.

- With a greater participation rate, students committed to a career path requiring specialization will be increasingly matched in number by those committed to a career that requires a broader education, and by those who are undecided on a career but wish to continue a general education to a high level.

- Concerns have recently been expressed by some of the

professional and learned bodies for physics, mathematics and engineering about courses that try to teach too much and in consequence teach ineffectively. These concerns are relevant to all branches of science.

- All higher education provision should include some opportunities for the development of skills such as communication including foreign language, analytical and evaluative skills, and skills in information technology, leadership and team work, and the ability to adapt to changing working environments (learning to learn).

- A modular curriculum offers flexibility to a student intake with a variety of background experience. It provides a framework for

implementing a national system of credit accumulation and credit transfer.

- Wider access may lead to a demand for different levels of higher education qualifications not widely available. Qualification structure is recommended based on clear progression from certificate of higher education, through diploma and degree, to enhanced and extended first degrees.

- Records of Achievement should replace the honours classification system and allow students and their future employers to be more aware of an individual's skills and knowledge.

- Moves towards more 'active' learning (e.g. supported self-study, group work and the use of new teaching technologies) are commended. The new multi-media technologies of videotape and interactive compact disks are likely to have an impact on the whole field of education; higher education should explore this opportunity and research its efficacy. A national body, as recommended by the MacFarlane report, should stimulate innovation in technology and learning systems and foster the production of shareable resources.

- Innovation in teaching will require

initial funding for resource production, for time for course design, and for staff development.

- Innovation in assessment must complement innovation in teaching. More students will need to be assessed on a wider range of skills and knowledge than previously.

- In a diverse system, a single pattern of academic year cannot be adopted by all institutions, nor would this be desirable. Several factors influence the debate on the optimum format of the academic year:

(i) in a modular system assessment should be more frequent than once per year;

(ii) time must be allowed for a modular system to be properly managed and for student guidance on study choice;

(iii) some students will choose to enter and leave higher education at different points;

(iv) there should be a reasonably coherent pattern between universities nationally and internationally;

(v) the teaching function of higher education does not need to be restricted to 34 weeks in the year for all institutions.

4. THE ROLE OF ACADEMIC STAFF

4.1 BACKGROUND

Although the provision of quality in higher education and research has been under scrutiny in recent years, the role of teaching in higher education has received little systematic attention. The nature of employment in HEIs has changed drastically. Tenure has been abolished, the proportion of staff on short-term contracts has risen substantially, the perceived social status of teaching and scholarship at all levels has fallen. There has been a relative downward drift in academic salaries. Staff:student ratios have worsened. These changes are symptomatic of a general decline in the attractiveness of a career in higher education. Extensive anecdotal evidence now exists that, from the pool of recently qualified, high quality graduate and doctoral students, there is a worrying migration from academia to other careers and countries.

Over the past 15–20 years the age profile of the academic population has become distorted, with heavy bunching in the 45–55 age range. This will give problems when large proportions of teaching staff retire simultaneously (Figure 13).

To face this problem, to meet the new demands being made on higher education and to ensure a commitment to change at all levels, it is vital now to reassess and redefine the role and working practices of teachers in higher education. The demands of a changing system will have to be met effectively by those currently in post.

4.2 TEACHING AND RESEARCH

There has been long-running debate on the role of research in individual institutions under a reformed higher education system. This has focused particularly on the concept of teaching-oriented and research-oriented institutions. It is clear that a prerequisite of effective higher education teaching is an up-to-date knowledge of subject. Adequate time and resources must be made available to teaching staff to allow for the appraisal of literature, attendance at conferences, development of course materials, authorship of text books, preparation of academic reviews, consultancy and professional practive, etc.—in short for scholarship.

In many disciplines, including the sciences and engineering, it is frequently possible to distinguish between scholarly activities and research (whether pure or applied). Given sufficient opportunity for scholarship, we believe that there is no absolute requirement that all higher education teachers must pursue both teaching and research. Where research is not emphasized, however, institutions must make sure that resources are available for scholarship. For those who teach at higher-degree level, the case that their teaching is strengthened by concurrent research is more compelling.

