

Chemical Education Group Seminar

**held on Thursday 9 March 2000
at Salters' Hall**

REPORT

**Exploring the Opportunities for
Chemistry Within the
New Post-16 Framework**

Policy Objectives of the National Qualifications Framework

Dr Nicholas Tate

The National Qualifications Framework should:

Ensure that all qualifications are valued.

The framework will clarify the role and levels of the different types of qualification. Within the framework there are three categories of qualifications:

- General - A-Levels
- Vocational - GNVQ (to be known as the Vocational A-Level)
- Occupational - NVQ

Provide a broader curriculum without sacrificing depth.

The introduction of the AS level will enable students to maintain breadth in their post-16 studies. In addition six key skills have been identified and signposted in specifications. Attainment in application of number, communication, and information technology will be recognised via a Key Skills Qualification. The other three key skills, known as the wider key skills, are improving own learning and performance, problem solving and working with others. The advanced Extension Awards (AEA) will provide opportunities for very able students.

Realise and widen the level of participation, retention and achievement.

This will be achieved by providing smaller units of qualification, i.e. the AS-level and by enabling students to mix vocational and academic qualifications.

Provide clear progression routes into Higher Education, employment and further training.

The framework and the implementation of *Learning to Succeed* will lead to rationalisation of qualifications and training opportunities.

Ensure that high and consistent standards are maintained.

The reduction in the number of specifications will make it easier to ensure high and consistent standards. In addition there will be a five-yearly review of GCSE's and A-levels. QCA will be monitoring the Awarding Bodies and publishing their reports (from May 2000).

Opportunities for FE

Dr Richard Evans

The Framework

The new curriculum framework, known generally as Curriculum 2000, will be introduced from September 2000. The national framework will offer a series of benefits, not only to students, but also to institutions delivering Curriculum 2000. It should reduce the confusion that many end users experience about the qualification system operating in this country. The three categories, or curriculum pathways, will create a clear national framework, spanning levels from pre-entry to NVQ 5, and hopefully bring about a rationalisation or tidying up of the plethora of rewards that have dogged this country for so long.

The characteristics of breadth, balance and depth are significant benefits of Curriculum 2000. Even though each of the three categories possess an integrity of its own, there are real opportunities for schools and colleges to combine awards across the category routes to provide a programme of study for students that can either provide breadth, balance and/or depth. The recent announcement by the Government of the intention to re-name GNVQ Advanced Awards as Vocational A-levels is a cause for concern. It may subvert the integrity of that middle category and put it very close to the general category and possibly send out messages about so-called 'academic drift'.

Qualifications

A great deal of effort has gone into reconfiguring the general (AS and A-level) and the general vocational (GNVQ) awards, but the third, and in many ways the most important category, has to date been neglected. Despite a huge potential market of twenty-eight million workers, the vocational route, yet again, seems to be ranked as second class compared to those of the supposed general (or academic) routes. The work-based route is important, particularly for such subjects as engineering, manufacturing, built environment technologies and vocational science and must be quickly improved in order for the exciting proposals of the Foundation Degree and the Graduate Apprenticeship to be established and articulated through that route.

It so often seems, in this country, that we benchmark all our awards against the supposed gold standards of either A-level or an honours degree. Truly there has to be parity of esteem of all awards and qualifications offered in this country and the structure of the framework should offer honourable exits for all our students and not appear to be driving them through one particular route. This country needs a great number of highly qualified 'technicians' in order to support the researchers and professional engineers et al. That is why the work-based route is so important, particularly for science-specific and science related disciplines.

In terms of Chemistry, the draft specifications for the new A and AS-levels have now been announced and Salters' are to be congratulated on their two specifications for Chemistry and Physics. Many staff in schools and colleges welcome the rich and effective resources that Salters' have developed on behalf of these two awards.

Once the specifications are finally agreed, then the institutions can develop, subject to their own strengths, rules of combination of awards and this most certainly offers a large number of exciting opportunities for Chemistry and the other sciences. Hopefully, admission tutors in universities and, equally important, employers will be made aware of these changes and see them as a valuable contribution to fulfilling the Government's agenda on standards, widening participation and skills.

Key Skills

The introduction of the Key Skills Qualification is to be welcomed. The role of the wider key skills, improving own learning, problem solving and working with others, is still unclear. These wider skills, particularly from the employers' viewpoint, are seen to be very important. If this country is serious about producing a highly qualified flexible and motivated workforce then the three wider skills must be introduced as quickly as possible into the framework, particularly at level NVQ 3-5. Successive reports from employers have indicated that they value these wider skills very highly and the insistence that they have to be measured in a traditional way is now getting in the way of integrating these into the National Framework.

Opportunities for Higher Education

Dr Mike Goldstein

Although there had been a growth in the number of students in Higher Education between 1986 and 1995 of 115%, the growth in chemistry was only 40%. Too often the courses offered by universities were not based on customer demand.

The New Framework should provide a number of marketing opportunities.

