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THE ROYAL SOCIETY

BEYOND GCSE

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A Report by a Working Group of
the Royal Society's Education Committee

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PREFACE

This report was prepared by a working group of the Royal Society's Education Committee under the chairmanship of Professor Leslie Crombie, F.R.S. It expresses deep concern that the scientific and technological needs of the UK will not be met unless there is a radical revision of post-16 education. This report considers strategies for improvement.

Beyond GCSE is published as a statement of the Council of the Royal Society, to encourage informed debate amongst educationalists and policy makers for post-16 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.

Professor B.K. Follett
Vice President and Biological Secretary,
The Royal Society

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SUMMARY

A seamless education system from age 5 to postgraduate level in which the potential of all students may be fully realized is vital if the future scientific, mathematical and technological needs of the UK are to be met. This requires especially major changes to post-16 education.

The introduction of the GCSE and the National Curriculum aims to provide a coherent framework of education and a balanced curriculum for all students up to the age of 16. The new emphasis, particularly in science, on experiential teaching and 'hands on' learning is very welcome; as also the importance attached to the application of skills in the assessment of each student.

However, current education provision for students post-16 is out of step; it does not reflect the balance, style or coherence now being sought for pre-16 education. Current post-16 education is broadly split into two types: an academic track demanding specialization and a high level of competence, and catering for a minority of the post-16 population; and a vocational track, regarded as 'second class' and less worthy than the academic track. There is little opportunity for transfer between the two tracks and no parity of esteem.

The education system of England and Wales does not compare favourably with that of other countries. Of major concern to the Royal Society and many others is the extremely high proportion of young people who leave education at the age of 16: far higher than that of many of our European trading partners. Many of those that do stay on are expected to specialize to an extent that restricts their future career choices.

Post-16 education needs urgent revision to incorporate: **greater participation and achievement** from a broader cross-section of young people; **flexibility** to ensure interests and personal strengths are met; **breadth** to ensure a balanced curriculum; **rationalization** across academic and vocational courses that is easily understood by students, employers and higher education; **entitlement** for all to a set of skills, competencies, relevant knowledge and understanding, and common features such as work experience, personal and careers guidance and statements of achievement. A revision along these lines will attract a higher proportion of sixteen year-olds to continue with their education, will allow easier access for those people who wish to return to learning, and will broaden education beyond the age of 16 to equip students with the flexibility to adapt to the changing needs of society throughout their lifetime.

To these ends the report proposes a major change to the current post-16 education system. The revised system is based on a **single integrated system** of academic and vocational education taught through a modular framework with study drawn from three domains: social, economic and industrial domain; scientific, mathematical and technological domain; and creative, language and aesthetic domain. Students will be assessed for an Advanced Diploma (normally after two years) or an Advanced Certificate (normally after one year of study), with the assessment of skills taking a prominent role. These changes have considerable implications, not least in terms of resources, teacher supply, accommodation and equipment, that will be needed to match the increase in participation. The content and style of higher education courses will also need radical revision in response to the needs of students and employers for more skills-based and flexible learning strategies.

SETTING THE SCENE

THERE have been important and welcome changes in teaching and assessment strategies in the compulsory phase of schooling in England and Wales in recent years. The General Certificate of Secondary Education (GCSE), introduced in 1988, and the National Curriculum, which for science and mathematics will be fully implemented by 1994, are designed to enhance participative and experiential learning with less didactic teaching. More emphasis is given to the application of skills and there has been a significant reduction in course content. The post-16 sector, especially the more traditional academic syllabuses, no longer matches the style of teaching and assessment pre-16. There is a gulf between the teaching and assessment strategies of GCSE and Advanced (A) levels, and a mismatch between the content-laden style of A-level, and the emphasis on skills and processes which is prevalent in GCSE syllabuses and vocational courses. The Society is concerned that the future scientific and technological needs of the UK will not be met without major changes in post-16 education and training.

Since 1951 post-compulsory education in England and Wales has been dominated by A-level examinations. Introduced to replace the Higher School Certificate, A-level examinations were designed to test the intellectual rigour of potential undergraduates. Candidates then, and now, studied for two or three single subject examinations, with exceptional students studying for four or five subjects.

In 1951 approximately 37 000 candidates were entered for A-level examinations. Today the A-level examination is used much more widely, not only as an entry requirement to higher education (HE), but also as a stepping stone for entry to employment. A-levels are expected to meet a diverse variety of needs, which go well beyond those for which they were designed.

The lack of breadth experienced by students taking A-level examinations has been widely recognized. The Society has previously criticized this excessive specialization post-16. The introduction of Advanced Supplementary (AS) syllabuses was partly a response to this lack of breadth, with the aim of broadening the experience of students studying at advanced level. In March 1987, the Secretaries of State for Education and Science and for Wales commissioned a group chaired by Dr Gordon Higginson to recommend the principles that should govern A-level syllabuses and their assessment. The Higginson Committee reported in *Advancing A-levels* (DES, 1988) with the recommendation that the study for A-level examinations be broadened to include five separate and equal subjects, which the Committee termed 'leaner and tougher' syllabuses. The response of the Secretary of State for Education and Science, although recognizing the need to broaden the post-16 curriculum, was to reject the recommendation for five separate subjects, and to rely on the AS examinations as a means of broadening the curriculum. The Society has argued previously that AS examinations do not provide a long-term solution to broadening. Complementary AS examinations (i.e. subjects similar to those studied at A-level) tend to increase not decrease specialization. Few schools and sixth-form colleges have adequate resources to offer a broad and contrasting range of AS subjects. A more radical solution needs to be found which goes beyond the needs of students studying for A-levels and encompasses all those involved in education post-16.

Alongside the academic system is a vocational system of education post-16 that is almost entirely separate both in style, content and assessment. Transfer between the academic and vocational systems is difficult and unusual. Transfer requires students to start afresh on the new system regardless of any qualifications which they may have already achieved. A principal provider of vocational, or work-related education is the Business and Technician Education Council (BTEC). Registration of students who pursue BTEC courses continues to grow; currently (1991) almost half a million students are studying BTEC courses. Other main providers of work-related qualifications include the City and Guilds of London Institute (CGLI) and the Royal Society for the Encouragement of Arts, Manufacture and Commerce (RSA).

In 1986 the Secretary of State for Employment, after consultation with the Secretaries of State for Education and Science, and for Wales, established the National Council for Vocational Qualifications (NCVQ). The Council's remit is to establish a framework in which the principles and procedures for a national system of vocational qualifications can be developed.

THE SOCIETY'S POSITION

The Society's concerns for post-16 education were most recently-outlined in its report *The 16–19 science curriculum and its assessment: statement of policy* (RS, 1988). The report endorsed the main recommendations of the Higginson Report and went further in recognizing that the whole provision for 16–19 education, not just A-level examinations, was an area which required review. Many of the arguments rehearsed in those reports remain pertinent, in particular the need for a broader education for a greater number of our 16–19 year olds than we now educate.

Against this background the Society's Education Committee established a working group, chaired by Professor Leslie Crombie, F.R.S., (full membership and terms of reference at Annex A), to consider further the implications of broadening post-16 education. Accordingly, this report considers the current pre-16 and post-16 provision, draws comparisons with educational systems elsewhere (with particular reference to some of our European trading partners as well as other major industrialized countries), identifies the features required for a rationalized post-16 education system, and outlines short-term and long-term strategies for improving the quality of post-16 provision for all its users. Fundamental to the group's thinking have been the main recommendations of the Society's earlier report, namely:

(a) It is undesirable for students to specialize too early, thereby reducing choice of study later on.

(b) There are strong advantages to the UK in offering a much higher percentage of 16–19 year olds a broad and balanced curriculum.

(c) Education after the compulsory period should be provided against a background of equal opportunities for study for those of different gender, social class and race, and regardless of which stage in life such further study is undertaken.

(d) To participate fully in a society that places increasing reliance on scientific and technological advances, all students who continue into post-compulsory education and training should have an entitlement to study some science and mathematics.

The proposals and concerns expressed in this report aim to assist relevant bodies in their decisions with regard to post-16 education and training, *viz*: the Department of Education and Science (DES), the Welsh Office, the Department of Employment, the School Examinations and Assessment Council (SEAC), the National Council for Vocational Qualifications (NCVQ), the National Curriculum Council (NCC) and the Curriculum Council for Wales (CCW), the GCE examination boards, the Business and Technician Education Council (BTEC), and the City and Guilds of London Institute (CGLI).

CURRENT PROVISION PRE-16

The introduction of the GCSE examination and the National Curriculum offer an opportunity for a coherent style of educational provision encouraging a broad curriculum for all pupils to the age of 16. Teaching strategies for GCSE courses emphasize learning through exploring; at least 20% of marks in science examinations are allocated to experimental skills. The application of skills figures large in the assessment procedures.

Another major influence on teaching and learning approaches is the Technical and Vocational Education Initiative (TVEI), funded by the Department of Employment. This initiative aims to help education to be relevant to the world of work and to produce people who are practical and enterprising as well as academic. It seeks to do this by involving industry directly, and through work experience, careers guidance, records of achievement and action planning to develop and enhance the personal effectiveness of the individual learner. At age 14 pupils involved in TVEI follow a broad balanced programme which requires both boys and girls to undertake biological and physical sciences, technology, information technology, and modern languages; reflecting the National Curriculum whilst providing a practical emphasis.

These developments have been publicly welcomed by the Royal Society. The introduction of the GCSE has quite properly led to a reduction in content of syllabuses which were overloaded. This has allowed greater concentration on the fundamental concepts, and a greater chance to apply skills to such tasks as problem solving and simulation. The Society continues strongly to support these trends and would wish to reaffirm its commitment to a balanced programme of science education, taught in 20% of the total curriculum time for all pupils in the last two years of compulsory schooling. The programme of science education should include the fundamental concepts of physics, chemistry and biology, as well as the study of interdisciplinary subjects such as Earth sciences, the environment and astronomy.

CURRENT PROVISION POST-16

Educational provision in England and Wales for 16-19 year olds in schools and further education (FE) colleges consists of **either** a wide range of vocational and pre-vocational programmes, accredited by a diversity of agencies, **or** the study of a limited range of academic subjects for AS or A-level examinations, administered by a variety of examination boards. Students opt for the

academic track or for the vocational or work-related track. The opportunities for some to select study from both tracks are negligible.

The provision of academic study, essentially A-level examinations, is split between schools and FE colleges. Figures for 1989 and 1990 show that approximately 60% of A-level examination candidates study in schools. The provision of full-time vocational study is currently almost exclusively through FE colleges. However, BTEC First Diplomas will be available in schools as well as FE colleges from September 1991. Added to this, the system also provides for some pupils to take additional GCSE examinations, or to re-take GCSE examinations in schools or FE colleges in the hope of improving their grades. Pre-vocational qualifications, such as the Certificate of Pre-Vocational Education (CPVE) are also available.

What the system currently lacks is coherence; it provides little by way of logical continuity and progression from the National Curriculum at age 16.

At the end of 1989, the Secretary of State for Education and Science requested the NCC and the SEAC to enhance the educational and vocational opportunities for 16–19 year olds by the inclusion of core skills in the curriculum. Although the primary focus of this initiative was the incorporation of core skills in A and AS syllabuses, the NCC and the SEAC were asked to liaise with relevant bodies, including the NCVQ, to consider the core skills for the curriculum overall including vocational qualifications. The NCC and the NCVQ have now published their responses and to achieve the common set of core skills proposed, it will be essential that the NCC, the SEAC and the NCVQ continue to work jointly to agree and specify precisely the core skill statements to be adopted, the methods of assessment and other aspects of implementation.

THE ACADEMIC TRACK

The majority of students in England and Wales who pursue academic qualifications after compulsory education will study for advanced A-level examinations or, with the introduction of AS examinations in 1987, a combination of A and AS examinations.

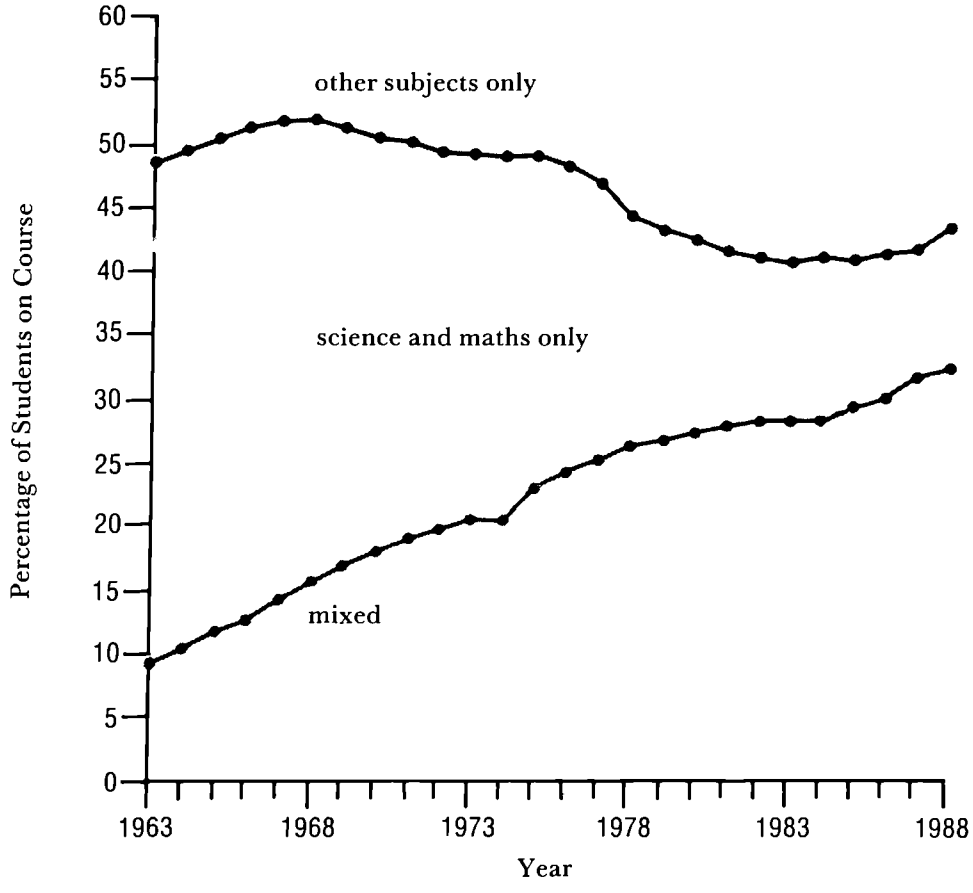
Students who pursue A-level studies concentrate on two or three subjects, or for the most able four or five. In contrast to GCSE, A-level syllabuses tend to be content-laden and teaching often relies heavily on a didactic approach. The focus on only two or three subjects requires students to opt for a specialized programme of study that inhibits later choice. Recent research by Alan Smithers and Pamela Robinson has shown a welcome growth in the number of students who choose to follow mixed A-level programmes, i.e. a mixture of arts and science subjects. This may be viewed as an attempt by candidates to broaden the curriculum at this level, and to delay specialization until a later date. Many of these students, however, will not have the appropriate mix of qualifications if they choose to continue into HE to study science.