Some institutions put a primary emphasis on their teaching function. For these it is important that students, particularly those who study to degree level, should
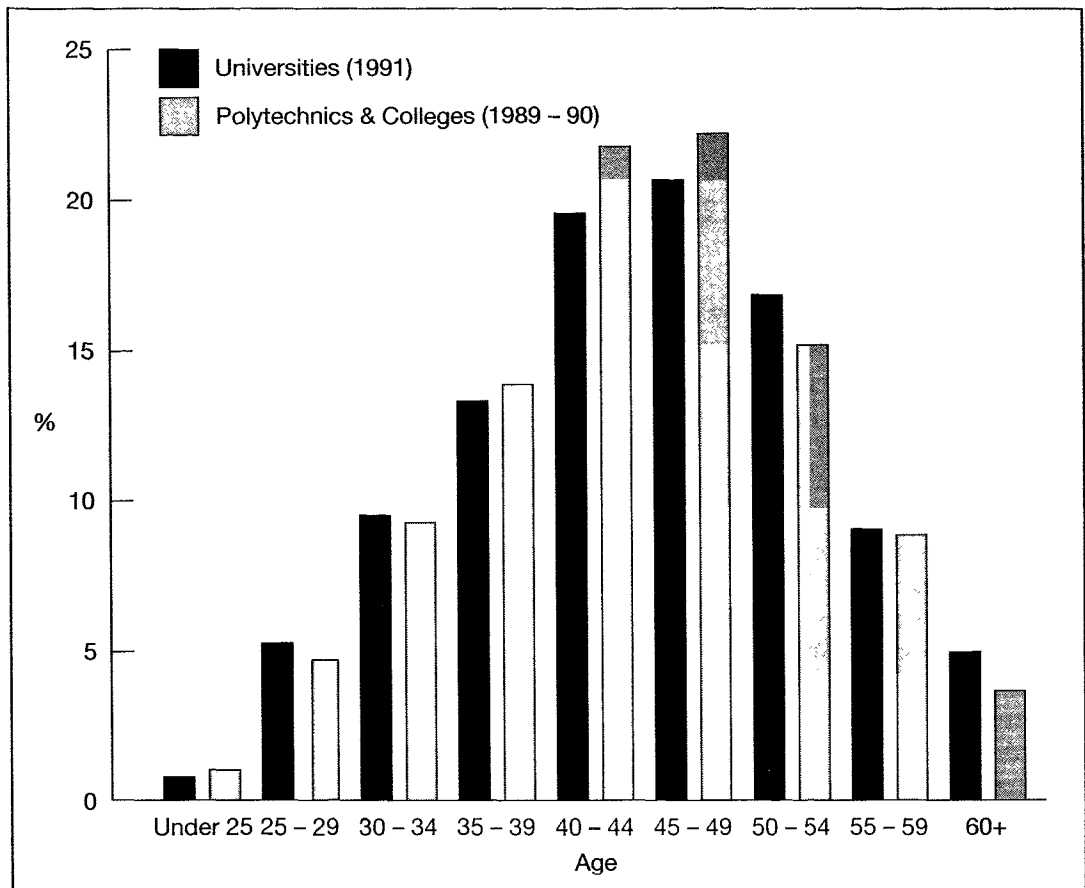
Figure 13. Age profile of academic staff (full-time, non-clinical academic staff, who are wholly institution financed).
Source: University Statistical Record.

have some exposure to an environment in which research or professional practice, such as consultancy or creative work, is pursued. In departments that have a significant research profile, it is important that the research and teaching duties of staff intermingle. The desire of some students to pursue a career in research is often motivated by the example of an enthusiastic teacher or researcher. An active researcher can bring something very special and valuable, to her or his teaching.

4.3 RECRUITMENT

The pool of indigenous postdoctoral workers far exceeds the number of currently available permanent posts. But quality, not quantity, is the problem in recruitment. Where difficulties have been experienced in recruiting high-quality candidates, institutions have responded by advertising posts with a broader job description or by delaying appointment. Neither strategy is entirely successful.

The Society (1992) has addressed the problem of academic career structure in its report *The Future of the Science Base*. In particular, it recommended that the career structure which institutions offer should include a mechanism to help those individuals who are unlikely to obtain permanent posts to find alternative career opportunities at an appropriate age.

It is essential that the teaching ability of candidates is assessed before appointment. In most institutions candidates are asked to deliver a sample lecture, usually on their research, and to respond to questions from an audience of staff and research students. In some disciplines it could be helpful to include a representative from the community of employers in the assessment process. Institutions may wish to consider giving candidates wider opportunities to demonstrate their teaching abilities bearing in mind the need to equate 'teaching' to a variety of delivery methods.

A major problem in HEIs is the under-representation of women on the academic staff, particularly in the higher positions. It is particularly acute in the physical sciences and engineering despite the recent increased participation of women students in higher education. Thee are a number of obvious factors – e.g. the need for career breaks – which come into play. Yet making generous allowance for these their remains a shortfall which is the responsibility of HEIs to understand and to cure.

4.4 PROBATION AND INDUCTION

It is vitally important, especially for new lecturers, that a system of training and mentorship is implemented as a part of the staff-development system. Training courses delivered within the institution to help develop fundamental teaching skills should be complemented by a mentor system in which an established senior academic familiar with the subject advises, guides and informally reviews the performance of the new lecturer.

The probationary period for new appointees should be an integral part of staff development and approached rigorously by both lecturer and

institution. During the probationary period substantial and easily obtained support should be available to deal with any problems that may arise, within a formal appraisal system. The normal probationary period should be extended to five years, although exceptionally lecturers may have their appointment confirmed earlier. This would allow proper appraisal of performance, and an extended period in which development and support would be readily available. The shortest notice for (normal) termination of a probationary contract should be two years.

4.5 TEACHERS NOT ON PERMANENT STAFF

Properly used, teachers not on the established staff can make a significant and distinctive contribution to teaching. In *The Future of the Science Base* the Society recommends a flexible system that allows graduate students the opportunity for paid teaching, similar to the Teaching Assistants Scheme in the

USA. They have particular value in fulfilling certain parts of the HEI's teaching function, such as practical demonstrations or seminars. The teaching commitment undertaken varies considerably depending on students' aptitudes and inclinations. Some formal teaching training should always be

given. Payment is directly from the institution, and supplements any grant received by the students. For those students who do undertake large teaching commitments, the registration period for the completion of the postgraduate qualification would need to be extended reflecting the proportion of time spent away from their research. In addition, the students' grant would need to be extended, possibly at a reduced level. There are obvious educational benefits, and it will encourage a more systematic development of teaching skills which traditional postgraduate courses are unable to provide. The benefits for the institution are also clear, enabling student numbers to rise without imposing unbearable pressures on teaching staff or letting the staff:student ratio decline below an acceptable limit. However, the use of Teaching Assistants should not supplant but rather supplement the role of permanent staff.

