



RE-APPRAISING POST-16 EDUCATION

Summary

This paper outlines the Royal Society's proposals for the long-term reform of post-16 education. The Society believes that an effective post-16 curriculum must provide opportunities for both breadth and depth of study, provide choice across the spectrum of 'academic' and 'vocational' education, and develop students' key skills. The Society previously conducted a major study on post-16 education, and presented its conclusions in *Beyond GCSE* (RS, 1991). Since that time there has been a wide debate on the need for reform, with Sir Ron Dearing's review of 16-19 education playing a key role in that debate. Sir Ron followed many of the recommendations made by the Society in *Beyond GCSE*. We do however, have reservations on important aspects of his review.

Our main concern has been to find a balance of breadth and depth of study, with sufficient flexibility to cater for the range of students' needs. We have considered a range of qualification frameworks which, as a long-term goal, we believe will better provide for the needs of students in post-16 education. We have concluded that a framework based on a modular system encompassing both academic and vocational education is most appropriate. Students' achievements would be recorded by an overarching Advanced Certificate. Units of study, of around 80 hours in length, would form the basis of a modular system. To achieve breadth of study students would be required to study at least two units in each of three domains: Scientific and Technological Domain; Social, Economic and Industrial Domain; and Languages, Humanities and Creative Domain.

The remaining units; approximately six for students of average ability, perhaps nine or more for the most able, would be chosen freely across the three domains. This would allow either specialization in one area or the continuation of a more broad-based approach. The Advanced Certificate would also require achievement in Key Skills and opportunities for the development of problem-solving and study-skills.

Introduction

There have been a number of developments in educational structure, curriculum and assessment since 1991 when the Society's views on post-16 education were published in the report *Beyond GCSE*. Over the last two years the Society has been considering its policy in the light of these changes, and has contributed to the review of 16-19 education by Sir Ron Dearing and the Government's more recent consultation paper *Qualifying for Success*. However, the Society now wishes to restate and in some respects develop its long-term policy for post-16 education. It is a long-term perspective which forms this paper's main recommendations, building on the ideas put forward in *Beyond GCSE*. This paper has been endorsed by the Council of the Society, and was prepared by a working group comprising Mr M.H. Coles (Institute of Education, *Chairman*), Mr T. Easingwood (University of Derby), Sir John Horlock, F.Eng., F.R.S. (Treasurer, The Royal Society), Mr R. Rees (The Royal Society, *Secretary*), Mr A.N. Thornley (Headteacher, Guisley School, Leeds), Professor W.F. Vinen, F.R.S. (University of Birmingham).

What we are trying to achieve

The features of an effective post-16 curriculum must have its roots in pre-16 curricula. Equally, it must provide good progression post-19. The curriculum must also be accessible to students beyond the age of 19, facilitating life-long learning. We have attempted to look at the curriculum for the 16-19 age range with this broader perspective in mind. The range of education opportunities available beyond the age of 16 must provide the skills, understanding and motivation to provide the foundations for work, for higher education and for an individual's contribution to society. The framework must provide students with:

- a programme of specialist studies to develop knowledge, skills and understanding in areas which match their interests, motivation and career intentions;
- a programme which will encourage them to maintain contact with areas of study other than their main specialist studies;
- choices across the spectrum of 'academic' and 'vocational' education to ensure relevance to their education and career aspirations;
- opportunities to apply what they have learned from all aspects of their study, and demonstrate achievement through synoptic assessment of material that has been studied;
- the Key Skills of communication, application of number and use of information technologies,
- opportunities to develop personal skills such as team-working, study-skills and problem solving capabilities;
- careers guidance and work experience.

Beyond GCSE

Beyond GCSE was published both to stimulate national debate and to make firm recommendations for policy change. It was published at a time when there was little consensus on the possible models of reform of post-16 education. The principal recommendations in *Beyond GCSE* were as follows:

- a single curriculum framework, based on a modular system, of academic and

vocational education would replace the (then) twin track approach to post-16 education comprising A levels and vocational awards;

- two new qualifications would eventually replace the range of academic and vocational qualifications then on offer. There would be an Advanced Diploma, achieved after the equivalent of two year's full-time study, and an Advanced Certificate achieved after the equivalent of one year;
- three broad domains: social, economic and industrial; scientific, mathematical and technological; and creative, language and aesthetic in the curriculum framework. A flexible choice of study across these three domains would allow breadth and depth of study.