As can be seen in Figure A, the growth of mixed subjects at A-level has been steady. Mixed A-levels continue to grow at the expense of the sciences only or the arts only.

A-level syllabuses have evolved considerably. But the contrast between the still mainly content-laden syllabuses and didactic strategy of A-levels and the skills and processes orientation of GCSE remains and is likely still to deter many from further study post-16, particularly in mathematics and science. A recent study at Oxford University into the attitudes of sixth-form

Figure A

CANDIDATES SUBJECT OPTIONS AT A-LEVEL



Source: *Increasing participation in higher education*, Smithers and Robinson (1989).

students towards science and technology courses concluded 'the passive role that they were expected to have in receiving their A-level courses was unwelcome for many, causing them to reject such courses either before, or shortly after, joining them. This was in strong contrast to the very positive attitudes that students had from TVEI, BTEC and work experience courses, where the emphasis on students taking responsibility for their own action was having a positive effect on student attitudes and achievement' (*Making Choices*. Oxford University, 1990). In addition to the difficulties of mismatch of content and teaching style of A-levels, their method of assessment is a further deterrent to continuing study. First, assessment is based mainly on examinations taken at the end of two years of study. There are few schemes that allow an intermediate step for the student who does not finish the two-year course. For the majority of A-level students, those leaving the course after one year of study have no record of achievement at all. Second, the proportion of students who fail A-level examinations remains high. Although the number of candidates gaining grades A-E has risen slightly in recent years, the proportion who fail remains near to one quarter of the total entry. Results for 1989 and 1990, shown in Annex B, show that failure rates for AS examinations are markedly higher than A-level. For those candidates who fail, some of whom will be among the academically most able, there will be no record of their achievement or progression

above GCSE level. This remains a major disincentive to those contemplating continuing their studies after 16.

AS examinations were introduced in 1987 as a means of introducing breadth into A-level study. They are designed to be a two-year course to be studied to the same depth as A-level examinations but with half the content. In their first year AS examinations had a very low take up: by 1990 45 000 AS examinations were entered, compared with 684 000 A-level examinations. The Senior Chief Inspector, in his annual report for 1989–90, noted that some institutions were not using AS examinations to broaden study, but as an insurance policy or as a preparation for A-levels.

Research by Alan Smithers and Pamela Robinson into the provision of school science teachers has shown that where there are shortages, AS syllabuses are often not taught. There can also be organizational reasons behind a restriction on the variety of courses offered emanating from a squeeze on resources more generally. In 1989–90 less than 20% of schools were able to offer AS science courses (see Figure B).

Figure B

AVAILABILITY OF AS EXAMINATIONS*

Subject	AS Exam Course		
	Taught Separately	With A-Level	Not Taught
Biology	5.9	11.8	82.4
Chemistry	0.8	8.4	90.8
Physics	1.7	14.3	84.0

* Percentage of 119 schools with sixth forms

Source: Teacher provision in the sciences (Smithers and Robinson, 1990)

The Society remains concerned about the effective contribution of AS examinations to broadening academic education.

THE VOCATIONAL TRACK

FE colleges traditionally offer both academic and vocational courses. The system of vocational qualifications in this country is extensive. Vocational qualifications at all levels are awarded by numerous bodies, but predominant for science and mathematics-based courses post-16 are BTEC

and CGLI. The present arrangements for vocational qualifications need clarification to help employers, HE and those seeking training. In recognition of this, the Government established the NCVQ, to reform and rationalize the provision. The NCVQ is proposing an assessment-led and competency-based framework for vocational awards. By 1992 the Council has been asked to complete the framework of National Vocational Qualifications (NVQs) to cover 80% of the working population. The definition of the various levels of NVQs is given below.

Figure C

DEFINITION OF NVQ LEVELS

Level I: competence in the performance of work activities which are in the main routine and predictable or provide a broad foundation as a basis for progression;

Level II: competence in a broader and more demanding range of work activities involving greater individual responsibility and autonomy than at level I;

Level III: competence in skilled areas that involve performance of a broad range of work activities, including many that are complex and non-routine. In some areas, supervisory competence may be a requirement at this level;

Level IV: competence in the performance of complex, technical, specialized and professional work activities, including those involving design, planning and problem-solving, with a significant degree of personal accountability. In many areas competence in supervision or management will be a requirement at this level.

Level V: competence which involves the application of a significant range of fundamental principles and complex techniques across a wide, and often unpredictable, variety of contexts. Personal accountability and autonomy feature strongly and often significant responsibility for the work of others and for the allocation of substantial resources.

Source: *NCVQ*

NCVQ has a central role to play here but its separate existence from the SEAC is not likely to encourage cross linkages with the academic track. It is essential that the frameworks being created by the NCVQ and by the SEAC are rationalized to achieve proper cohesion and continuity.

The BTEC approves vocational courses in a wide range of subjects at three levels: BTEC First, BTEC National and BTEC Higher National. The BTEC Firsts are vocational qualifications for young people (at least 16 years old) who may have had little success with GCSEs. The courses develop essential skills and knowledge and provide a foundation for further study. The courses can be studied over one year part-time (while gaining relevant work experience in employment), one year full-time or two years part-time. The qualification is approximately equivalent to 4 GCSEs (grades A-C). The BTEC Nationals are nationally recognized qualifications for technicians or junior administrators and are equivalent to two A-levels. They may be taken part-time whilst in appropriate employment, or full-time over two years. The BTEC Higher Nationals are qualifications for higher technicians, managerial and supervisory levels and are equivalent to the

old pass degree or about two thirds of an honours degree. The table below shows the relationship between BTEC stages and other academic qualifications. However, it should be noted that stating 'equivalence' between BTECs and other qualifications signifies the route open for the next stage of study rather than direct comparison in style or content (e.g. successful BTEC National students, like successful A- level students, will be accepted for degree level study).

Figure D

THE RELATIONSHIP BETWEEN BTEC QUALIFICATIONS AND OTHER QUALIFICATIONS

Qualification	Entry Level	Description	Age	Min Duration	* Equivalent to
14-16 Foundation Programme	Available to 4th and 5th year secondary pupils	A pre-vocational foundation programme offered in conjunction with City & Guilds. Taken with GCSEs as part of a school's core and/or option programme	14-16	2 years	Pupil's progress and achievement recorded individually on a profile and certificate. No direct equivalence with other courses Most students will also obtain GCSE qualifications
Certificate of Pre-Vocational Education (CPVE)	Available through school college and YTS No formal entry requirements	Pre-vocational programme offered in conjunction with City & Guilds Students can experience a range of vocational areas and develop a broad range of skills related to future study and adult life Can be taken alongside further GCSEs or GCE 'A' and A/S levels	16+	Usually 1 or 2 years depending on other areas of study	Pupils progress and achievement recorded individ -ually on a profile and certificate. Depending on level achieved, progression can be to either BTEC First, BTEC National or other vocational courses or directly into employment
BTEC First Certificate **BTEC First Diploma**	No formal examination passes stipulated but some centres prefer GCSEs/GCE O levels	Initial vocational qualification for those who have chosen their areas of work Students develop essential skills which provide a foundation for work or further study	16+	1 year part-time 1 year full-time or 2 years part-time	Several 'O' levels/GCSEs
BTEC National Certificate **BTEC National Diploma**	BTEC First Certificate or Diploma Or four GCE O level/GCSE grade C or better CPVE or Foundation Programme with suitable attainment or equivalent qualification	Nationally recognised qualification for technicians and junior management positions	16+	2 years part-time 2 years full-time or 3 years part-time	GCE 'A' level (The BTEC National is accepted as a standard route to University subject to obtaining the right grades and may be taken in LEA schools)
BTEC Higher National Certificate **BTEC Higher National Diploma**	BTEC National Certificate or Diploma Or suitable GCE 'A' level pass Or equivalent qualification (The actual requirements depend on each course)	Nationally recognised qualification for higher-technician, managerial and supervisory posts	usually 18+	2 years part-time 2 years full-time or 3 years part-time	Generally accepted by employers as pass degree equivalent

* Because of the vocational nature of BTEC courses, it is not always appropriate to compare BTEC qualifications to other purely academic qualifications However, in this column we list the generally equivalent standards for guidance only.

Source: *BTEC*

There remains a perception of low status associated with vocational courses in general compared with the 'academic'. A major concern is the need to reassure prospective BTEC students of the equal value of BTEC National Awards and A-levels. These awards are an alternative to A-levels, and it is essential that parity of esteem is engendered. Some HE admissions tutors also need

convincing, although more are realizing the achievements inherent in a BTEC qualification. Interestingly, most employers seem to have much less difficulty.

Another major examination body which is involved in the assessment and recognition of achievement in vocational education and training is the CGLI. Many of the City and Guilds schemes require science or science-related topics as the main part of a vocational course. Students attend colleges under various modes, namely: full-time, part-time, evening only, block release and, increasingly, distance learning.

Schools and colleges have over the past few years developed and run the CPVE, now organized by the CGLI. This award offers valuable opportunities for students, although it is not always regarded highly by employers. Pupils completing CPVE have progressed to BTEC National awards, A-levels and employment. But evidence has shown that few students attempt any of the science elements within the CPVE framework, with enrolment for CPVE generally falling.

Some FE colleges offer students the opportunity to gain professional qualifications. These are validated by the relevant professional body such as the Royal Society of Chemistry and the Institute of Biology. This work is classified as HE and most of the programmes are part-time. Students are graduates or possess equivalent qualifications, for example, BTEC Higher Diplomas/Certificates.

Many Local Education Authorities (LEAs) are currently implementing curriculum strategies for TVEI extension post-16; the Department of Employment is supporting the provision of a common curricular framework for all learners. Curricula are being devised on the basis of the 'entitlement' for all students of a broad framework for their studies post-16. Planners are required to identify skill areas including communication and number skills; information technology; science and technological capability; and familiarity with European cultures (including language skills). LEAs are asked to demonstrate that they have in place a number of whole curriculum strategies, including tackling divides between academic and vocational tracks (which, by closing off some options for further exploration, can make it hard for a student to develop to his or her full potential). Extension of TVEI will require schools and the FE sector to cooperate, particularly over such areas as carrying over GCSE coursework between the two sectors.

ACCESS COURSES

There are many people in the population who leave the education system with no formal education post-16. Furthermore physical science subjects have sometimes been taught in schools and FE in such a way as to induce in those who fail, or do less well, the feeling that they will never understand 'hard' science. This is not the case, for example, with geography. It is particularly important, therefore, that there be high quality access and pre-access courses (such as one year evening classes) in science subjects which will help candidates who feel the need to return to education. Access courses provide further opportunities for this substantial sector and can help to address the under-representation of certain groups in both FE and HE. It should be noted, however, that the great majority of students on access courses are aged over 21 and a wide variety of ages participate.

Access courses have proliferated in England (88% of LEAs provide courses) and there is a significant expansion in Northern Ireland and Wales. 583 courses are provided in 298 institutions in the UK (CNAA, April 1990). 15 000 places were offered to students in England in 1989–90. Virtually every course covers more than one subject. Humanities and social sciences are the most

popular subjects but science, IT, computing and mathematics together account for 54%. However, there is a particularly high drop-out rate in science access courses. This needs serious consideration and a solution, if courses are not to perpetuate a poor impression of science that many pupils may have already picked up at school or in FE.

OPEN LEARNING

It is appropriate to note that large numbers of adults, often with little by way of formal educational qualifications, do study science, mathematics and technology through the Open University and other open learning institutions. The Open University was granted its Royal Charter in 1969 and over 100 000 people now hold Open University degrees. Since the first Open University Science Foundation course was launched in 1971 over 167 770 have applied to study the course, and 77 000 have been admitted. Of these 52 790 have successfully completed the course. About one third of those students who register for the science foundation course do not hold sufficient qualifications to enter traditional degree courses in HE. During the same period 62 783 people have successfully completed the second level science courses and 21 661 have gained third level science credits in biology, chemistry, physics and Earth science. In 1990 the number of students registered for the mathematics, science and technology foundation courses were, respectively, 3707, 4039 and 4393.

IN SUMMARY

So at present students opt for traditional, vocational, pre-vocational or access courses which compete with each other for the post-16 student pupil population in a system which is confused and confusing. Students who decide that they have embarked on a course unsuited to them find it difficult to change direction. Not all the options may be available at any one institution and no credit is given in the new course for achievements made in the course no longer followed. The system is inflexible: it is failing to meet the needs of a diverse 16–19 student population.