Other individuals not on the established staff may also play a useful role in teaching. In particular, they can allow

specific skills or knowledge, not readily available in the department, to be imported for particular purposes. Such sources include employees from industry and commerce or teachers from other sectors of education. It is worth noting that in some Grandes Ecoles in France, as much as 50% of the teaching load is carried by contributions from industrial engineers and scientists. A more substantial contribution from outside the HEI, perhaps amounting to 10% of the total could have a significant beneficial impact in some subject areas.

Flexibility in employment contracts to allow full use of job-share schemes and part-time contracts would also allow a greater range of academic and industrial experience within an institution, although the costs of training, appraisal and a relatively higher proportion of management support must be recognized. Other beneficial possibilities include posts shared with industry and opportunities for women returners who have taken a career break.

4.6 STAFF APPRAISAL AND CAREER STRUCTURE

Appraisal systems, closely related to staff career development, are a key part of staff management. Appraisal in higher education should include feedback from students, review of course development and production of course materials, observation of teaching, and interviews, preferably informal.

The system should highlight and encourage quality and innovation in teaching, and should form an integral part of the institution's quality assurance mechanisms. Opportunities for staff development should allow, where appropriate, staff to spend time outside the academic environment in industry or commerce.

There is a clear progression from lecturer to senior lecturer based on excellence and innovation in teaching. However, promotion beyond this level has traditionally not been based primarily on teaching performance. This lack of recognition of teaching abilities has been to the detriment of higher education, and there is no reason why promotion to senior levels, including professorial, should not be obtained for excellence in teaching, provided an appropriate level of scholarship has been maintained and provided that the case for outstanding performance in teaching can be substantiated. This would make significant steps towards developing a culture in which teaching is valued equally with research.

4.7 ENSURING QUALITY

Higher education in the UK is noted worldwide for its low failure rates, for the relatively short length of undergraduate courses, and for providing a high quality of education. These achievements have, however, been built on a highly selective education system with lower participation rates than those of our industrial competitors. As breadth of entry to higher education grows and the participation rate rises, educational provision must be appropriate for a diverse student population. Thus some criteria for quality will be universal, whereas others will be specific to the needs of particular students on particular courses.

4.8 QUALITY ASSURANCE AND QUALITY ASSESSMENT

The first Annual Report of the CVCP's Academic Audit Unit (now subsumed into Higher Education Quality Council, HEQC) described its role as examining and commenting on the adequacy of:

(i) *Universities' mechanisms for quality assurance in provision and design of courses and degree programmes*:

- having centrally planned monitoring of courses and teaching;

- scrutinizing new courses or degree programmes (or revision of them);

- monitoring course design in relation to student intake and non-traditional entrance;

- monitoring validation by the university of courses in associated institutions.

(ii) *Universities' mechanisms for quality assurance in teaching and communication methods:*

- monitoring existing courses and degree programmes including data collection, such as student numbers, drop-out rates, classified degree results, etc;

- monitoring postgraduate training and research, including appeals procedures at postgraduate research degree level;

- seeking external examiners' views;

- monitoring and informing students of their progress and examination performance, including appeals procedures;

- promoting innovative practice in universities such as use of interactive video and expert systems.

(iii) *Universities' mechanisms for quality assurance in relation to academic staff*:

- assessing and monitoring academic staff;

- provision for staff development.

(iv) *Universities' mechanisms for quality assurance in taking account of:*

- external examiners' reports;

- students' views on courses;

- views of external bodies – professional accrediting bodies and employers etc.

Although most of these procedures are quite common, they have not in the past been a universal feature of university teaching. The importance that the Audit Unit places on student appraisal of teaching is particularly commended. All these features should now become the norm. We also note that, although these are described as internal procedures, they incorporate requirements to seek out and take account of an appropriate range of external groups, external examiners, employers, professional accrediting bodies, etc. A similar function was carried out by the Council for National Academic Awards (CNNA) throughout the 1970s and 1980s. The adequacy of quality assurance procedures was a major factor in its decision to delegate authority to the former polytechnics in the 1980s, while still retaining a monitoring role. External audit is still, we believe, the most appropriate mechanism for ensuring that all HEIs give proper priority to quality assurance. Recognizing the diversity of HEIs and the interaction between their various functions, we also support the development of a system of departmental and institutional reviews already in place in many universities as part of the Quality Assurance Audit. These should involve appropriate external experts as well as internal academics. Several possible models could be adopted: that developed by the CNAA, the quality control system of The Netherlands joint universities board, or possibly the accreditation model used in the USA.

Implementing a full range of quality-assurance mechanisms will be costly, and only a small proportion of the total costs will be directly borne by the funding councils. Most costs will remain indirect and hidden. They are incurred by staff spending time on quality assurance which might otherwise be devoted to other duties. Hence it will be important to monitor the whole quality assurance system to ensure that it will itself give value for money. It is not clear to us who will make this vital assessment. The basis of quality assurance schemes is to deliver an improved product, with greater efficiency. Although there is inevitably an initial overhead with such schemes, the on-going procedures must remove rather than introduce more bureaucracy.