Key changes in post-16 education since 1991

Since 1991 there have been many changes to post-16 education. Some are the continuation of long-term trends, such as the increase in mixed A level programmes, others are major innovations, such as the development of General National Vocational Qualifications (GNVQs). Here we highlight key changes which affect this phase of education.

(i) Increase in participation in post-16 education.

There has been a significant increase in participation in post-16 education over last 10 years. More people are progressing to advanced level education (A levels and Advanced level GNVQs), and fewer are dropping out. This has led to a broader range of student needs, capabilities and aspirations.

(ii) Changing patterns of uptake in science and mathematics.

The proportion of students opting for a specialist programme of A level science and mathematics has shown significant decline in the last 15 years. Over the same period the proportion of students mixing their study across the science-arts boundary has shown significant growth. In developing our proposals we have taken account of the increasing demand for

some science beyond 16. However, increasing the number of students who make a significant commitment to science and mathematics will depend more on imaginative curriculum development than on wholesale reform of the system.

(iii) The Introduction of Science GNVQs

The first GNVQs were introduced in 1992, the Science GNVQs (at Intermediate and Advanced levels) followed in 1994 and attracted about 6000 students in the first year. The qualifications provide a broad scientific education for students intending to follow science-based employment or science courses in further or higher education. Students develop the skills, knowledge and understanding that underpin a wide range of technical occupations. The Key Skills of communication, application of number and information technology are an essential part of GNVQs, although the Society is concerned that satisfying the requirements for application of number indicates success at a relatively elementary level of mathematics. Currently there are about 4000 students registered for the Advanced Science GNVQ and about 4000 students are registered for the Intermediate Science GNVQ. Numbers of students following a course leading to the Foundation Science GNVQ are very low. Science GNVQ recruitment is now stable; it is likely that a combination of poor publicity for GNVQs generally and the rapid expansion of modular science A levels has slowed growth of science GNVQs. There is evidence from GNVQ centres that Advanced GNVQ Science is offered to students who have poor chance of success at A level, i.e. students with weaker average GCSE grades. About two thirds of Advanced Science GNVQ students (approximately 1500 p.a.) apply to study science in higher education. The courses they choose are predominantly applied science courses in the new universities, but low levels of achievement in mathematics implies transferring a major teaching load onto higher education institutions for any candidate accepted for a degree in the physical sciences or engineering.

(iv) Changes to curricula at A level.

The content of A level syllabuses has changed very little since the publication of *Beyond GCSE* in 1991. The main change in A level

provision has been the rapid expansion of modular A level schemes. These syllabuses are now much more popular than the more traditional form A level courses with assessment at the end of the course.

(v) Increase in higher education participation.

Participation in higher education has shown marked growth during the 1990s. The proportion of young people choosing to continue to higher education is now 30% of the cohort. There has also been marked growth in mature, part-time and other 'non-traditional' students. Despite these increases many science and engineering departments are finding it difficult to recruit students into science and engineering courses. During 1997 some universities decided to merge or close science and engineering departments in response to this difficulty.

The Dearing recommendations

In May 1995 the Government commissioned Sir Ron Dearing to consider ways to strengthen, consolidate and improve the framework of post-16 qualifications. In particular the review was to have regard to the need to maintain the rigour of A levels, to build on the development of GNVQs and NVQs, to increase participation and achievement, to prepare young people for work and higher education and to secure maximum value for money. The key recommendations were as follows:

- A national framework of qualifications would be established based on the three existing pathways; A levels, GNVQs and NVQs.
- The AS level would be reformulated to become the first half of an A level, normally studied in one year.
- Skills for work and life-time learning would need emphasis, including the key skills of communication, the application of number and the use of information technology.
- Development of a National Certificate, to be awarded for completion of two A levels, or equivalent, in any subjects, plus key skills.