- A broader programme of post-16 opportunities should produce a larger pool of applicants
- The mix of academic and vocational qualifications should promote both academic and vocational degree courses. Chemistry is a subject with both academic and vocational appeal and so should benefit from this.
- The horizontal AS/GNVQs should prove better predictors of HE success and completion.
- The Advanced Extension Award ought to identify the most able students.
- The new UCAS tariff should enable universities to make their entry requirements more specific.

The New Framework should promote a range of curricular opportunities in HE.

- The increasing breadth of study in science should provide a better base for chemistry within science.
- The mixing of science, arts and humanities at post-16 should lead to a broader range of degree courses.

- Chemistry modules could be used to add breadth to other subjects.
- The mixing of vocational and academic courses post-16 could create a demand for more vocational degree courses.
- The introduction of key skills post-16 may lead to a re-think of methods of learning in HE.

Implications for Employers

David Giachardi

A review of the Post-16 structure is long overdue.

Concerns

- All change
Is it wise to change so many variables, such as the Qualification Framework, the introduction of the Learning Skills Councils and the Adult Learning Inspectorate, at the same time?
- Transition Processes
The uncertainty is leading to the loss of good staff. The change from TECs to the LSC will be difficult.

Impact

- Industry is not homogeneous and there are great differences between the various sectors so the new framework does not have one single impact.
- There is always a long time lag before most employers recognise new qualifications.
- There is concern about the lower esteem for work based learning relative to institution-based.
- It is important that the new Learning Skills Council is not the Further Education Funding Council reborn.
- There is suspicion about grade erosion and immense scope for confusion.
- There is still much detail to be revealed.

Funding

- Broad support for the objectives in the January 2000 Consultation Paper.
- Why not entitlement for 16-25 as per National Skills Task Force?
- Funding should follow individuals not the institution.
- Formula funding should differentiate adequately between high and low cost sectors.
- Fundamental disagreement that there is a 10% limit on employer-based training contracted by local Learning Skills Council to employers.

Industry and the Inspection Regime

- Educational inspection processes appear very laborious and bureaucratic.
- Inspection processes produce league tables that are rarely of formal interest to industry.
- Most people in business have their own inspection processes, which may not be rigorous or fair, but are practical and utilitarian.
- It is not possible to "inspect in" quality at the end of the line. It is preferable to have high quality inputs rather than inspection.

What kind of Chemistry and for whom

John Holman

Problems

- Schools have been asked to increase the number of A-levels by 33% but there is no more money available. In a typical school this could mean four more teachers are needed.
- These are considerable changes at a time when teachers are very demoralised. This is not because of discipline problems or levels of pay but because of too much work and bureaucracy.

Post-16 Chemistry Numbers

It is possible to identify two types of student who might study chemistry post-16. Those intending to study chemistry or needing chemistry at the next stage of education and those who will never use chemistry again. The evidence so far seems to be that the new framework has not produced a great increase in the take-up of A-level chemistry. The number of students who will continue with or need chemistry is fixed and unlikely to increase substantially; however there are a large number of students who could fall into the other category who could increase the uptake of A-level chemistry. Are we doing enough to promote chemistry for those who will not read chemistry at university?

Opportunities for Expansion

- Chemistry should be seen as part of a general education and a useful subject for anyone.
- Chemistry provides excellent opportunities to teach the Key Skills. For example, the Salters' open book paper students develops the following key skills
 - communication is developed by writing a 1000 words on a new topic and producing an abstract
 - information technology skills are developed as students search for information from the Internet
 - numeracy is developed by the data handling requirements.

Summary Presentation

David Moore

The 16+ Framework presents an enormous opportunity, but do we have enough good teachers to deliver it?

Initial Concerns

- If the students find AS chemistry difficult will they drop it at the end of year 12?
- Examination results being unavailable until mid August, which is too late for making plans for year 13.
- The amount of teaching time available, in particular for the AS-level.
- How will admission tutors respond?
- Assessment arrangements are still not clear.

Opportunities

- Flexibility means that the needs of a greater number of students can be met.
- The promotion of Further Education.
- It provides an opportunity for universities to re-think their degree courses. For example, there could be more courses in chemistry and education.

Careers Advice

Students should receive careers advice that:

- Starts at Key stage 3
- Clarifies the requirements of universities and further education.
- Informs as to the type of academic or vocational qualifications required by different occupational areas.
- Is up to date, for example entry to the technician role is not longer at 18 but subsequent to a degree.
Can the careers service cope with these new demands?

Key Skills

- These should be embedded in A-levels but more clarification is required.
- There is still a lot of confusion and this must be seen as a developing process

Reports on Morning Discussions

Group 1

Chair Sir David Harrison

Curriculum Problems

The group thought that Curriculum 2000 had serious implications both for planning and for teacher work load, in that no one knew how many students would transfer from AS to A2. However, as the most popular curriculum plan for the AS years seems to be an offer of four AS levels, there is certainly almost a requirement for teachers to teach more hours.