The essential strength of the academic audit and institutional review processes are the wealth and variety of evidence collected from external as well as internal sources and the commitment to improvement gained by involving academic staff in the process. Both these advantages are absent when inspection becomes the dominant form of evaluation. There must be some doubt whether the proposed quality assessment by inspection will give value for money. One might add that the qualities needed by an inspector with the experience and wisdom to command the confidence of institutions would make an excellent Dean. Can we afford to divert such talent into an inspectorate that will contribute nothing to the system's productivity? It has recently been suggested (*Science in British Universities: a Diagnosis with Some Suggested Therapies*, Eric A. Ash, Royal Society of Arts, 20 January 1993) that before rushing to judgement on the basis of inspection, there should be some examination as to whether the measurement implied by the process is repeatable (i.e. that two inspecting groups would come to similar conclusions). It seems clear that experiments to assess such minimal basic

reliability should precede larger scale implementation.

The proposal to assess teaching on a three-grade scale raises further problems. Either the gradings will be sensitive to institutional diversity and appear subjective or they will impose uniform criteria that ignore diversity in order to appear more objective. Neither is desirable. As the chances of moving from 'satisfactory' to 'excellent' will be slim in many departments, there will be little incentive to change. Internal quality assurance on the other hand is compatible with a Total Quality Management (TQM) philosophy of always seeking improvements. It is with good reason that TQM experts condemn norm-referenced rating systems as counter-productive, because they are insensitive to whether quality is being improved in individual situations.

We therefore consider that the current arrangement to assess the quality of teaching in higher education is deeply flawed. Further consideration should be given to this issue to ensure an appropriate arrangement which commands the respect of the higher education community.

4.9 KEY POINTS

- Given sufficient opportunity for scholarship, there should be no absolute requirement that all higher education teachers must pursue both teaching and research.

- The recommendation of *The Future of the Science Base* (Royal Society 1992) stands: that the career structure of postdoctoral higher education staff should include a mechanism to help those individuals who are unlikely to obtain permanent posts to find alternative career opportunities at an appropriate age.

- It is essential that the teaching ability of candidates is assessed before appointment. This assessment should be wider than consideration of traditional lecturing ability.

- The under-representation of women on the academic staff, particularly in the higher positions needs to be understood and cured by HEIs.

- A system of training and mentorship needs to be implemented in each HEI as part of the staff-development system.

- The normal probationary period for lecturers should be extended to five years and should be an integral part of staff development, and be rigorously appraised by both the lecturer and the institution.

- Graduate students should be allowed the opportunity for paid teaching, similar to the teaching assistants scheme in the USA. Some formal teacher training should always be given.

- Staff appraisal should highlight and encourage quality and innovation in teaching, and should form an integral part of the institution's quality assurance mechanisms.

- Opportunities for staff development should allow staff to spend time outside the academic environment, in industry or commerce.

- Promotion to senior levels, including professorial, should be considered

for excellence in teaching, provided an appropriate level of scholarship has been maintained and provided that the case for outstanding performance in teaching is substantiated.

- The quality assurance procedures outlined by the CVCP's Academic Audit Unit (now subsumed into HEQC) should become the norm, including quality assurance in provision and design of courses and degree programmes; in teaching and communication methods; in relation to academic staff; and in relation to external examiners reports, students' views on courses and the views of external bodies. This must be achieved with no increase, and

preferably a reduction, in current levels of bureaucracy.

- External audit remains the most appropriate mechanism for ensuring that all HEIs give proper priority to quality assurance.

- Most costs of quality assurance remain indirect and hidden. It will be important to monitor the whole quality assurance system to ensure that it will itself give value for money.

- The proposal to assess teaching by the use of inspecting teams is deeply flawed and not recommended in its proposed form.

5. FINANCING HIGHER EDUCATION

5.1 BACKGROUND

Many of our recommendations have major implications for the funding of higher education. We do not consider it to be in our remit to consider in detail the mechanisms and level of financing the system. We would, however, not consider our work complete without a broad indication of our concerns, and recommendations for change, as the system evolves. We have not considered the funding of research, which, although of central importance to the Society, also falls outside our remit.

Our discussion has focused on two issues: the institutional costs of providing for a substantial increase in participation; and the share of the costs borne by the students who participate in higher education.

5.2 INSTITUTIONAL COSTS

We welcome the Government's commitment that, for the foreseeable future at least, public funds will continue to be the prime source of revenue for higher education (HE White Paper, 1991). We do not believe that private or philanthropic institutions should be called on to fund the core costs of higher education. However, if expansion of the system is to continue, reaching the participation rate of one in three young people – the Government target – the cost of providing the necessary increases in human and physical resources will be very substantial.

The unit costs of higher education have already been driven down, and any spare capacity in the system has been taken up. The many examples of institutions restructuring their provision to provide greater efficiency often lead to a single gain, not a year-on-year improvement. Moreover, restructuring often demands an initial investment before any savings can accrue. It is vital, therefore, that the capital and development costs of restructuring are fully recognized.

Although there is anecdotal evidence of a lowering of standards, we believe that the quality of higher education has generally been maintained. But there has been another price for the lowering of unit costs. As resources are diverted to provide for expansion, the backlog of repair and maintenance to the fabric of many institutions continues to grow. It is a problem which was recently addressed in the Pearce report. A subsequent sample investigation has revealed that the total backlog of maintenance in the university system lies between one and one and a half billion pounds. In addition to having to live with this backlog of maintenance, institutions have continuing need, particularly in the light of the necessary changes we have discussed, to embark on physical restructuring programmes. Funding for this purpose is, for many HEIs, particularly difficult to find.