- Development of a National Diploma to be awarded for achievement across four domains of study: science, technology engineering and mathematics; modern languages; arts and humanities; and the way the community works. Students would be required to study at least two full A levels, or equivalent, to provide depth of study, and ensure that at least one AS level, or equivalent, was completed in each of the four domains to provide breadth, plus satisfy key skills requirements.

The Society produced a detailed commentary on these proposals (RS, 1996) which supported the broad thrust of Sir Ron's review, although some reservations were expressed regarding aspects of the key recommendations. The Society was not convinced of the need to introduce a National Certificate, and considered that the proposal for the National Diploma to be based on four domains of study presented a considerable barrier to its widespread adoption, in particular for those students who wanted to follow a programme of study with science and mathematics as their main subjects.

Limitations to the Dearing recommendations

Many of the recommendations put forward by Sir Ron Dearing carry the full support of the Society. However, with regard to promoting broader studies and allowing students to study aspects of both academic and vocational/applied education, it believes the 16-19 review has significant limitations. In particular, the nature of the qualifications available (A levels, GNVQs, AS levels) does not allow the flexibility of a modular system to be fully exploited. Each of these qualifications requires students to make a significant commitment of time, thus allowing the study of no more than a few subjects. Even though most of the qualifications on offer will be based on modular provision, the recommendation that they continue in their existing form is likely to ensure that most students will continue to specialize in two or three subjects. **We believe that qualifications of the same intellectual challenge, but taking less curriculum time, would allow more flexibility.** Sir Ron Dearing also made recommendations for an overarching Advanced Diploma, summarising

achievement in existing qualifications and indicating a breadth of study. We believe that some students would face major difficulties in following the Diploma, especially those who wish to retain some emphasis on science or technology. Similarly the Diploma offers few opportunities for students to choose across both academic and vocational qualifications. **Therefore the principal mechanism recommended by Dearing to promote breadth of study seems to us to have fundamental flaws.**

Alternative models for a certificate-based qualification

We have considered mechanisms which we believe, as a long-term goal, will achieve the requirements outlined above. These build on the recommendations of the Dearing 16-19 review. As a starting point, each option structure relies on smaller units of study than recommended by Dearing to provide the necessary flexibility. We will return to unit lengths after a discussion of the number of domains which best provides a broad curriculum for students. Each of these structures provides some guarantee of breadth of study, but allows some aspects to be studied in depth.

(i) Three domain structure

The domains would be broadly based, including units or qualifications from across the academic and applied/vocational spectrum. Initially the units would be based closely on existing A level modules or GNVQ units. In time, however, this system provides opportunities for developing a greater range of units. We recommend that the domains be structured as follows:

- Scientific and Technological Domain;
- Social, Economic and Industrial Domain;
- Languages, Humanities and Creative Domain.

A minimum level of study from each of these broad domains provides the guarantee of some breadth of study.

(ii) Four domain structure

This was the original proposal of the Dearing

16-19 review. The domains were to be structured as follows:

- science, technology and mathematics;
- modern languages;
- arts and humanities;
- the way the community works.

The basis of this award would be two full A levels or an Advanced GNVQ, with other subjects taken as complementary studies. However, this proposal has been criticised as it presents particular difficulties for students who wish to combine the study of science and mathematics with other subjects. To achieve the full Diploma would require study of science and mathematics to advanced level from the same domain *plus* study in the remaining three domains to at least AS level. For all but the highest ability students this is a demanding programme of study. During the initial consultation on the Dearing recommendations this proposal was modified in recognition of this problem; five domains was deemed to be a more appropriate structure.

(iii) Five domain structure

This structure has two variants, either study in all five domains, or study in a choice of four domains out of five. This proposal was the modified version of the Dearing post-16 recommendation. The domains are divided as follows:

- science and technology;
- mathematics;
- modern languages;
- arts and humanities;
- the way the community works.

This is based on the four domain structure originally proposed by Dearing, but has the mathematics and science areas split into separate domains.