COMPARISONS WITH OTHER SYSTEMS

IN considering post-16 education in England and Wales, the Society was keen to compare systems in European countries, and also other major industrialized nations. The Society's main concerns were the route of participation in education, and the structure and breadth of provision. The main points of the international comparisons are given here, with more detailed examinations given in Annex C.

PARTICIPATION RATES

As Figure E (below) shows, the UK compares unfavourably with other European Community countries and major industrial nations with regard to full-time participation rates. It is vital for participation rates in the UK to be, at least, broadly compatible with our competitors if the UK is to trade in world markets effectively.

Figure E

PARTICIPATION OF 16–19 YEAR OLDS IN FULL-TIME EDUCATION AND TRAINING, AS A PERCENTAGE OF AGE GROUP

(1987–1988)	Age 16/17		Age 17/18		Age 18/19	
	M	F	M	F	M	F
Australia	70.2	75.2	57.7	60.5	29.0	29.7
Belgium	91.9	93.3	88.1	89.3	67.4	69.0
Canada	92.4	92.5	75.6	75.3	56.4	56.3
Denmark	90.4	92.4	76.9	78.8	68.6	67.5
France	80.3	85.1	69.3	76.7	57.9	63.6
Germany	94.8	93.9	81.7	79.8	67.7	64.9
Italy*	54.0**		47.0**		41.0**	
Japan	89.8**		87.6**		50.0**	
Netherlands	93.4	92.8	79.2	77.7	59.7	57.6
Spain	64.7	66.3	55.9	58.3	30.4	27.4
Sweden	80.8**		83.1**		44.1**	
UK†	51.3	54.8	33.7	36.6	18.8	18.6
USA	94.6	94.4	88.6	88.9	57.3	53.5

* 1986

** male and female

† England, Wales and Scotland aggregated. There are higher participation rates in Scotland than in England and Wales.

Source: (i) *Education of OECD Countries 1987–1988* (OECD, 1990)
(ii) *International statistical comparisons of the education and training of 16–18 year-olds* (DES, 1990)

BREADTH AND ASSESSMENT

Scotland has academic examinations 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. Able students take five subjects at age 17 and a further three at age 18 but a free choice of subjects does not prevent specialization. A modular vocational system is increasingly being used by 17 and 18 year-olds to complement their other studies.

France has a two year vocational track and a three year HE track (*Baccalaureat*). The first year Baccalaureat consists of seven subjects from restricted options ensuring breadth. There is less breadth later on. Assessment is by written and oral questions.

Germany requires all students up to age 18 to continue in the education system for at least one day a week. The HE track (*abitur*) consists of broad subject areas ensuring breadth with final written examinations in two main subjects, one optional and a further optional oral examination. The grading system also takes account of coursework.

Italy has five types of post-compulsory school (from age 14). For the academic route the curriculum is either broadly arts or science oriented. Students study between 9 and 11 subjects. Assessment is at the end of the course (3–5 years) in two broad-based examinations and an oral in two further subjects.

Japan offers a variety of general and vocational courses post-compulsory schooling. A broad range of 8 subjects is studied and a minimum standard is required in each subject, based on a system of credit accumulation.

USA The two year high school diploma is made up of units from six subject areas. Both general and vocational courses are offered.

Sweden offers 'theoretical' and vocational courses and more than half of students take the latter; both allow entry to HE. There are no external examinations at any stage; centrally designed standardized tests are marked at the school. Students receive a leaving certificate showing graded results per subject.

SUMMARY OF INTERNATIONAL COMPARISONS

With the comparisons with other education systems, the Society has focused its attention on the rate of participation and the differences in breadth and style of assessment. In these respects the education system of England and Wales compares unfavourably with other countries. The Society believes that if the UK is to trade effectively with other countries, we must educate and train more of our 16–19 year olds than we currently do. The narrowness of study, particularly in academic education, is seen as a major barrier to increasing participation.

The International Baccalaureate and the European Baccalaureate are both considered in more detail:

INTERNATIONAL BACCALAUREATE (IB)

The IB was established in the 1960s primarily to provide for internationally mobile students a curriculum and examination system which would have international acceptability. Currently offered by schools in some 50 countries and accepted by HE institutions worldwide, the IB programme is taught in over 20 schools/colleges in the UK and the IB Diploma is accepted by all British universities. Its philosophy emphasizes the importance of breadth in the curriculum, alongside opportunities for specialization, and encourages students to learn how to learn, rather than to concentrate simply on an encyclopaedic approach to learning.

The programme of study is based on six subjects, 3 (or 4) at Higher Level and 3 (or 2) at Subsidiary Level. Candidates for the IB Diploma must study one subject from each of the following groups:

Group 1	*Language A*: (first language) including the study of world literature.
Group 2	*Language B* (foreign language learning experience).
Group 3	*Study of Man in society*: history, geography, economics, philosophy, psychology, social anthropology, organization and management studies.
Group 4	*Experimental sciences*: biology, chemistry, applied chemistry, physics, physical science, experimental systems.
Group 5	*Mathematics*: mathematics, mathematics with computing, mathematical studies, mathematics with further mathematics.
Group 6	One of the following: (a) Art/design, music, Latin, Classical Greek, computing studies. (b) A school-based syllabus.
Alternates	A candidate may offer, instead of a group 6 subject; a third modern language, a second subject from group 3 (the study of Man in society), or a second subject from group 4 (experimental sciences).

In addition candidates must also produce an extended essay in one of the IB subjects, follow a course in the theory of knowledge and engage in extra-curricular activities. Candidates may also offer single subjects for which they will receive a certificate.

EUROPEAN BACCALAUREATE

The European Baccalaureate was established in 1957. It is intended to be delivered to the children of officials of European Community Institutions. It is only taught in nine 'European' schools, which are situated in Belgium, Germany, Italy, Netherlands and the UK. The baccalaureate is taught from the age of 11. Subjects which are compulsory until the age of 18 are: first language (mother tongue), second language (foreign language), mathematics, history, geography, science (separate

sciences from age 15), physical education and ethics. The study of these subjects is almost exclusively academic; there is little vocational study offered. In common with some European countries there is no intermediate examination at age 16.

The curriculum for the European Baccalaureate is characterized by its breadth. The study of eight subjects is compulsory. Beyond the age of 16 students study two optional subjects, which usually increases their specialization to either arts, science or languages.

POST-16 EDUCATION: FUTURE REFORM

THE COMPONENTS

IF the UK is to remain competitive in an increasingly scientific and technological age many of the issues and concerns which have been outlined earlier will need attention. A reform of post-16 education must be viewed as an investment for the future prosperity of the UK. Further, if the post-16 sector is to be attractive to a greater proportion of our young people, it will need to incorporate many components which are either not inherent in the current system or deserve greater attention.

PARTICIPATION AND ACHIEVEMENT

There is now an urgent need to increase the participation of our post-16 education system to levels which are, at least, comparable with our European trading partners. In parallel with the increase in participation we must maximize the achievement of those individuals who decide to continue with post-compulsory education. A clear statement on desirable levels of participation and achievement must be given by the DES. In this respect the targets noted by the CBI in *Towards a skills revolution* (CBI, 1989), shown at Annex E, might form a helpful basis for further discussion.

BREADTH

International comparisons show that the education system of England and Wales is exceptional amongst our trading partners in encouraging such specialization of study to two or three subjects at advanced level at the age of 16. This inevitably closes career options later on and deters wider participation. It also denies students the benefit of a broad-based education that will equip them with the flexibility to adapt to changing throughout their lifetime. A post-16 system which takes us into the 21st century must encourage breadth of study. The system should ensure the study of **both** communication (including foreign language) skills **and** science and mathematics for **all** students in a broad and balanced curriculum. Breadth of study will develop a clearer understanding of the issues which face society.

ACADEMIC/VOCATIONAL DIVIDE

The Society believes it is essential to allow students to bridge the divide between academic and vocational education which currently exists. This would allow students the freedom to choose a mix of academic or vocational education appropriate to their future careers, or to transfer between academic and vocational education, or to choose to follow one track. Ending this division and creating a unified system will produce students whose skills and competencies match those required by the nation, and will encourage greater participation.

RATIONALIZATION

Various suggestions have been put forward to rationalize post-16 provision and to increase participation rates. There is pressure for reform from industry, learned and professional institutions, HE and Government. Numerous reports and statements have emerged from these sectors, many of which are listed at Annex D.

There is an inherent difficulty in matching pre- and post-16 provision, although the A and AS principles drafted by the SEAC attempt to address this issue. A and AS syllabuses were not designed with the content and processes of the National Curriculum in mind. Many vocational qualifications are based on the development of core skills and competencies which are also difficult to match against the subject-based National Curriculum. However, the core skills and themes for the post-16 sector identified by the NCC, the SEAC and the NCVQ are welcome and may be central to transcending some of the difficulties posed in attempting to rationalize the systems that currently operate. Particularly welcome is the proposal that scientific and technological understanding as a theme be included in all post-16 programmes of study, and that work experience should be carefully planned, structured and used to develop basic skills.

SOME RECENT DEVELOPMENTS

Before outlining a future framework of provision post-16, it is useful to note some recent developments. A number of schemes are based on the idea of A-level enhancement in delivering a broader range of skills. The *Yorkshire, Humberside and North East Enhancement Project* originated from five LEAs considering the implications of TVEI post-16, especially for A-level pupils. The project seeks to develop programmes that build on pre-16 provision within an 'entitlement' framework related to the knowledge, skills, and understanding that students need for their future personal and career development. The programmes are designed to meet individual needs with appropriate guidance and personal counselling. Programmes are structured within a CPVE framework, concentrating on A-levels but may also lead to BTEC qualifications. Each individual programme has a 'core' defined in terms of skills and understanding and 'enrichments' include work experience, residential experience, cross-curricular applications of technology and records of achievement.

The *SATIS 16–19 Project* (Association for Science Education, 1990) also aims to enhance post-16 science provision through a wide range of resources providing support for both general education and the enrichment of specialist academic and vocational science courses. SATIS units are designed to meet the growing demand for science teaching programmes which seek to foster the qualities of mind that are needed in a changing world including the ability to think, to act, to apply as well as to receive knowledge and to communicate effectively. A particular feature of SATIS 16-19 materials is that they use a comprehensive range of teaching and learning approaches.

Another development is the concept of an A-level programme enrichment where the curriculum is extended by means of an additional study element. The *North-West/University of Liverpool TVEI Scheme* is one example of this. It is based on group project work of increasing complexity and is open to all

pupils irrespective of the number and nature of A-levels studied. The three required projects are designed to encourage the development of skills and processes relevant to the world of work. They have been identified by schools, industry and HE working together. These include setting targets, working to deadlines, developing the interactive skills needed for group work, decision-making, organizational skills, information handling and communication. The subject and nature of the final project involves active negotiation with local industry, business, commerce and/or an HE institution. Assessment is undertaken on a group basis and is validated by the University of Liverpool which provides a record of achievement.

A number of modular schemes have been developed. They all seek to provide greater pupil choice among study programmes and enhanced pupil motivation from short-term learning objectives. The *Wessex Project* involves schools and FE colleges in the development of modular courses which contain a compulsory core of A-level subject material and are assessed by standard external examinations. Various models for managing the core in different subject areas have been developed and in some cases the examination is taken at the end of the first year. The core represents 60% of the course and the remaining 40% consists of four complementary modules, selected from a range of modules. The aim is that these modules will provide breadth of study of content and processes. The modules are either issue-based or thematic and, in science, foster an appreciation of science in the context of the real world, emphasize student-centred and active learning and encourage the development of a range of skills including study skills. A feature of the scheme is that complementary modules need not be drawn from the same subject bank as the core modules. For example, core biology can be supplemented by modules in geography or mathematics. The pilot scheme currently incorporates programmes in biology, chemistry, physics, design and technology, modern languages, business studies, art and design and economics. Mathematics, English and creative arts are also being developed. The scheme is currently limited to A-level but it is hoped to extend it to include AS examinations in due course. In one FE college (Gloucestershire College of Arts and Technology) thirty-nine students are already participating in a common first year modular course, leading to BTEC or A-level examinations in year two, in an attempt to bridge the academic/vocational divide post-16. This is a very encouraging development, and wider availability should be encouraged.

The *Cambridge Modular A-level Science Project* will operate under the University of Cambridge Local Examinations Syndicate (UCLES) Module Bank System. It will enable pupils to gain a range of single subject or double-award AS and A-levels in biology, chemistry, physics or science. The scheme incorporates foundation modules in biology, chemistry and physics, optional subject-focused modules and extended study modules. The modules, which are assessed and certificated on their completion, represent 40 hours study time. AS awards are made on the basis of studying three modules, a single A-level requires the study of six modules, and a double award, twelve modules. All awards require the appropriate foundation module(s) and an extended study module. The single and double-award science awards require the study of all three foundation modules. The scheme aims to provide the opportunity for all pupils to study some of the broader aspects of science and to develop skills common to all scientific disciplines.

The Wessex Scheme is operational but restricted geographically by the SEAC to a limited number of approved centres and candidates. The other schemes with the exception of SATIS and UCLES projects are operating on a pilot basis. They all aim to improve flexibility and introduce a greater diversity of teaching and learning approaches. The enhancement and modular schemes, whilst aiming to extend the boundaries of A-level, are to a greater or lesser extent based on existing

syllabuses. The Wessex and North-West modular schemes do most to improve access and participation and provide a bridge across the academic/vocational divide.

Lastly, the *Northern Modular Science Scheme,* which is currently being developed by a group of LEAs in the North-West, is a modular A-level science programme which aims to ensure continuity and progression from pre-16 modular schemes introduced as part of TVEI entitlement. Within a framework of scientific and cross-curricular transferable skills, pupils will be offered a range of modules that establish a foundation or set of foundation experiences. Additional modules at a variety of levels will build on these and lead to AS, A-level or BTEC qualifications.