We also note the growing concern that some specific aspects of the wider educational experience offered to students are threatened. Under-capitalization of libraries,

laboratories and other learning services will clearly lead to deterioration in the quality of higher education. In the sciences and engineering. We are particularly concerned for the provision and maintenance of expensive equipment, and an appropriate level of fieldwork and project work. These are necessary for the study of many disciplines. There are no cheap substitutes. Furthermore, the rationalization and closure of departments will restrict the breadth of study available at individual institutions.

These issues must be addressed. Throughout this report we have indicated the very considerable financial implications of the transition to mass higher education. Without a commitment from Government to provide the necessary resources for this transition, the quality of education will decline. We have outlined the challenges that face institutions in moving to a mass participation system. The challenge to Government must be to provide the enabling financial support.

5.3 STUDENT FUNDING

It is common ground that the provision of higher education, for those able to profit from it, provides a benefit to the student as well as to society at large. The key question is how the costs should be divided between these two beneficiaries.

Until recently most of the cost was assigned to the tax payer, i.e. to society at large. This disposition was more generous to the student than in many other countries, especially those of the European Community. It was manageable, though perhaps not equitable, when the participation rate was small. With a larger participation rate it is not viable.

TUITION FEES

The first question is whether the contribution should be towards the tuition fees or towards maintenance. We believe that there are strong arguments for maintaining the tuition costs as a national contribution: that the charge on the student should relate to maintenance. The principle that tuition costs are borne by society at large should apply to all students on approved courses whether full or part-time. Our concern is that the relative expense of tuition in the sciences

and engineering would be reflected in higher tuition fees levied on individual students, providing further incentive to pursue non-science studies.

Present arrangements for the payment of tuition fees do little to demonstrate that all post-18-year-olds able to benefit from higher education have an entitlement to financial support for its cost. A system similar to that outlined by Finegold (1992), where all post-18-year-olds are allocated credit vouchers for the cost of further or higher education, would raise the profile of opportunities for further study. The credit vouchers could be used for approved courses in both further and higher education, or a combination of both, either for a block of continuous study such as a full-time qualification, or intermittently through working life.

MAINTENANCE COSTS

The need for bearing enhanced maintenance costs under the present system would be a barrier for some students, and not only for those from families who find it difficult to afford. Student hardship discourages entry into higher education and may lead to more who do not complete their study.

In discussing how the cost of student maintenance should be shared, it is helpful to recognize *three* groups who are involved: the tax payer (society at large); the student and his or her family; and the graduate* (i.e. the successful student at a later stage in her or his life). The manner in which the load is divided between these three parties is complex.

The present situation is that students whose parents' income fall below a fairly modest total receive a maintenance grant. Until 1990 this more or less kept up with the retail price index (RPI). Since that time the increments to reflect the RPI have been made available in the form of an interest-free loan arranged through a new Government-owned loan company. The grant, with the loan element, is sufficient – or nearly so – to maintain a student, prepared to live in spartan style, during the study periods, though not in the vacations. The cost is currently borne by the tax payer, though by early next century there will be a modest contribution from the repayment of loans. Students whose parents earn an income above the threshold receive a reduced, or nil grant. The costs of maintenance can be reduced if the student studies at a local HEI, so that he or she can reside at home. Although we believe that there are disadvantages for the student in adopting this route, it is one which is widely practised in other EC countries. It must have a role to play in securing the wider access we seek.

The provision of near-full grants for a large segment of students, is more generous than in many other countries. As we have said repeatedly, the national aim must be to increase the number of students coming from families with modest incomes. It is a direct consequence of this expansion in higher education that the means testing of maintenance grants will have to be further sharpened, even though we recognize that this in itself will exacerbate the difficulty of attaining the one in three target.

The present loan system was assembled in some haste because the commercial banks did not wish to participate in the scheme. It is not proving to serve its intended purpose well. It is costly to administer: direct costs are high, and there is a great deal of hidden cost within the HEIs. The repayment schedules, which normally require repayment within five years of graduating, can prove difficult.

In the provision of maintenance support there is scope for the imposition of graduate taxes or other forms of loan, or commercial loans with normal interest charges but guaranteed by Government. The recent study commissioned by CVCP (*Review of Options for the Additional Funding of Higher Education,* CVCP, 1993) has outlined several options that allow greater student contribution towards the cost of higher education.

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*   'Graduate' is used as shorthand for students who have completed their higher education studies, irrespective of whether it involves the award of a qualification.

5.4 KEY POINTS

FINANCING HIGHER EDUCATION

- The expansion of the higher education system must involve additional Government investment and recurrent expenditure. Only a small part of the cost can be recovered from 'efficiency gains'.

- The State should continue to bear the tuition costs of higher education for full-time students and should in future also cover the tuition costs of part-time first-degree students.

- The maintenance costs for students is currently the joint responsibility of Government and the student and his or her family, and is still one of the most generous in the world. A direct consequence of an expansion in higher education will be that means testing of maintenance grants will have to be sharpened.

- In the provision of maintenance support there is scope for the imposition of graduate taxes or other forms of loan, or commercial loans with normal interest charges but guaranteed by Government.