(iv) Other qualification structures

There are alternative qualifications which already have a certificate based structure, including several in other European countries and the International Baccalaureate (IB). We believe the IB structure is appropriate for high-ability students, but we are less convinced of its suitability for less able students. Although these Baccalaureate-type awards have merit in their own right, we believe that the three alternatives

above develop more easily from the current approach to post-16 education, and therefore present better options.

Our long-term recommendations

The Society has carefully considered how best to structure the curriculum and assessment framework. We do not support the four domain framework, not least because it disenfranchises many science and mathematics based students from attempting it. This model should not be seen as a compromise between three or five domains, as it is inherently flawed. Our key concern has been to find a balance of breadth and depth of study, with sufficient flexibility to cater for the range of students' needs. In this respect both the three domain model and the five domain models (with science and mathematics separated) are more suitable - both provide breadth, with some measure of choice. Within our discussions there has been support for both models. The five domain model, with study from either all five or a choice of four domains, has less flexibility, and we recognize that some students will wish to follow a particular area or subject in more depth than this model offers. We therefore conclude, on balance, that the three domain structure best achieves the flexibility to allow a broadly based education beyond 16, but without sacrificing opportunities for some measure of specialization for students who wish to study some areas in more depth. A fully modularized post-16 system has the potential to appear very complex to students, parents, teachers, employers and higher education. A three domain structure will also serve to reduce this complexity. In the long-term we believe our proposals provide the opportunity for students in post-16 education to delay the point at which irrevocable choices about their main areas of study must be made. This, however, will depend on a number of factors. In particular the standard of learning skills developed within post-16 education will have to be raised, ensuring students are better able to make the transition to higher education. Admissions criteria for higher education will also need to be considered, but this must take account of the increasing pressures on university departments.

Specifying the number of domains that students must study is an important tool in ensuring breadth. We are equally concerned that students should have an opportunity to study some topics in depth. In a unit-based system, the size of these becomes important. We believe that the minimum size of units of study should be about 80 hours. Currently most modules in A level and GNVQ are based on 60 hours of study. Longer units allow the added depth which advanced students need to show their capability to best effect. However, units in excess of 80 hours will restrict the opportunities for some students to sample across a range of subjects. Two of these 80 hour units would be equivalent to an AS, 4 to an A level, and 8 to an Advanced GNVQ.

Criteria for the three domain Certificate

The award of the Certificate would be based on a *minimum* of two units in each of the three domains. This is the guarantee of breadth. Units would, at least initially, be derived from existing A Level modules/GNVQ Units. We see great merit, as the system evolves, in opportunities to match combinations of units to serve particular purposes e.g. biology with statistics units. We would see that, in time, the Certificate would replace existing A levels and GNVQs as the main credential sought by higher education and employers.

It will be necessary to specify a minimum level of achievement for the award of the Certificate. We believe that this should be equivalent to the current 'matriculation' level of two A levels, therefore we recommend that a **minimum of 8 units** should be completed successfully for the Certificate to be awarded. However, we believe that students of **average ability will study approximately 12 units**. It is important that the highest ability students are able to follow a challenging and relevant programme of study, and get recognition for their achievements. We believe these proposals provide the flexibility to encourage this. Enabling students to study additional units would allow them to deepen their knowledge of a subject, provide opportunities for an extended project giving an improved overview of some aspect of their work, or provide more opportunities for breadth of study. We believe that **more able students could follow a programme comprising 15 units**, or

even more in exceptional cases. We outline below some examples of study programmes which would appeal to a range of student groups. These are given to indicate the flexibility of our proposed structure, not as recommended models in themselves. We believe that there would be value in grading individual units and the overall Certificate. This would provide valuable feedback to students on their performance, and would help employers and higher education to recognise strengths and weaknesses.

In addition to the requirements for a number of discipline based units, we see the development of students' key skills as an important element of the Certificate. Employers, universities and students value these skills highly. The Society supported Sir Ron Dearing's emphasis on the Key Skills of information technology, communication and the application of number. We reiterate this support here. In our proposals the requirement to demonstrate achievement in these **Key Skills would be an essential part of the Certificate**. We believe that these skills should be taught in the context of other units, rather than free-standing subjects.