A FRAMEWORK OF PROVISION

Having considered the educational systems of other countries, the International and European Baccalaureate, proposals such as *The British Baccalauréat* from the Institute of Public Policy Research, and the experimental developments reported above, we conclude that the most appropriate system for the UK would be one based on a single framework of broad provision which encompasses both academic and vocational study. The place of this single framework in the overall educational system is shown in Figure F.

ENTITLEMENT

Central to a revised post-16 education system is the concept of specifying entitlement for all students. This entitlement would be based on three aspects: a specified **set of skills** delivered through each student's programme of study; development of relevant **knowledge and understanding** appropriate to the student's needs; and entitlement to **common features** such as work experience, careers and personal guidance, and a nationally-recognized statement of a student's achievement.

(a) SET OF SKILLS

The Society supports the developmental work on core skills which is being undertaken by groups such as the NCC, the NCVQ, the SEAC and the FEU, and would wish to urge further cooperation. In the report *Core skills 16–19* the NCC argues that 'the development and assessment of core skills, within a whole curriculum framework, for all post-16 students will prepare them for life and work in the 21st century and bring education and training together'.

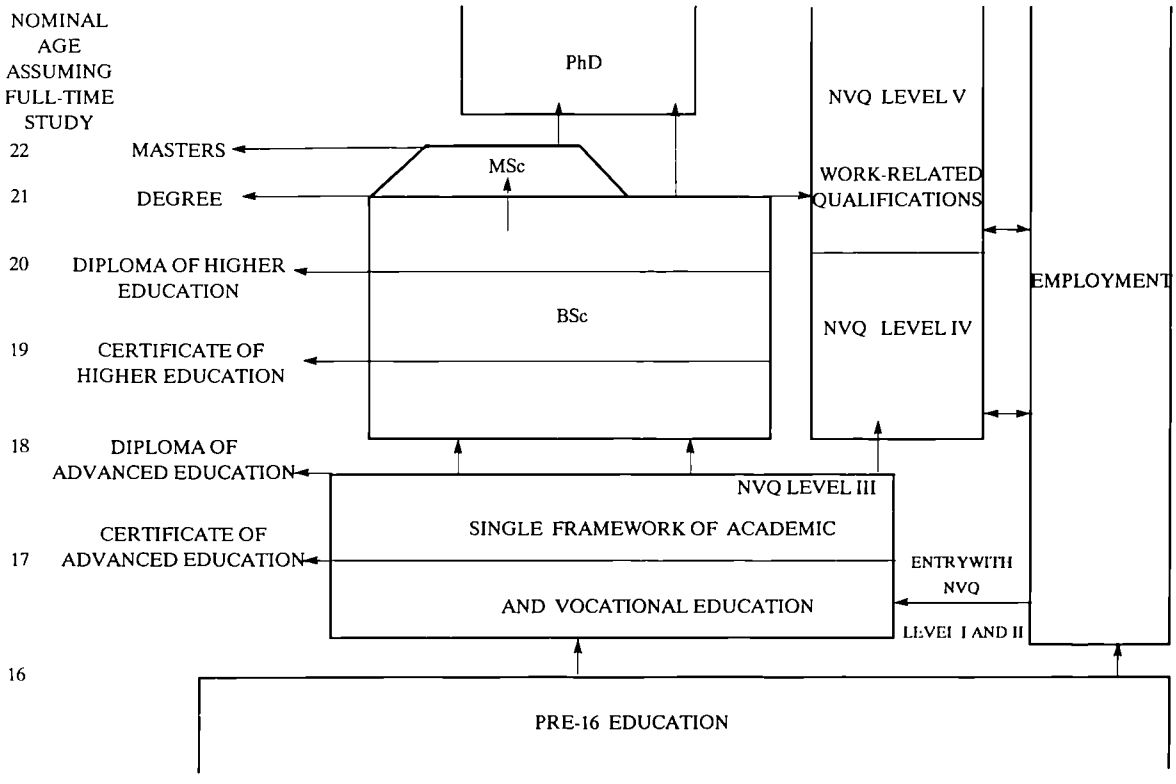
Students would build on their achievements in the National Curriculum through the further development of appropriate skills. These skills are central in enabling students to bridge the divide between vocational and academic education. The skills outlined by the NCC are communication; problem-solving; personal skills; numeracy; information technology; and foreign language competence. These are all skills equally appropriate for post-16 education and should be integral to all students' programmes of study, and assessed accordingly.

(b) KNOWLEDGE AND UNDERSTANDING

A vital part of each student's entitlement must be a coherent body of knowledge (and the understanding it develops), rigorously taught and assessed, and relevant to the future needs of the student in both employment and further study. Three domains through which knowledge and understanding might best be acquired are outlined later. The amount of science studied, and the way in which it is delivered by teachers, will vary but there should be a minimum entitlement for all.

Figure F

A REVISED FRAMEWORK FOR POST-COMPULSORY EDUCATION



(c) COMMON FEATURES

Central to a student's educational and personal development are a common set of features that underpin any programme of study.

One such feature must be effective **personal and careers guidance** from appropriately qualified teachers or careers officers. Teachers will need comprehensive understanding of post-16 opportunities to complement the advice provided by the careers service. In particular, students will need advice on transferring between courses and between institutions. Guidance will need to continue throughout the time a student is involved in post-16 education. With continuing guidance

students would be more able to take well-informed decisions regarding breadth of study post-16 and the general coherence of their studies for further study or employment later, as well as selecting an appropriate package for specific later careers in science or engineering.

The Training and Enterprise Councils (TECs) also have a role to play in guidance. The CBI Task Force on Vocational Education and Training challenges the TECs in *Towards a skills revolution* (CBI, 1989) to act as regulators of the local training market to ensure that employers seeking public funding for course costs are offering worthwhile training opportunities to every young employee. In particular the TECs are asked to ensure that each individual's choices are well-informed through developing advice and guidance systems based on individual action plans, records of achievement and appropriate vocational counselling.

Relevant **work experience** in industry, commerce or the community is another essential feature for post-16 programmes of study. The Society recognizes the commitment which industry has already given to developing links with schools and colleges, and hopes that further commitment from all sectors will be forthcoming. The programme of work experience should be assessed against a set of nationally recognized outcomes, so that future employers, and others, could evaluate the student's performance.

Another feature to which each student should be entitled is a suitable, and comprehensive, **statement of achievement** throughout compulsory and post-compulsory education. The recent initiative to establish a national Record of Achievement taken by the DES and the Department of Employment is welcome and employers and HE are urged to use them.

FLEXIBILITY

Within the framework of entitlement students should be required to follow a programme of study which is broad and balanced. The framework must allow students a degree of **flexibility** so that choice is not unnecessarily constrained, and students have the option to follow one branch of study to substantial depth, or to broaden their experience further in ways appropriate to their future needs and aspirations. Reform of the current post-16 system must be sufficiently flexible to develop fully the potential of every student who continues their education beyond the age of 16 whether wishing thereafter to continue to HE and for those who will progress to a variety of jobs.

CURRICULUM FRAMEWORK

The curriculum framework (shown in Figure G below), in which the programme of study for each student will be negotiated and delivered, is of crucial importance to the ultimate success of any revision of post-16 education. We have concluded that an appropriate framework could be based on three separate domains of study in which skills, competences, relevant knowledge and understanding, and common features are developed. The three domains are a social, economic and industrial domain; a scientific, mathematical and technological domain; and a creative, language and aesthetic domain. The domains would provide a recognizable context in which study would

take place. A carefully planned programme of study, with a balance of study across the three domains, with features including personal and careers guidance, work experience and negotiated statement of achievement, would offer the entitlement and flexibility specified earlier.

Figure G

ONE POSSIBLE CURRICULUM FRAMEWORK POST-16

Skills, competencies, relevant knowledge and understanding		
Social, economic and industrial domain	Scientific, mathematical and technological domain	Creative, language and aesthetic domain
Common features Personal and careers guidance Work and community experience Statement of achievement		

Note The single framework above is designed to close the current academic and vocational divide. The three domains are not intended to be prescriptive; there will be overlap in some areas. The domains provide the context for a balanced programme of study made up of skills, competencies, and relevant knowledge and understanding, that is underpinned by common features set against a relevant, social background.

With this framework, we believe a **modular approach** would best match the requirement for movement between academic and vocational approaches post-16. A modular approach offers the student flexibility in his/her programme of study and the opportunity to follow the most relevant package for his or her needs. It would provide short-term targets that allow the student continuing achievement. Credit transfer is possible and individual modules can be easily modified and up-dated with current issues and new knowledge. Two types of module are envisaged: **foundation modules** taken by each student from each domain to ensure a breadth of background knowledge and skills in each student's programme of study; and **advanced modules** from one or more domains, providing the flexibility to vary the amount of study time for each domain to suit individual needs. Post-16 qualifications should form part of a nationally-recognized scheme, and thus the study of advanced modules would lead to qualifications analogous to NVQ level 3.

QUALIFICATIONS

In parallel to the adoption of the single, integrated framework described above, the Society supports the adoption of a unified set of qualifications post-16. We propose an **Advanced**

Diploma, most generally achieved after two years' full-time study, and an **Advanced Certificate**, which will most often be achieved after one year of full-time study. The Certificate would be available to provide a statement of achievement for those students who wish to continue their education in the post-compulsory period for one year, and proceed then to employment through which they can obtain other qualifications leading to further or higher education. Some students may be employed either full or part time during their studies post-16, and any relevant work experience should enable appropriate exemptions in gaining a Certificate or a Diploma. The Advanced Diploma would be an NVQ level 3 with successful completion being the minimum requirement to progress to HE.

Given a modular approach, we do not believe a time limit should be set for the completion of either the Certificate or Diploma. Some students may wish to, or need to, take longer than would be normally expected to complete and gain qualifications. For example, a student may wish to take two years of full-time study to complete an Advanced Certificate, or a student might study for six years part-time to gain an Advanced Diploma. Such flexibility will significantly raise the participation of all ages of students at this level of education.

ASSESSMENT

Post-16 education would best build on the assessment innovations traditional to vocational qualifications and introduced in academic qualifications with the GCSE. Assessment at GCSE has considerably more emphasis on the acquisition of skills than earlier examinations. These developments have been welcomed by the Society as a desirable move away from the heavily content-based O-level courses. Many vocational courses are also skills-based. There is positive feedback from many HE institutions accepting BTEC students onto their undergraduate courses. Some would argue that these students have a better understanding of the skills they have acquired than their A-level counterparts. This would suggest that a change in the style of A-levels towards a more skills-based approach would be of maximum benefit to students who will have experienced GCSE-style learning strategies, and of maximum benefit to employers and to HE who will find a greater understanding by students of the concepts studied. Unified academic and vocational qualifications should be more skills-based enabling students of all abilities to build upon their strengths.

An appropriate balance of in-course and end-of-course assessment, and a variety of assessment strategies other than a single terminal examination, should be employed. All aspects of the programme of study should be assessed, with performance measured and graded against nationally-recognized criteria. Skills as well as knowledge and understanding should be assessed and reported in each student's statement of achievement. Aspects of the common features, such as work experience, should also be measured against national criteria.

Differentiated assessment has been used successfully at other levels of education, and it is believed that it would be suitable for post-16 education also. This would stretch the most able and enable lower ability students to demonstrate their abilities positively, rather than suffer their performance defined in terms of what they cannot do.

We believe a system of credit accumulation to be appropriate for the assessment of this modular curriculum framework. Each advanced module would be allocated a credit rating, with half

modules attracting a half rating. Foundation modules would be given an appropriate level of credit. The Advanced Certificate and the Advanced Diploma would be specified in terms of credit points with, for example, 20 points achieving an Advanced Certificate and 40 points achieving an Advanced Diploma. We do not offer further details in the firm belief that others, with experience in curriculum design, are better placed to undertake the task. However, we are satisfied that these principles provide a firm basis for developing a sound framework for post-16 education.

VALIDATION

We envisage an important role for a single national body which will be responsible for the establishment of national criteria for post-16 education against which students' achievements can be measured. One aspect of this work will be the validation of modules offered by awarding bodies. Another aspect will be validation of local centres, such as FE colleges or schools, needed to ensure they offer the appropriate level of resources and staff to deliver and assess the curriculum framework to national standards.

IN THE SHORT TERM

It is one thing to propose a single, modular framework that crosses the academic and vocational divide, it is much more difficult to move to this quickly. We believe the framework we have outlined can transcend the inherent tension between the content and subject-based approach of current advanced level provision and the competence-based vocational programmes, but we acknowledge the difficulties there will be in reaching the goal of a unified, rationalized system. The recent developments which aim to enhance current post-16 provision and cross the academic/vocational divide described earlier are an encouraging sign in the short-term. The lifting of regulations preventing BTEC First Awards in schools now provides the scope to adopt such approaches much more widely.

IMPLICATIONS

HIGHER EDUCATION

HE courses as currently designed are not going to turn out sufficient scientific and technological graduates to meet the immediate needs of the UK. Furthermore, employers are increasingly looking for graduates with transferable skills that equip them to be flexible to the needs of a changing world. It will no longer be appropriate for HE to make minor adjustments to existing courses; more radical revision is required. In addition, the students themselves will increasingly be demanding the style and quality of learning strategies that they will have experienced earlier in life. So there will be pressure from the students too for change.

The Institute of Physics, the Standing Conference of Physics Professors and the Committee of Heads of Physics in Polytechnics have recently reported on the future pattern of degree courses in physics (*The future pattern of higher education in physics,* Institute of Physics, 1990). Students and employers, it argues, agree that present HE courses are not satisfactory because they try to teach too much, and in consequence teach it 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, far better. 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 and in the problem solving skills needed by industry and others.