6. SUMMARY AND CONCLUSIONS

The dominant theme of our study is that it is in the national interest, that all those capable of benefiting from higher education should do so. **The UK has fallen behind most of its competitors in approaching this goal. There is a consensus that rectifying this situation must count as a high national priority.** (1.1)

The Government target, largely supported by the opposition is that the participation in higher education should, by the year 2000, reach one in three young people. To attain this target will require profound changes in the whole higher education system. Our study has sought to chart some of the needed changes. (1.2)

The first of these is the need to **widen the catchment for higher education,** and to persuade segments of society which – in this country – have rarely participated in higher education, to begin to do so. (1.3)

Higher Education Institutions (HEIs) have markedly different missions, and aim to serve different educational needs. **This diversity will need to be maintained and in certain respects further enhanced,** so as to achieve the wider participation which is sought. There are rather few general statements on any aspect of higher education which have equal validity over the whole range of HEIs. (1.4)

To have any prospect of curing the problem of under-recruitment from the lower socioeconomic segments of society it would be helpful to understand the cause— specifically perhaps why the UK fares worse, in this respect, than so many other nations. We believe that the most important single cause to be a **lack of awareness of the objectives and benefits of higher education.** The second cause, closely related to the first is the lack of coherence in the post-compulsory education system. The rational and, it must be said, radical proposals in the Society's earlier report *Beyond GCSE* have not been accepted by Government. The Government's present policy is to devise a system which encompasses A-levels at the more 'academic' end of the spectrum and NVQs at the more vocational end with GNVQs falling between the two. Such a system is a step in the direction of the proposals in *Beyond GCSE* particularly if some modular commonality between the different routes is developed. **The jury is still out on the question of whether this system will be able to provide a structure that can sustain the range of perceived needs.** We have found it particularly difficult to assess the role of GNVQs. The first five have just completed their first year of trial. The one that would be of particular interest to the Society – science – has only just started its pilot year, and its details are not yet widely known. (2.1, 2.2)

We trust that the temptation to discard elements of the present system prematurely, such as, for example, much of the good practice developed with BTEC, which has helped a great deal in widening access, will be resisted. The history of education shows that predictions of what will and what will not work have not always hit the bull's eye. (2.2)

There will be a continuing need for many to bridge gaps between earlier educational attainments and the challenge of a particular higher education course. **The concept of 'access' courses is one which has proved its value; they should**

continue to be fostered and developed. (2.3) Furthermore, franchising and partnership activities between further and higher education will provide more routes into higher education.

There is a need to tell potential students of the available educational opportunities. This does not happen automatically, except in a restricted segment of the population. We see the need for HEIs and to some extent for Government to play a greater role in publicizing higher education. **It is vital that we use opportunities to promulgate higher education to the local community; and that we recruit national mass media, including the tabloid press, to providing more visibility of higher education.** The need to spread the word applies as much to mature students as to the 18/19-year-old population; it applies as much to portraying the possibility of part-time and distance-learning education as for full-time study. (2.4)

University education has been largely based on the three-year single honours degree, a situation which will be retained in many universities. There has, however, been a growing recognition of a problem in the sciences. The rapid growth of the subject has tended to lead to ever widening syllabuses, so that only the ablest students had any chance of gaining a deep understanding of the key principles. **The solution advocated by the Institute of Physics, which we wholly support, is to move towards a reduced syllabus in the traditional single honours degree course. A minority of students aspiring to a career as professional physicists would continue to an extended and enhanced course, earning the 'M.Phys' degree.** Similar schemes are being considered for the other sciences and mathematics. Engineering had already moved in this direction some years ago by embarking on the M.Eng,

which is offered in many universities and is mandatory in some. (3.3)

We have no doubt that an extended and enhanced degree is the minimum required to educate scientists and engineers to fully professional levels, comparable to those reached by their peers in other EC countries. (3.3)

All higher education courses should incorporate some opportunities for students to gain more personal transferable skills. The need is seen as particularly acute in the case of scientists and engineers who are not, as a group, regarded by the rest of the community as noticeably skilled in verbal or written communication. The skills are the better learned if they are integrated into the course and not presented as a bolt-on option. (3.4)

Many universities have operated modular systems based on Course Units for many years — following the trend in the USA where it has been universal for several decades. The remaining differences lie mainly in the assessment process, specifically whether a student's performance is assessed shortly after the module is completed or whether the assessment is left to a single period during the summer. We believe that the balance of advantage lies with assessment at the end of each module, again following the system which has for long been adopted in the USA. Synoptic modules will help to give the student a coherent view of his or her programme of study. (3.5)

The adoption of modules, coupled with a credit accumulation (CA) system, facilitates the provision of flexible courses adapted to the needs of individual students; it facilitates the participation of part-time and mature students. **We believe that modular course structures, with evaluation based on credit accumulation, is the**

right strategy for the whole of the higher education system. (3.6)

The transfer of credits within an institution is straightforward. The development of a complete credit accumulation and credit transfer system, allowing transfer between institutions, is of a different order of difficulty. Efforts to develop such a system are worthwhile, to provide additional flexibility in course provision and to accommodate students who, for whatever reasons, have to move to another part of the country. It must be appreciated that they will never be automatic. A HEI having a particular mission cannot automatically accept credits from another, possibly very different institution. (3.6)

Successful participants in higher education should emerge with a qualification that reflects the level of their achievement. **The 'Certificate of Higher Education', 'Diploma' and 'Degree' similar to those proposed in** *Beyond GCSE* provides an appropriate structure and an extended and enhanced first degree in some disciplines will provide a wide range in qualification levels (3.9)

To portray to employers and others the standard achieved in each one of these qualifications, a single global assessment is no longer appropriate. **We believe that the time to bury the 'honours classification' has arrived.** Instead, again following the precept of the USA and most EC countries, the students should receive a transcript of individual results for each module or a more comprehensive record of achievement building on the National Record of Achievement now issued to all school leavers. This provides more information than an honours classification, though of course it will be possible to produce some weighted average, if that is what is required. (3.10)