Moving to an entirely modular or unit-based system can mean that coherent study *within* subjects and *between* subjects is threatened. We believe that this is an important issue to face, and have considered how best to ensure that there is a value to an individual's programme of study which is greater than the sum of the individual units. An important tool in ensuring coherence would be the use of synoptic assessment to test understanding across more than one unit. The difficulty in achieving this should not be under-estimated; we therefore recommend that it is addressed urgently. We also believe that it will be necessary to state rules of combination for some units. Some units will also specify pre-requisite study; either pre-16 qualifications or other units. In addition to these specified requirements, we see that the advice provided by schools and colleges and through careers guidance will also play a part in ensuring study does not become too fragmented. As with the current qualification frameworks, we believe that university departments will continue to specify the areas of study which are essential pre-requisites. These aspects will all lessen the possibility of students choosing inappropriate combinations of units.

In addition to the range of units and key skills studied, we believe that other important aspects should also be developed. Work experience and the development of broader skills, such as problem solving, team-work, learning 'how to learn' or developing study-skills, are all important aspects and are valued highly by employers and higher education. We believe these are of crucial importance and should be an all pervading aim of post-16 education.

Case Studies

These examples indicate the range of study programmes that we have considered in formulating these proposals. In each case the Certificate will also require achievement in Key Skills to complement the subject-based units. All examples are based on level 3 qualifications.

1. Specialised science-based student: Total study 12 Units plus Key Skills.
Scientific and Technological: Physics (2 units), Mathematics (3), Chemistry (3)
Social, Economic and Industrial: Business Management (2)
Languages, Humanities and Creative: French (2)
2. High ability science-based student: Total study 16 units plus Key Skills.
Scientific and Technological: Mathematics (3), Technology (2), Chemistry (4) Physics (2)
Social, Economic and Industrial: Economics (2), Industrial Process Management (2)
Languages, Humanities and Creative: French (2), Art History (1)
3. Broad-based student: Total study 12 units plus Key Skills.
Scientific and Technological: Biology (2), Chemistry (2)
Social, Economic and Industrial: History (2), Geography (2),
Languages, Humanities and Creative: Media studies (2), Art (2)
4. Vocationally-based student not following Advanced Certificate: Total study 10 units plus Key Skills
Scientific and Technological: Chemistry (1), Health Studies (1)

Social, Economic and Industrial: Hospitality and Catering (6)
Languages, Humanities and Creative: Art (1), Photography (1)

Lifelong-Learning

One particular advantage we see to this structure is the opportunities it provides for life-long learning, either for adult returners to full-time education or for part-time study. The 80 hour unit-based curriculum will allow part-time students more opportunities for 'bite-size' learning goals. The flexibility inherent in these recommendations may be less of a deterrent for adult-returners who may wish to study a broader range of subjects than the traditional diet offered by three A levels. For many students, it will be neither necessary nor, perhaps, possible to work towards the required number and breadth of units needed for completion of the Advanced Certificate that we propose. In these cases we recommend that the National Record of Achievement be used to summarise the success in individual units rather than the Certificate.

Resource Issues

Our recommendations imply an increase in contact time for some students. This has resource implications for schools and colleges which must be addressed. Similarly, there are implications for higher education. Change of this fundamental nature cannot be undertaken without the appropriate resources. Although our proposals are for long-term reform, we feel it is essential that the resource implications of reforming post-16 education are considered and committed at the earliest opportunity.

We have also given some thought to the practicalities of implementing the framework in schools and colleges. Of the different models of curriculum provision we considered, we believe that a structure based on three domains will be the most straightforward to operate more particularly in matching curricula and qualifications to the needs of students. This approach will also be readily understood by parents, higher education and employers.

Conclusion

We recognise that further consideration will have to be given to the detail of these proposals, in particular to the nature of units within this structure, and to the possible need for units with different levels of demand, e.g. Foundation level. We believe that our long-term vision can be achieved by a series of incremental steps,

taking the recommendations put forward by Sir Ron Dearing to align GNVQ and A level frameworks and for the creation of an overarching certificate as a starting point. However, we feel it important that policy-makers set out a long-term vision which will guide short-term reform, and which can be promoted and shared by all those with an interest in post-16 education.

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