We support this reasoning, and see it as applicable more generally to all branches of science. HE will have to review critically the pattern of undergraduate courses offered, entry qualifications, course structures, teaching methods, assessment procedures, and the practices of admissions tutors. We have recommended more than one exit point from post-16 education. It will be appropriate for there to be multiple exit points from HE too. A modular system that enables credit accumulation and credit transfer would also be appropriate. The Institute of Physics report recommends a reduction in the content of three-year physics undergraduate courses by approximately one third, so that students gain a better understanding of the skills and knowledge offered, and also in order to reduce the overload which many syllabuses now have. The accelerating growth of scientific knowledge also demands such a reduction. This is a common requirement that we believe will be found desirable in many science courses.

We support the idea put forward by the Institute of Physics that in order to maintain excellence a reduced-content Honours physics course will need to be followed for some students by a further one-year Masters courses. Similar arrangements will be desirable for other science subjects too mainly because those who wish to do PhD courses, or to work as professional scientists (e.g. registered with the relevant professional institutes), will first need to cover additional material. Such Masters courses could be developed on a modular basis so as to be attainable by either one year of full-time study or through credit accummulation. This would help to meet the increasing need for highly qualified manpower in a technological society.

TEACHER SUPPLY

An increase in the participation rate of post-16 students will have obvious consequences for the supply of teachers. If more students are to be taught a wider range of subject areas, the current shortages of teachers in certain subject areas will become more critical unless there is a substantial in-service training. Of particular concern to the Society is the demand for teachers of science and mathematics. Research by Alan Smithers and Pamela Robinson, and the Society's own annual survey of the output of newly trained teachers, has shown a current imbalance of science teachers currently in post (see Figure H) in terms of discipline (i.e. there are more teachers in post trained to teach biology then there are to teach physics) and there is a downward trend in the output of newly qualified science and mathematics teachers (see Figure I). The statistical evidence available shows the position in schools. Anecdotal evidence suggests similar difficulties in these subject areas in the FE sector.

Figure H

MATCH BETWEEN TEACHERS' QUALIFICATIONS AND COURSES TAUGHT AT A-LEVEL*

Subject of Qualifications§	A-Level Courses			
	Biology (N=417)	Chemistry (N=349)	Physics (N=342)	Other Science (N=43)
Biology	90.2	2.5	0.3	18.6
Chemistry	1.3	79.9	6.3	9.3
Physics	0.0	1.3	69.3	37.2
General or Combined Science	1.1	3.5	4.7	2.3
Other Science and Technology	6.6	12.3	16.3	32.6
Non-Science	0.8	0.6	3.1	0.0

* Percentage of courses taught by teachers with main qualifications in the subject.

§ Main subject of degree or teachers' certificate, full-time teachers only.

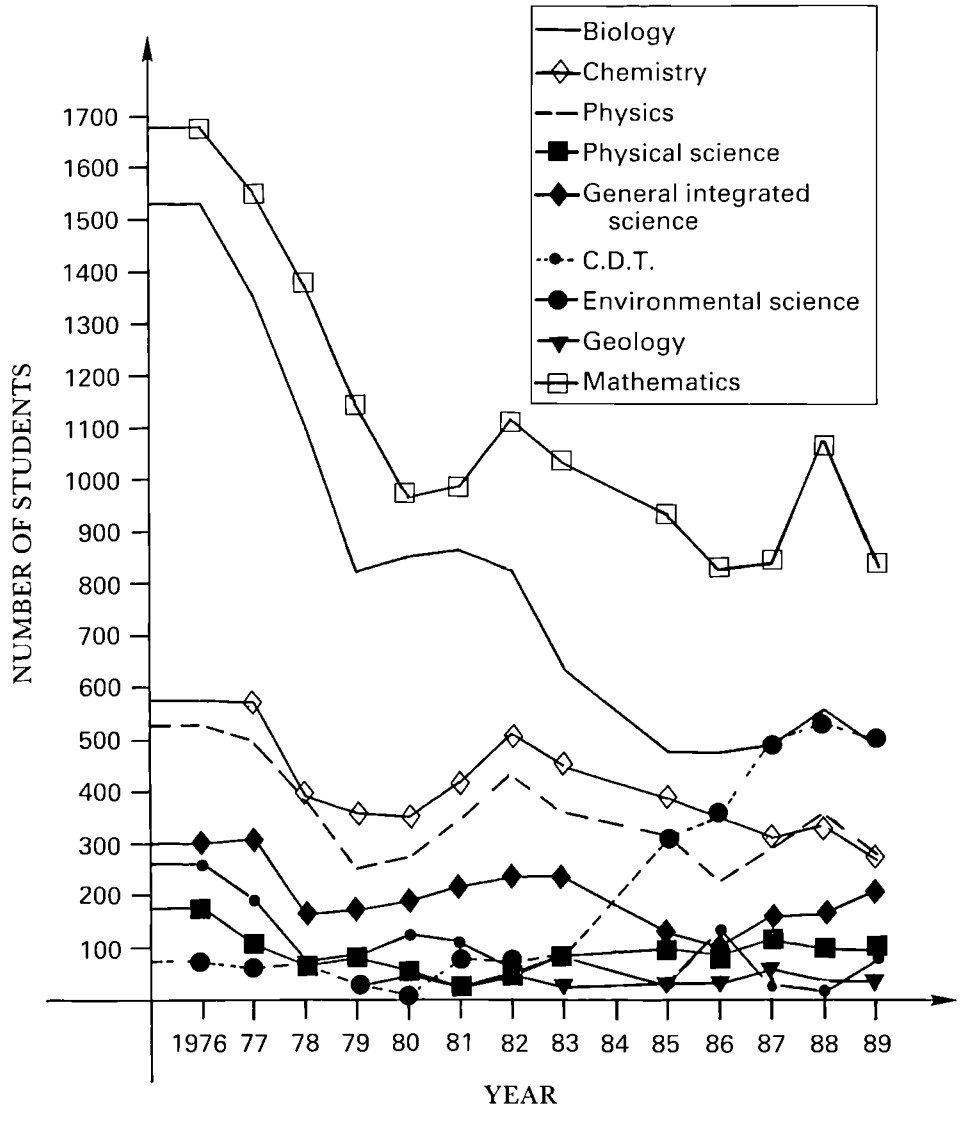
Source: *Teacher provision in the sciences*, Smithers and Robinson, (1990).

It has been difficult to obtain up-to-date statistical evidence of the supply of mathematics teachers. The report of the Cockcroft Committee, *Mathematics counts* (HMSO, 1982) noted that the supply of mathematics teachers in maintained secondary schools did not match the demand, e.g. 21% of mathematics teaching was covered by teachers whose main qualification was not related to mathematics. In the report *The shortage of mathematics and physics teachers* (Smithers and Robinson, 1988), it was reported that the situation had not improved.

The DES in its submission to the House of Commons Select Committee on Education, Science and Arts study on *Teacher supply in the 1990s* (HMSO, 1990), and in its projection for the supply and demand of teachers *Projecting the supply and demand of teachers: A technical document* (DES, 1990), reported the following possible shortfalls: 1000 from a demand of 20 000 mathematics teachers; 1500 from a demand of 11 000 physics teachers; and 2000 from a demand of 11 000 chemistry teachers, based on current curriculum models. We are deeply concerned that a coherent and successful programme

Figure I

OUTPUT OF NEWLY TRAINED SCIENCE AND MATHEMATICS TEACHERS 1976–1989



Source: Royal Society

of higher recruitment and retention of science and mathematics teachers is implemented by the DES.

In the short-term these problems will need to be addressed by the DES, and other relevant bodies, to ensure that an appropriate number of well-qualified teachers are in post. The DES and LEAs will also have to give serious attention to the in-service needs of those teachers in post and of new recruits. In the longer term, however, it is hoped that by increasing the participation rate of post-16 students, and ensuring a broad balanced curriculum that includes science, more candidates will come forward for initial teacher training in science or science subjects. Eventually the breadth of

study that will be experienced both pre-16 and post-16 will ensure that future teachers will be more able successfully to deliver a well-balanced programme of study.

RESOURCES

There would be resource implications if the post-16 system were broadened as we suggest and adequate provision of laboratory and classroom space and equipment resources would need to match increases in the participation rate of post-16 students and the amount of science offered. This will be crucial to the successful implementation of our recommendations. Findings by Smithers and Robinson already suggest difficulties over the facilities available for teachers of sciences (see Figure J).

Figure J

FACILITIES FOR SCIENCE TEACHING

Per Cent

School Type	Not Enough Teaching Rooms/Labs	Inadequate Facilities & Equipment	Taught Outside Science Area	Not enough Technicians
Comprehensive to 16	43.5	80.4	60.9	52.2
Comprehensive to 18	53.2	64.9	57.1	64.9
Sixth Form College	0.0	33.3	50.0	16.6
Secondary Modern	53.8	53.8	61.5	53.8
Grammar	40.0	70.0	20.0	70.0
Independent	33.3	29.6	55.6	22.2
Total	44.7	62.0	41.3	53.1

Percentage of schools reporting shortages

Source: *Teacher provision in the sciences*, Smithers and Robinson, (1990).

We believe that some resource-based problems may be alleviated by further cooperation between schools and local FE colleges. The so-called 'downward franchising', in which a local FE college delivers certain aspects of a student's programme of study for which the school may not be adequately staffed or equipped, may ease the financial burden placed on schools which offer a broad range of examinations. Increasing use of alternative methods of delivery, e.g. distance learning, may be appropriate for some schools, especially smaller rural schools.

The Society hopes these issues will be considered in parallel to considerations of the post-16 system by the DES, education authorities, and by other relevant bodies.

PRINCIPAL RECOMMENDATIONS

THE ultimate objective of a curriculum review should be the development of a seamless education system from age 5 to postgraduate level, a system in which the potential of all students is fully developed, and through which the manpower needs of the UK are fully satisfied. The proposals outlined in this report will, we believe, improve on the current fragmented system which discourages entry and fails many who participate in it.

We urge the DES, the Welsh Office, the Department of Employment, the SEAC, the NCVQ, the NCC, the CCW, the GCE examination boards, and the vocational qualification awarding bodies to adopt the following proposals:

(i) The complete system as we have proposed it should be based on a single curriculum framework encompassing both academic and vocational education. A modular approach is best structured to achieve this. It is flexible for students, provides achievable short-term targets, is easily up-dated and facilitates credit transfer.

(ii) Students in post-16 education should have their entitlement specified in terms of a programme of study of skills, competencies, relevant knowledge and understanding, common features such as careers guidance and work experience, all set against a relevant social background. The system would give sufficient flexibility to cater for the needs and aspirations of all students, but the fundamental principle that students would follow a broad and balanced curriculum would underpin all students' programme of study.

(iii) The context for the framework would be provided through three domains. These could be a social, economic and industrial domain, a scientific, mathematical and technological domain, and a creative, language and aesthetic domain.

(iv) We propose two qualifications, an Advanced Diploma (generally achieved after two years' full-time study) and an Advanced Certificate (generally achieved after one year of full-time study). Both qualifications would be gained by successful completion of a specified number of modules taken from the domains of study.

(v) Modules will require validation by awarding bodies. Local centres offering the framework (schools and FE colleges) will also require validation to ensure adequate resources and staffing levels to deliver and assess the curriculum to national standards.

(vi) HE providers will have to consider their courses, and adopt a more skills- and process-based approach that equips each student with flexible, problem-solving skills adaptable to life in the 21st century. This will require a critical review of courses offered, entry qualifications, course structures, teaching methods, assessment procedures and the practices of admissions tutors. A reduction in the content of many HE science courses will be necessary. Specific Masters degree courses should be made available for those who intend to practise in areas of science to an advanced or professional level.

(vii) We recognize the implications these reforms would have for providers of post-16 education and HE. These proposals would need to be discussed in parallel with a discussion on the

increase in resources required to implement this radical change.

The Society recognizes the difficulties of achieving, in one step, the radical revision of a system which has developed over many years. There are some interim steps towards the first phase of achieving the important long-term goal of a single system of post-compulsory education for the whole ability range:

(a) Developments to allow transfer of accumulated credit across the academic and vocational divide should be encouraged. Several initiatives are currently moving in this direction; these are encouraging short-term developments.

(b) All schools should be actively encouraged to offer vocational courses such as BTEC First Awards and National Diplomas alongside academic qualifications. The lifting of regulations which prevented BTEC First Awards in schools now provides the scope to achieve this. Appropriate resources must be made available so that all schools and FE colleges may offer academic and vocational qualifications in parallel.

(c) Employers and HE should be encouraged actively to recruit students with qualifications which reflect a broad and balanced, academic and vocational education.

ANNEX A

TERMS OF REFERENCE AND MEMBERSHIP OF THE WORKING GROUP

TERMS OF REFERENCE

1. Noting the Society's earlier report *The 16–19 science curriculum and its assessment: statement of policy* (RS, 1988), to consider the desired form for, and the implications of, a broader post-16 provision, with particular reference to:

   (a) the subject mixes post-16 suitable for students already decided on following science, engineering and/or mathematics courses in further or higher education, for students undecided or for those with a preference for other disciplines;

   (b) the best approach to, and depth of study of, science subjects and mathematics to satisfy the varying needs of students in (a) above;

   (c) the extent to which the post-16 curriculum should be defined or constrained;

   (d) the implications for HE, both in entrance requirements and first degree course content (including consideration of the length of degree courses);

   (e) the needs of pupils continuing in full-time education after age 16, but who are not expecting to go on immediately into full-time HE but who may wish to participate later as adult returners to the formal education system.

2. To identify mechanisms by which the broadening of the post-16 curriculum might be achieved, having regard to (a) the points above, (b) coordination between traditional and vocational courses, (c) the need to start from the true current position, (d) the resources required and available, and (e) the benefits and constraints of a modular post-16 curriculum.