Many universities, many individual academics, are continually experimenting with new ways of teaching, new ways of encouraging learning. **The report by the Scottish University Principals on** *Teaching and Learning in an Expanded Higher Education System* argues the case for a national body to stimulate innovation in teaching and learning systems, a proposal that we fully support. (3.9)

Most universities teach undergraduates for between 30 and 36 weeks in the year. This suggests the possibility that one might seek to facilitate some of the needed expansion by teaching up to 48 weeks per year. It is a question that is currently being studied by the Flowers Committee following their interim report. **We believe that there is merit in some HEIs moving towards a longer teaching year, particularly those whose mission is centred on the teaching function. The case for doing so in research-oriented universities is not so persuasive.** (3.11, 3.12)

All is not well in the academic teaching profession. Relative downward drift of academic salaries, coupled with rapidly increasing student:staff ratios have taken their toll. Happily, nevertheless, talent continues to flow into the system. Competition for 'permanent' posts is fierce in most HEIs. In the sciences it leads to the phenomenon of talented researchers in posts supported by soft (i.e. uncertain) funds, often into middle age. We are fully in accord with the recommendation in the Royal Society report on *The Future of the Science Base* (1992) to help such staff towards alternative career opportunities. (4.3) Most academic staff in the older universities and many in the new universities are active in teaching and research, though the proportion of the time devoted to the latter can vary very widely, reflecting personal and institutional priorities. There is a

widespread perception that in recruiting, and promoting staff, universities emphasize research at the expense of teaching. It is a perception of limited validity but not without basis in some cases and in some institutions. **The assessment of teaching performance should be emphasized both at recruitment and when considering promotion.** The teaching performance should be supported by adequate training and peer-help. (4.2)

It is not always possible to predict the future performance in teaching and research when recruiting a new member of staff. The current 'probation' period of three years is inadequate to perform the needed filtering function or a sufficient period of support. **We recommend that for all HEIs, the probationary period should extend over five years.** (4.4)

Research students participate in teaching. The extension of this system so that some students make a more extensive contribution as teaching assistants – though of course at the expense of some extension for the time to complete their researches – is attractive. We also believe that in science and engineering subjects, in particular, the use of outside lecturers from industry could with advantage be expanded. (4.5)

Institutions and departments within them must take the responsibility for the quality of the teaching provided for the students. This is a major responsibility for heads of departments and of institutions; a responsibility that can be discharged in a variety of ways, not least by asking the students. In recent years there has been a growing tendency to 'nationalize' quality control, a move that has come to full fruition by the appearance of the Higher Education Quality Council. **The HEQC will audit the steps taken by individual institutions to assess quality. We see this as a useful support for the internal assessment.** However, the

Funding Councils further intend to assess the teaching performance, inter alia, by sending inspection teams. **We are dubious whether conclusions taken from such an inspection can be sufficiently reliable to command the confidence of the HEIs.** (4.8)

Higher education costs already amount to more than 1% of the GDP. With the planned expansion, this figure is set to rise. The way in which the financial load is distributed is an important economic and political decision. (5.1)

Tuition costs for full-time students should continue to be based on public funding. Further, this principle should be extended to part-time students. We believe this to be an equitable reflection of the fact that higher education benefits the whole of society. (5.3)

Student Maintenance grants are the other costs of student support. The UK arrangements have been more generous than those which obtain in other EC countries or in the USA, yet our success in recruiting from the less well-off segment of the population is poor. The costs can be reduced by more students living at home. With some reservations, we recognize this as one route which could ease the cost of expansion.

In general, the cost of maintenance needs to be shared between three constituent parties: the tax payer; the student (and her or his family); the graduate (i.e. the successful student at a later stage). The manner in which the load is divided between these three parties is complex. What to us seems clear is, that it is a direct consequence of the agreed expansion (one in three participants in higher education), that the means testing of the maintenance grant will have to be further sharpened, even though we recognize that this in itself will exacerbate the difficulty of attaining that target.

In the provision of maintenance support there is scope for moving towards the imposition of graduate taxes or other forms of loan, or commercial loans with normal interest charges but guaranteed by Government. The current study commissioned by CVCP will bear on these problems (5.3).

SUMMARY AND CONCLUSIONS

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ANNEX A.

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ANNEX B.

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ANNEX C.

GLOSSARY OF TERMS

ACOST	Advisory Council on Science and Technology
BSc	Bachelor of Science
BTEC	Business and Technology Education Council
CA	Credit Accumulation
CBI	Confederation of British Industry
CD-I	Compact Disc-Interactive
CHPP	Committee of Heads of Physics in Polytechnics
CNAA	Council for National Academic Awards
CSUP	Committee of Scottish University Principals
CT	Credit Transfer
CVCP	Committee of Vice-Chancellors and Principals
ED	Employment Department
EPC	Engineering Professors Conference
GCSE	General Certificate of Secondary Examination
GNVQ	General National Vocational Qualifications
GSVQ	General Scottish Vocational Qualification
HE	Higher Education
HEFC	Higher Education Funding Council
HEIs	Higher Education Institutions
HEQC	Higher Education Quality Council
HITECC	Higher Introductory Technology and Engineering Conversion Course
IoP	Institute of Physics
LMS	London Mathematical Society
MPhys	Master of Physics
MSc, MSci	Master of Science
NVQ	National Vocational Qualification
OU	Open University
OECD	Organization for Economic Cooperation and Development
PCFC	Polytechnics and Colleges Funding Council
RS	Royal Society
RSA	Royal Society of Arts
SCOP	Standing Conference of Principals
SCOTCAT	Scottish Credit Accumulation and Transfer
SCOTVEC	Scottish Vocational Education Council
SEB	Scottish Examination Board
TASC	Teaching as a Career Unit
TEC	Training and Enterprise Council
TQM	Total Quality Management
UCAS	Universities and Colleges Admissions Service
UCCA	Universities Central Council on Admissions
UFC	Universities Funding Council