3. To make recommendations for the Society, the education community, the Government and others, as appropriate.

4. To report to the Education Committee.

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ANNEX B

Figure K

A/AS EXAMINATION RESULTS 1989 AND 1990

	A	B	C	D	E	N	U
Biology							
A	11.9 (12.2)	15.0 (15.1)	15.5 (15.4)	17.1 (17.1)	15.7 (15.5)	11.9 (11.3)	12.9 (13.4)
AS	7.6 (10.0)	9.5 (13.4)	12.8 (14.9)	15.9 (17.6)	19.1 (17.3)	15.9 (13.5)	19.2 (13.3)
Chemistry							
A	16.1 (14.8)	17.6 (17.0)	15.0 (15.6)	15.0 (15.6)	13.6 (13.8)	10.5 (10.4)	12.2 (12.8)
AS	10.8 (7.9)	11.2 (10.5)	10.3 (10.8)	14.5 (14.6)	17.2 (17.4)	12.7 (14.1)	23.3 (24.7)
Physics							
A	13.9 (13.3)	15.1 (14.4)	15.5 (15.6)	16.4 (16.7)	15.0 (15.1)	11.9 (12.0)	12.2 (12.9)
AS	9.2 (9.1)	11.1 (9.7)	12.3 (13.1)	17.4 (16.1)	18.5 (16.8)	14.8 (16.4)	16.7 (18.8)
Science*							
A	11.2 (10.2)	15.6 (15.6)	17.3 (17.5)	17.5 (17.7)	16.1 (14.9)	10.2 (10.4(	12.1 (13.7)
AS	11.4 (11.6)	14.7 (14.8)	17.7 (17.4)	17.4 (16.3)	15.2 (14.9)	10.1 (12.3)	13.5 (12.7)
All subjects							
A	11.7 (11.4)	15.5 (15.3)	16.9 (16.5)	17.7 (17.4)	15.2 (15.3)	10.7 (10.9)	12.3 (13.2)
AS	8.2 (8.0)	10.5 (10.5)	13.4 (12.7)	15.7 (14.4)	16.6 (15.8)	13.5 (13.4)	22.1 (25.2)

* All science subjects other than physics, chemistry and biology.

(SEAC, 1991 All GCE Boards, UK candidates only)

ANNEX C

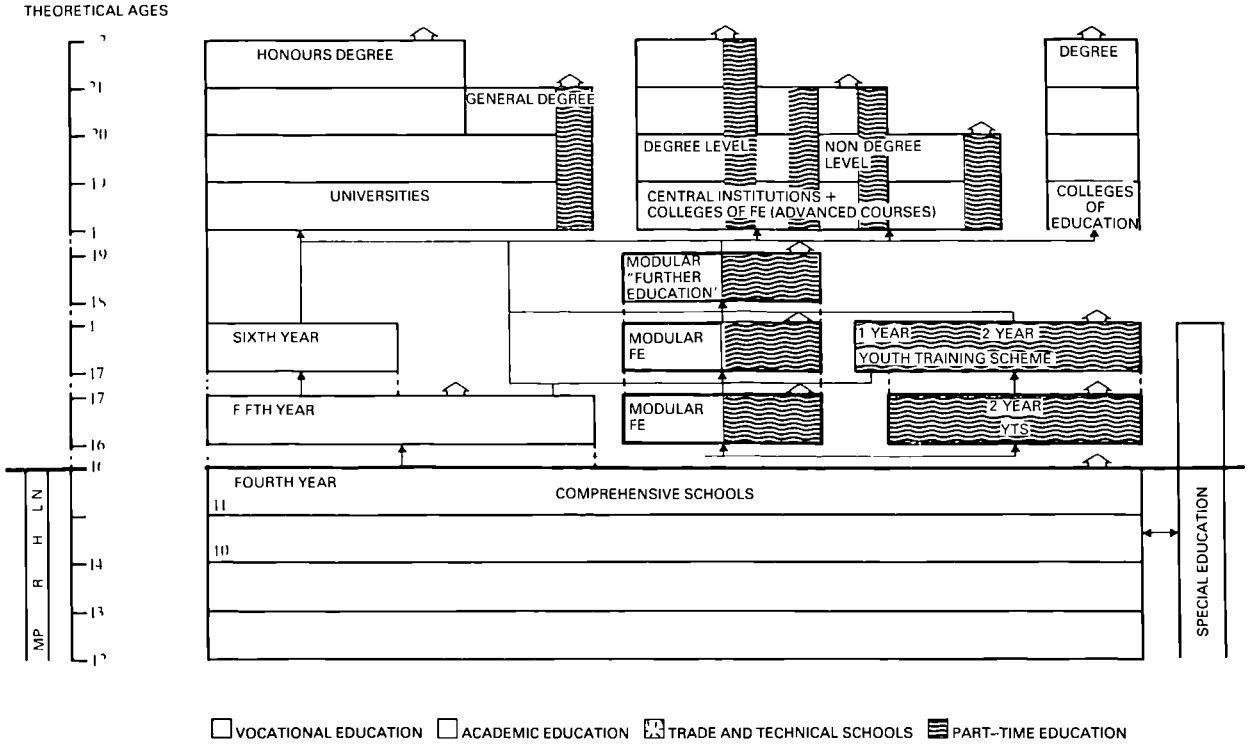
COMPARISONS WITH OTHER EDUCATION SYSTEMS*

SCOTLAND

For many years all students have had to take at least one science from the age of 14. Pupils enter their first year of secondary education (S1) at age 11½ to 12½ and study for four years until the end of compulsory secondary education at age 15½ to 16½. Post compulsory education begins at year 5 (S5), the education system is outlined in Figure L. Once secondary education is completed students may enter employment or continue to HE.

Figure L

EDUCATIONAL PROVISION IN SCOTLAND



*Sources: (i) *Selected National Education Systems I* (DES, 1985)
(ii) *Selected National Education Systems II* (DES, 1989)
(iii) *Pathways for learning: education and training from 16–19* (OECD, 1989).

Pupils encounter a national examination in their fourth year of compulsory secondary schooling (S4), the standard grade (analagous to the GCSE). One year later at S5 they sit the higher grade examination, and for those who pursue two years of post-compulsory education there is the Certificate of Sixth Year Studies (CSYS). The CSYS was not originally intended as a recognized basis for university entrance, but is increasingly thus used.

At standard grade, higher grade and the CSYS, there are courses available in biology, physics and chemistry. Recently science has been available at standard grade only. In all courses the move towards skills and processes, away from content, has been prevalent. The syllabuses for both highers and CSYS have been revised recently to take account of the content reduction in standard grade syllabuses.

The Scottish Consultative Council on the Curriculum (SCCC) has issued guidelines to headteachers on the curriculum design appropriate for the last two years of secondary schooling. These identify the essential features of pupils' experience as the skills of communication, numeracy and learning, creative and critical thinking, and personal and social skills. The advice given by SCCC is that these skills could be delivered through eight different modes: language and communication (which could include English and foreign languages), mathematics studies and applications, scientific studies and applications, creative and aesthetic activities, technological activities and applications, social and environmental education, religious and moral education, and physical education.

Scotland has a tradition of breadth in its post-compulsory education; able pupils will readily take five highers at the end of S5 and may take further highers, or two or three CSYS at the end of S6. A typical pupil who enters HE may have studied for eight standard grades, five highers and two or three CSYS. But despite Scotland's reputation for breadth, the form of that breadth is increasingly being questioned by teachers, by pupils, and by employers. In many cases breadth will merely mean extending the number of complementary subjects studied, rather than introducing contrasting studies. There is an increasing feeling that more pupils should retain some linguistic study, some mathematics, some science, and some technology throughout their whole school career. The problem of how to persuade pupils to do that when the choice of subjects is free has not yet been resolved. The advantage of the Scottish Higher System is that it provides an attainable target for many pupils. It is common for pupils to leave, even after two years post-16, with one or two passes at grade C (the minimum grade considered to be a pass). Such pupils would have little chance of any qualifications from the A-level system.

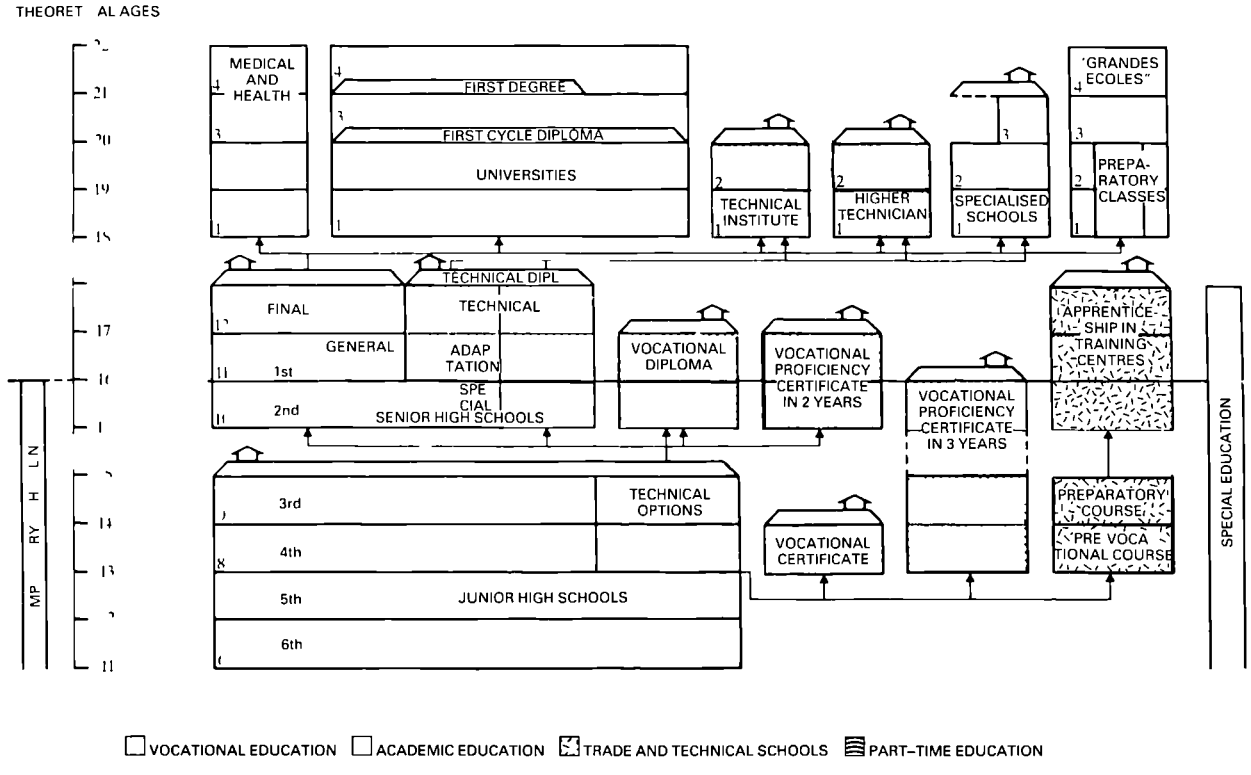
The provision of vocational education is through the extensive list of SCOTVEC modules, and through the limited list of 40-hour courses of the Scottish Examinations Board. These modules were devised originally for the vocational market, not for use in schools, but are being found increasingly suitable for 17 and 18 year old students to complement or enrich their chosen fields of study. SCOTVEC is currently involved in a review of its science provision. The new proposals provide an excellent model for continuing and vocational education.

FRANCE

Post-compulsory education starts at 15 and has two broad tracks, one shorter vocational track, and one longer track leading to HE entry and some professions. The educational system is outlined in Figure M. The vocational track is a two year short course leading to a craft qualification, either the *Certificat d'Aptitude Professionelle* (CAP) or the *Brevet d'Etudes Professionelles* (BEP). Both are recognized as entry to careers in industry and commerce, although the BEP is less specialized than the CAP.

Figure M

EDUCATIONAL PROVISION IN FRANCE



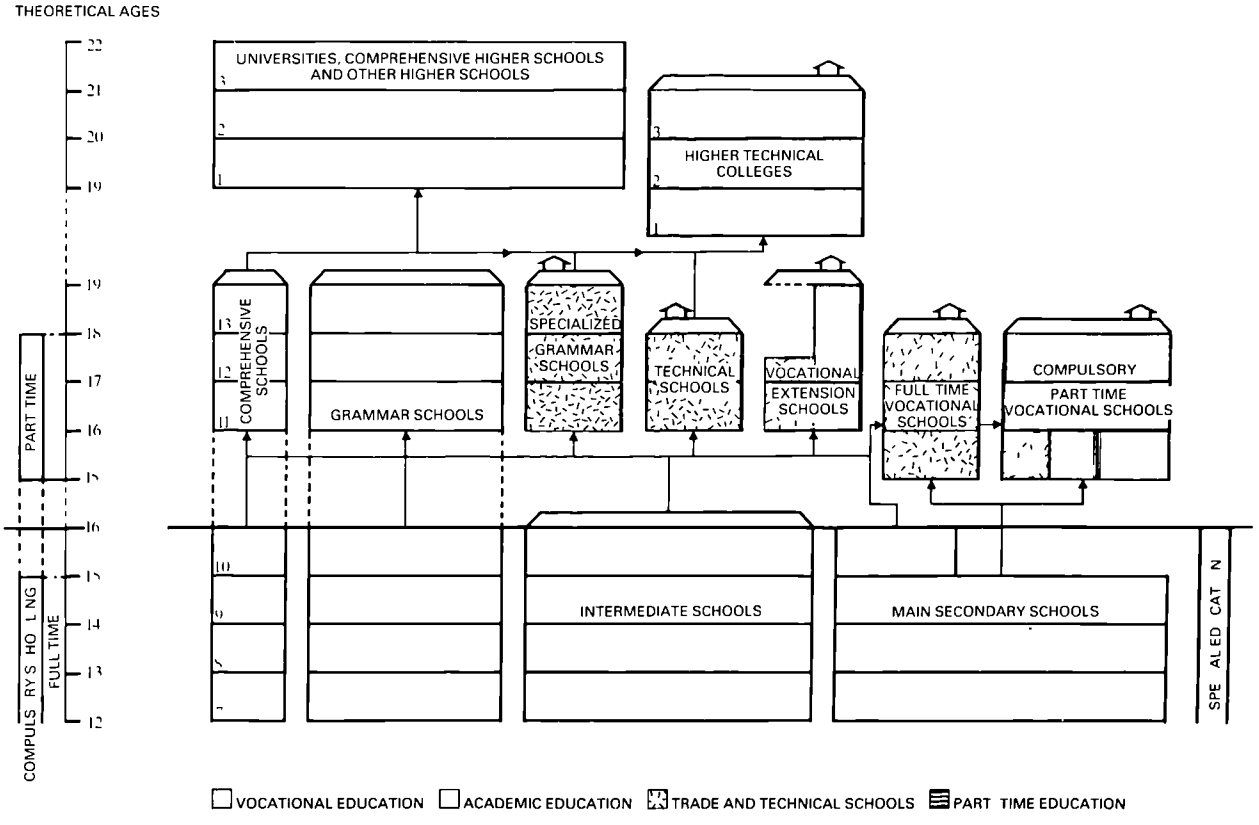
The longer, HE track is for three years, leading to the Baccalaureate which is a multi-subject examination with a broad first year of study consisting of seven subjects. The second and third years of post-compulsory education are more specialized and lead to one of five general baccalaureates or one of three technical baccalaureates. Candidates are examined with written and oral questions with a pass rate of approximately 66%. The baccalaureate allows automatic entry to HE and is a qualification for entry to some professions. University courses in general comprise three study cycles: two years leading to a general university study diploma; two years leading to a *licence* and then a *masters*; and three years leading to a doctorate or one year for a diploma involving training for a profession.

GERMANY

Germany has a dual system of post-compulsory education. Those who choose not to continue their studies past the compulsory schooling must continue their vocational education for one or two days a week until the age of 18. Post-compulsory education takes place in a variety of school types both vocational and technical/academic offering a variety of provision. The education system is outlined in Figure N. The entry qualification to HE, the *abitur*, consists of broad subject fields with final examinations in two main subjects and one optional subject and a further oral examination in another option. This range must include a modern foreign language, mathematics or natural science and German. The grading system takes account of coursework as well as the final examinations. Some 1.1 million students annually participate in HE courses of four to five years in universities and three to four years elsewhere.

Figure N

EDUCATIONAL PROVISION IN GERMANY

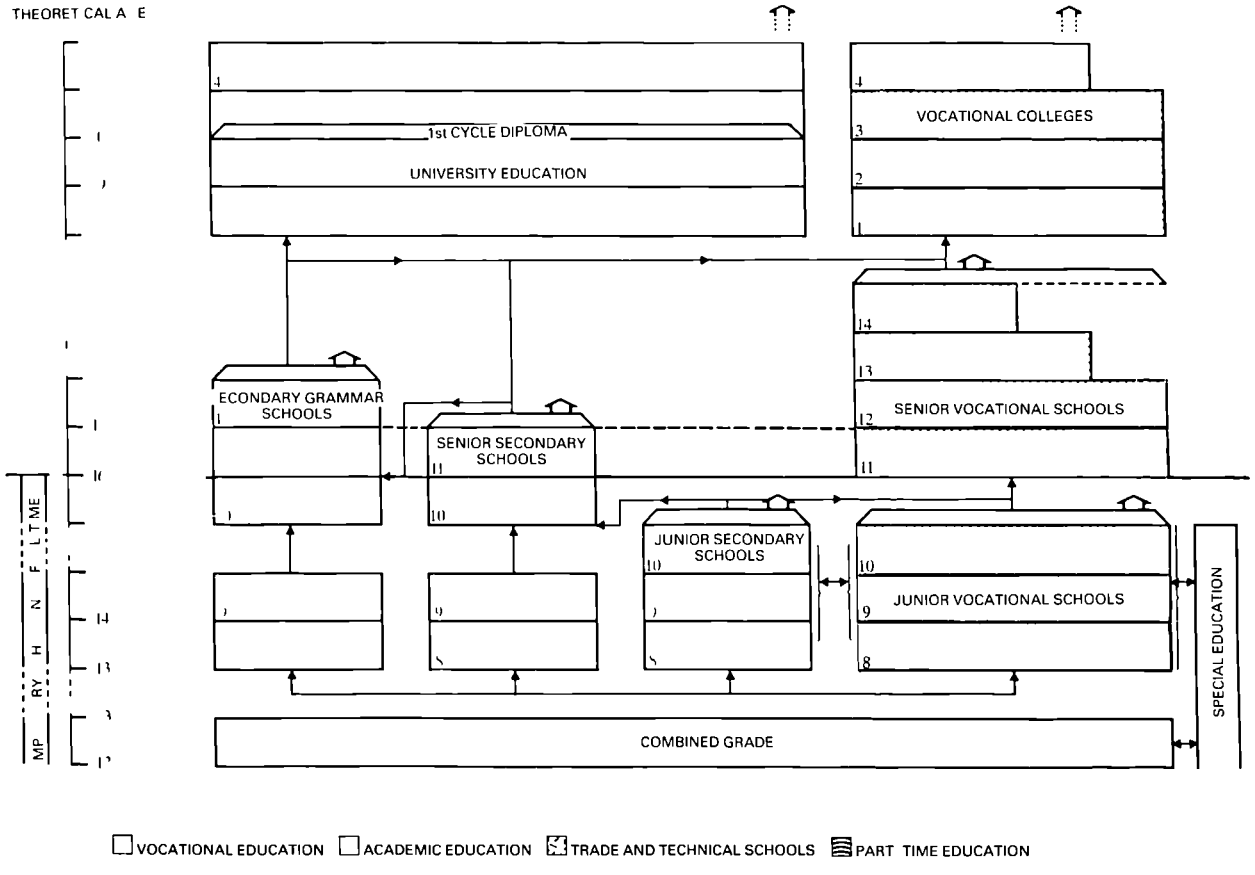


NETHERLANDS

Compulsory education is for 10 years from age 6 to 16. The education system is outlined in Figure O. Five types of secondary education can be distinguished: pre-university education, junior and senior general education, and junior and senior vocational education. Pre-university schools have a six-year course with a final examination of seven subjects. General education schools give access to vocational HE colleges with a final examination of six subjects.

Figure O

EDUCATIONAL PROVISION IN THE NETHERLANDS



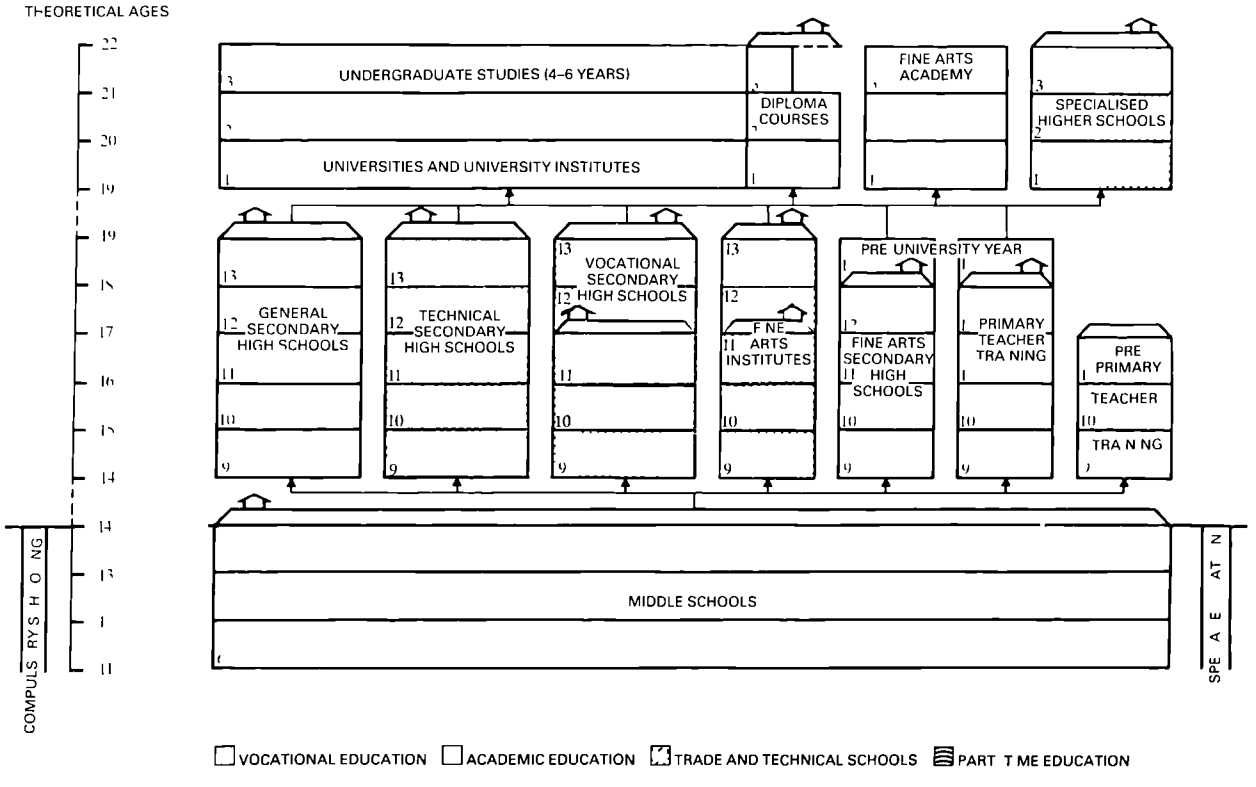
ITALY

Compulsory education in Italy lasts from age 6 to 14. At the age of 14 students sit the *Licenza di scuola media*, an intermediate school certificate. Successful completion of the intermediate certificate allows access to one of five types of post-compulsory schools: grammar schools (general academic education), fine arts schools, teacher training schools, technical schools (combination of academic and vocational study) and vocational schools (more practical training than in technical schools). Post-compulsory education lasts between 3 and 5 years. The provision is outlined in Figure P.

For those students who opt for the academic route, the curriculum is either broadly arts oriented or science oriented. Students study for a wide range of subjects, between 9 and 11, depending on which stage of post-compulsory education they are at. The assessment at the end of post-compulsory education consists of two broad-based examinations and an oral examination in two further subjects. Students who successfully complete the *maturia*, a higher secondary certificate, qualify for university entrance.

Figure P

EDUCATIONAL PROVISION IN ITALY

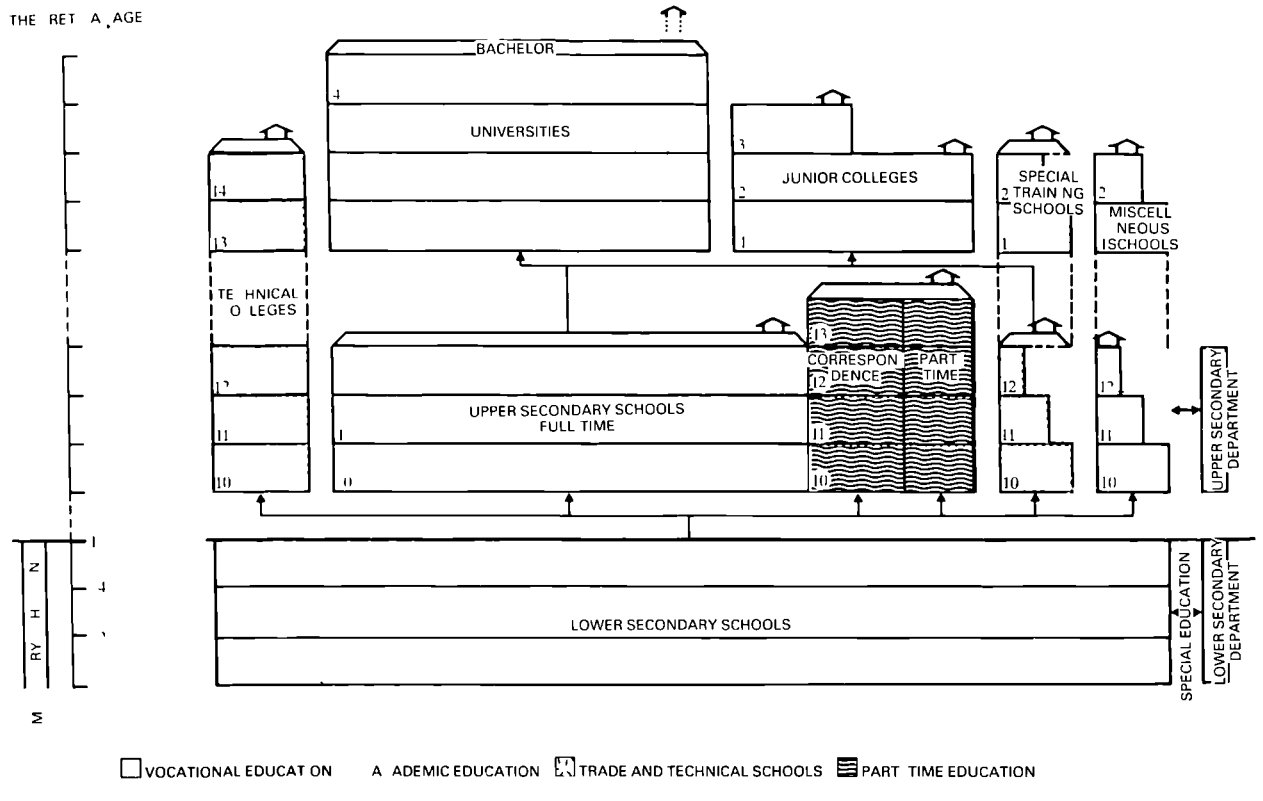


JAPAN

94% of students continue into post-compulsory education in upper secondary schools. Full-time HE courses last for three years but provision is made for part-time study. The education system of Japan is outlined in Figure Q. Courses can be either general or vocational, and the choice available varies between schools which may offer solely general study, or both types of courses, with a varying range of vocational options. All pupils must study Japanese, social studies, mathematics, science, health, physical education, fine arts and (for girls only) home craft. One foreign language (usually English) is also required. To graduate, 80 credits are required with a minimal level to be attained in each subject. Just over one third of upper secondary graduates continue to HE and about 40% to employment. Usually the first company joined is the employer for life, so pupils are under pressure to achieve educational success to ensure their future early. Serious career opportunities are limited for girls. Most university HE courses are four year and cover wide general study in the humanities, social and natural sciences, foreign languages, health and physical education, and professional subjects. First degrees are obtained by a continuous assessment credit system.