ANNEX D.
THE GNVQ AND HIGHER EDUCATION

The National Council for Vocational Qualifications (NCVQ) was established in 1986 with one of its principal aims to rationalize vocational qualifications. Since its creation it has begun to develop a framework that operates across five levels spanning foundation to graduate/professional level. NVQ Level 2 is broadly equivalent to four GCSEs grade C or above, or their equivalent, whereas NVQ Level 3 is equivalent to 3 GCE A-levels or the BTEC National Diploma or equivalent.

Assessment in NVQs is criterion referenced. This means that candidates are either deemed competent or not yet competent. There is therefore no grading in occupationally focused NVQs, and this has been a problem for those in higher education looking for admissions mechanisms.

During the development of the NVQ framework several issues have been highlighted, namely:

(i) achieving parity of esteem between vocational and other qualifications;

(ii) increasing the breadth and balance of both vocational and school qualifications;

(iii) enhancing opportunities for access to higher education through the vocational route;

(iv) introducing vocational qualifications into schools.

The Government White Paper, *Education and Training for the 21st Century*, (HMSO, 1991), proposed the introduction of a general NVQ that should cover broad occupational areas and offer opportunities to develop the relevant knowledge and understanding, and to gain an appreciation of how to apply these in work. The White Paper went on to say that GNVQs should:

(i) offer a broad preparation for employment as well as an accepted route to high level qualifications, including higher education;

(ii) require the demonstration of a range of skills and the application of knowledge and understanding relevant to the related occupations;

(iii) be of an equal standing with academic qualifications;

(iv) be clearly related to occupationally specific NVQs so that young people can progress quickly and effectively from one to the other;

(v) be sufficiently distinctive from occupationally specific NVQs to ensure that there is no confusion between the two;

(vi) be suitable for use by full-time students in colleges and, if appropriate, in schools who may have limited opportunities to demonstrate competence in the workplace.

GNVQs are also based on five levels and the early introductory phases focus on Levels 2 and 3. Again, Level 2 is equivalent to 4 GCSEs grade C or above or their equivalent, whereas Level 3 of the GNVQ is equivalent to 2 GCE A-levels or their equivalent.

Currently there are five programmes recently completed their pilots in about

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one hundred institutions across the country. From September 1993 science, construction, and hotel and catering join these five programmes. It is hoped in time that many programme areas will be developed for GNVQs and that this will complement the existing NVQ framework.

The basic structure of GNVQs is unit-based, comprising at Level 3, 8 mandatory and 4 optional units. The total hours of contact for the delivery of a GNVQ Level 3 is 15 hours per week. This allows an additional set of units to be offered, and it is this that makes the framework exciting and full of potential. GNVQ Level 2 can be delivered over one year's full-time study, whereas the Level 3 is delivered over two years by full-time study.

Lessons learnt from the first phase of introduction will allow the framework to be made available to adults who may wish to study on a part-time basis, but the initial phases are focused on full-time mode of study and the younger student.

GNVQ Level 3 will be an entry gate into higher education. As mentioned above, the framework comprises eight mandatory units and four optional units. Across these clusters of units there are real possibilities to deliver a provision that possesses both breadth and balance, and to a degree, depth. The depth can be realized within the optional units, but the real potential for the framework is how institutions use the opportunities to create additional units. For example, a student could do a GNVQ + 1 A-level, 2 AS-levels, or several occupationally specific NVQ units. With this approach students will follow a programme of study that should lead to an equally sound preparation for higher education as other routes.

For science this offers opportunities to open up access and increase participation in science and science-related programmes. Increasingly, students enter post-16 education to pursue popular vocational science programmes and the GNVQ framework will allow greater flexibility for students to change the focus of their studies. The mandatory units will be able to provide the student with a good foundation of science knowledge and understanding while the optional and additional units will allow the student to specialize in a specific science or vocational science area or to go into more depth in the broad programme area. This flexibility is important if the student wishes to gain entry to higher education or go into a specific job or career. The GNVQ framework will also allow students to progress to the higher levels of occupationally specific NVQs.

The challenge for higher education admissions staff lies in the sheer volume of the (unfamiliar) evidence presented by GNVQ students, and its differences from the relatively familiar and established A-level. The task is compounded by an increase in total entry numbers against a backdrop of diminished resources for selection.

Handling such a volume of information, in an unfamiliar language, requires cooperative action by higher education and Awarding Bodies together. The task cannot be addressed satisfactorily by individual admissions staff. It will, for example, increasingly be necessary for whole disciplines to identify the requirements for entry to their courses, and to analyse the GNVQ (and probably A-level) to see where the confirming evidence may be found. A similar central exercise may also be necessary to approach the matter of the up-to-six additional units in the GNVQ from more GNVQ/NVQ units, or from A or AS-levels.