Figure Q

EDUCATIONAL PROVISION IN JAPAN

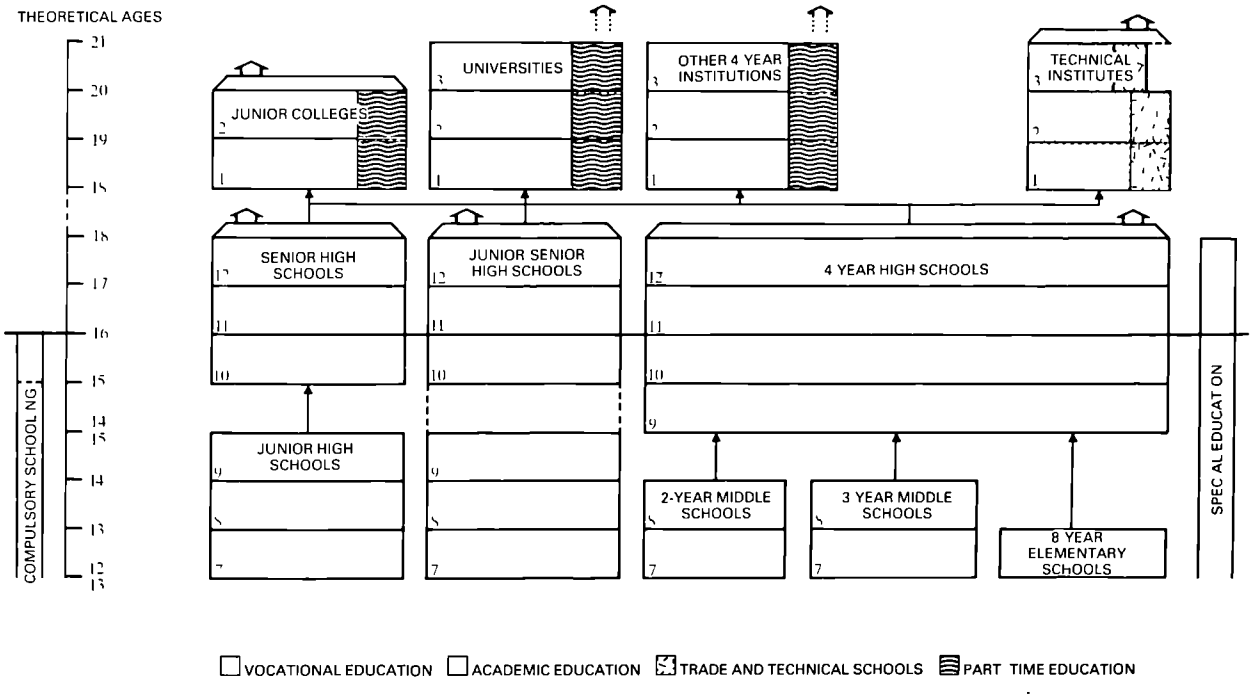


USA

In most States the final two years of high school are post compulsory. The high school diploma consists of up to 16 units broadly divided into English (4 units), social studies (3 units), mathematics (2 units), science (2 units), one foreign language (2 units), and health and physical education (3 units). High schools offer vocational courses, which pupils can choose to study, combined with general subjects. In addition, vocational or technical high schools concentrate on trade and industrial courses. Over 12 million students enrol annually in HE, which is of two kinds: four years leading to degrees or two years leading to diploma courses. The system is shown in Figure R.

Figure R

EDUCATIONAL PROVISION IN THE USA

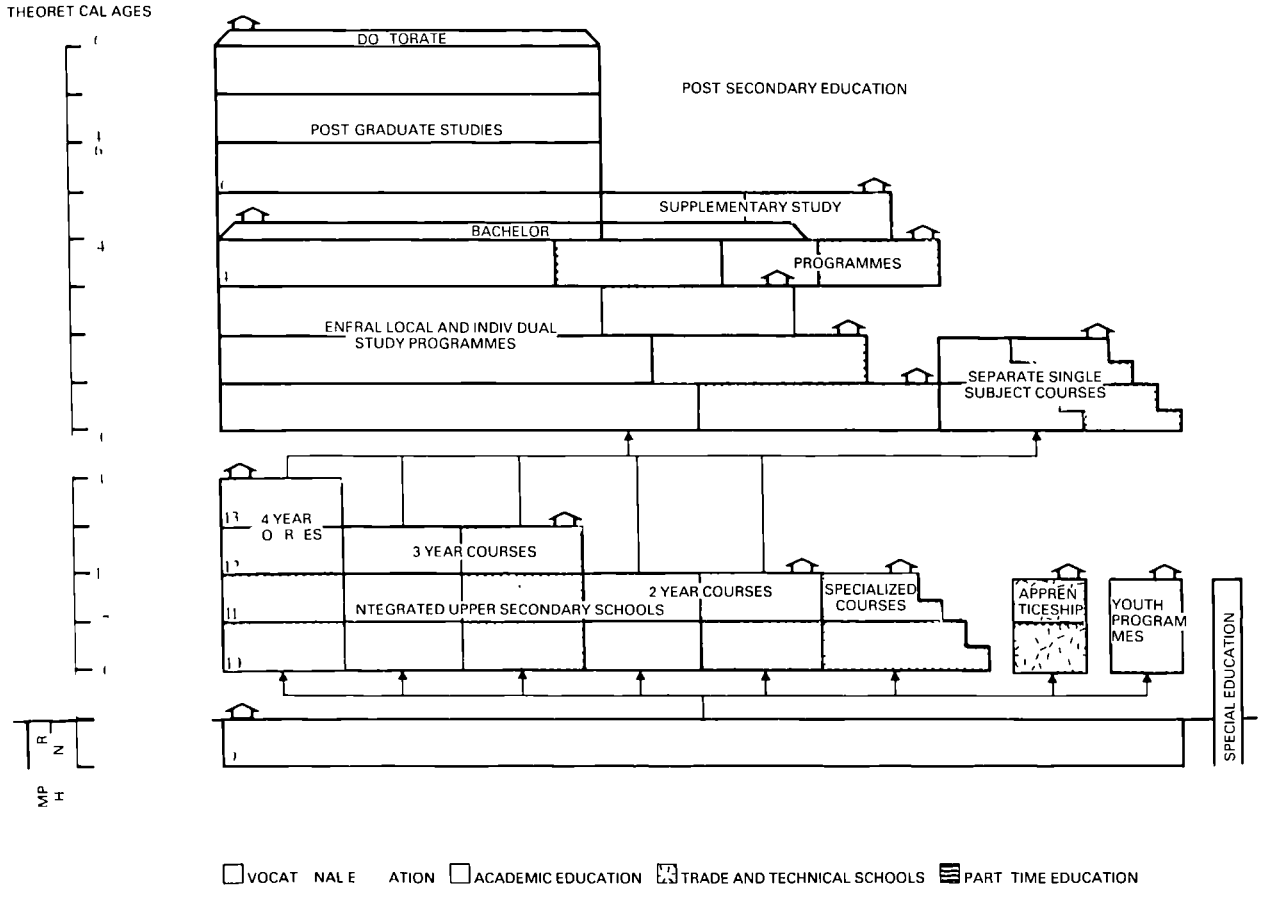


SWEDEN

Sweden has a highly centralized education system that is compulsory to age 16. More than 90% of 16 year olds apply for upper secondary school for 2 to 4 years in one of 27 courses. Increasing numbers take a year off before post-compulsory education to get work experience. Courses are 'theoretical' or vocational; more than 50% take the latter and all courses can qualify students for HE. The 3 and 4 year courses mainly comprise theoretical studies of general subjects and theoretical vocational subjects. Students taking the 4-year vocational course can obtain an upper secondary school leaving certificate after 3 years. The fourth year results in the qualification known as 'upper secondary school engineering graduate'. There are no external examinations. Students receive a leaving certificate showing graded results per subject assessed at the school from centrally administered tests. Some 0.2 million students participate annually in HE, either at university or a specialist college. A first degree takes 3 years.

Figure S

EDUCATIONAL PROVISION IN SWEDEN



ANNEX D

REPORTS AND STATEMENTS ON POST-16 EDUCATION DRAWN UPON BY THE WORKING GROUP

ASE, CNAA, SCUE (1989) *Post-16 science studies: the A and AS level dimension*

Ball, Sir Christopher (1989) *Aim higher: widening access to higher education*

Ball, Sir Christopher (1990) *More means different: widening access to higher education*

CBI (1989) *Towards a skills revolution*

Central Statistical Office (1991) *Social Trends 21*

CNAA Project Report 27 (1990) *The accessibility of higher education*

DES (1985) *International statistical comparisons of the education and training of 16 18 year olds*

DES (1985) *Selected national education systems I*

DES (1987) *International statistical comparisons in higher education*

DES (1988) *Advanced supplementary levels: 1987 to 1988, pupils and students in English schools and FE colleges*

DES (1988) *Advancing A-levels*

DES (1989) *Selected national education systems II*

DES (1989) *GCE advanced supplementary examinations: the first two years*

DES (1990) *International statistical comparisons of the education and training of 16–18 year olds*

DES (1990) *The European schools and the European Baccalaureate*

DES (1990) *Projecting the supply and demand of teachers: a technical description*

The Engineering Council and Society of Education Officers (1988) *16–19 education and training*

Further Education Unit (1989) *Access to mathematics, science and technology*

HMI (1991) *Standards in education 1989–90*

HMSO (1982) *Mathematics counts: Report of the Cockcroft Committee*

HMSO Report of an interdepartmental review (1990) *Highly qualified people: supply and demand*

HMSO (1990) *The supply of teachers for the 1990s.* Second report of the House of Commons Education, Science and Arts Committee

Institute of Manpower Studies report No.177 (1989) *How many graduates in the 21st Century? The choice is yours*

Institute of Manpower Studies report No.193 (1990) *The European labour market review: the key indicators*

Institute of Physics (1990) *Report of the 16 19 physics course working party*

Institute for Public Policy Research (1990) *A British Baccalaureate*

International Baccalaureate Organization *Information folder*

NCC (1990) *Core skills 16–19*

NCVQ Research and Development report No.6 (1990) *Common learning outcomes: core skills in A/AS levels and NVQs*

NCVQ Research and Development Report No.7 (1990) *Accreditation of prior learning in the context of national vocational qualifications*

OECD (1985) *Education and training after basic schooling*

OECD (1989) *Pathways for learning: education and training from 16 to 19*

OECD (1990) *Education in OECD countries 1987–1988*

Oxford, University of, Department of Education (1990) *Making choices: An enquiry into the attitudes of sixth-formers towards choice of science and technology courses in HE*

The Royal Society (1988) *The 16–19 science curriculum and its assessment: statement of policy*

The Royal Society and The Engineering Council (1989) *Science education 16–19: conference report*

The Royal Society of Chemistry (1990) *Core-content for post-GCSE chemistry*

SEAC (1990) *Examinations post-16: developments for the 1990s*

Secondary Heads Association (1989) *Planning 16–19 education*

Smithers, A. and Robinson P. (1988) *Teacher shortage in physics and mathematics*

Smithers, A. and Robinson P. (1989) *Increasing participation in higher education*

Smithers, A. and Robinson, P. (1990) *Teacher provision in the sciences*

Speech by the Secretary of State for Education and Science to the Association of Colleges of Further and Higher Education (February 1991) *Staying on in education and training*

ANNEX E

CBI TARGETS FOR EDUCATION AND TRAINING

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 or education leading to NVQ level III or its academic equivalence.

By the year 2000 half 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.

(*Towards a skills revolution*, CBI, 1989)

ANNEX F

LIST OF ACRONYMS

A	Advanced (examination)
AS	Advanced Supplementary (examination)
ASE	Association for Science Education
BTEC	Business and Technician Education Council
CBI	Confederation of British Industry
CCW	Curriculum Council for Wales
CGLI	City and Guilds of London Institute
CNAA	Council for National Academic Awards
CPVE	Certificate of Pre-Vocational Education
CSYS	Certificate of Sixth Year Studies
DES	Department of Education and Science
FE	Further Education
FEU	Further Education Unit
GCE	General Certificate of Education (examining boards)
GCSE	General Certificate of Secondary Education
HE	Higher Education
IB	International Baccalaureate
LEA	Local Education Authority
NCC	National Curriculum Council
NCVQ	National Council for Vocational Qualifications
OECD	Organization for Economic Cooperation and Development
RSA	Royal Society for the Encouragement of Arts, Manufacture and Commerce
SCCC	Scottish Consultative Council on the Curriculum
SCUE	Standing Conference on University Entrance
TEC	Training and Enterprise Council
TVEI	Technical and Vocational Education Initiative

NOTES

NOTES

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