Concern was also expressed that the advice given to students on entry to sixth form courses did not give them focus; there appeared to be little advice on breadth of study and institutions let market forces define students' choice. The problem of the mathematical requirements for science should be addressed and students encouraged to either take an AS in mathematics, or to take free-standing mathematics units.

Whilst the view was expressed that higher education institutions could have an effect on breadth by making it a requirement, it was highly unlikely that the majority would do so. Similarly, the position of key skills was likely to be dependent on the requirements from higher education institutions for students to possess the Key Skills Qualification.

Higher Education

The view was expressed that a possible way forward was for higher education institutions to offer radically revised courses that required both a breadth and depth of study, but it was thought that many institutions would remain conservative.

The new course profiles in higher education will be important in allowing students to match their own knowledge skills and attributes to those of the courses. It was important for the institution to have a clear specification of what was being offered and what was required of the student.

Careers Advice

The quality of careers advice given to those embarking on sixth form courses was thought to be inadequate because the majority of careers advisers were generalists and had neither a detailed knowledge of the requirements for sixth form study, nor an awareness of the possible consequences of choice for study in higher education. There were too many instances of students being given advice based on interest, rather than the actual requirements for either courses or careers.

A problem with chemistry is its inherently vocational nature unless it is being considered in terms for public understanding.

Group 2

Chair Dorothy Atkinson

Managing the Curriculum

There was general agreement that the new framework was to be welcomed, even though in the early days students will add complementary rather than contrasting subjects to their portfolio.

Concern was expressed that if the AS course was taught badly the students have more opportunity to vote with their feet and opt out of courses. Hence chemistry teachers really must teach well in year 12 if they want to retain their chemistry cohort.

It was agreed that teachers, especially those in state schools, perceive that time pressures make it very difficult to be inspiring and to introduce to their courses experiences and learning opportunities which enrich the course. For example, showing the students how chemistry is applied in industry and other environments is difficult to achieve effectively due to lack of time, experience, awareness of available resources and opportunities.

It was recognised that the AS-level has been developed to be easier to manage in schools and is less loaded than A2. However, not enough has yet been done to demonstrate the 'real world' applications of chemistry, or to extend the really bright students.

It was agreed that teachers were the key to the implementation of the new Framework. This it is necessary to find ways to give teachers time for professional development and reflection.

Group 3

Chair Philip Evans

Concerns: depth, timing and progression

There are concerns about completing the AS in time for the summer exams, when to carry out practical exams seems to be a particular issue. It might be possible to start teaching the AS in year 11, but this raises difficulties about students who arrive in year 12. The AS course will be complete before the end of year 12, does that mean that all students should start on the A2 regardless of whether they intend to continue into year 13?

There is some uncertainty as to the depth of study at AS and A2. If AS is a bridge between GCSE and A-level, does this imply that the A2 is harder than current A-levels to ensure average difficulty comparable with the present A-levels? There may be problems when students who have found the AS easy to cope with start on the A2 course as a result.

In addition, there was considerable concern expressed at the very late arrival of the specifications for the new qualifications.

There is a tension between the extra depth implied by Advanced Extension Tests and the aim that students should be able to attempt them with no extra teaching. It was also suggested that World Class tests ought to be concerned with the breadth of knowledge rather than depth.

Opportunities

Early evidence from delegates suggests that there may be increased numbers in A-level science classes as a result of the AS. Where chemistry teaching is good the numbers are increasing. However, many of these are accounted for by students who are taking an additional science AS rather than a genuine broadening of the curriculum. This is unlikely to happen until schools are convinced that admissions tutors will recognise and reward a broader offering from candidates.

14-19 Curriculum

Much of the discussion centred on the role of the GCSE. There was a feeling that the examination at age 16 helped to give a focus for children and success helped to revitalise and motivate students. However, balanced against this was the concern about the amount of assessment to which children were now being subjected. It was also felt that the GCSE exams are contributing to a learning environment where all that matters is what can be measured; there is too much pressure to move on without proper consolidation and little opportunity for extended work.

Key skills

Many of the schools represented by delegates were already tracking the key skills to identify where they could be assessed. There was a concern that there has been too much emphasis on assessing the key skills across the curriculum and that insufficient attention has been paid to how the key skills might be developed.

It was acknowledged that industry visibly values key skills. It would be helpful if HE did the same.

Reports on Afternoon Discussions

Group 1

Chair Sir David Harrison

There was anecdotal evidence that where institutions had plenty of students who were studying A-level chemistry at present, the numbers were not expected to rise for next September. However, where there were smaller numbers currently, an increase was predicted. It appeared that students were choosing complementary rather than contrasting subjects.

The question was raised as to what is the standard requirement for a sixth form student – is it now 3½ A-levels rather than 3. This implies that students will have a reduced entitlement to self study time and teachers will have more contact time.

In practically-based subjects such as chemistry there are further constraints because of the requirement to produce practical assessments by 1 May in the AS year.

Group 2

Chair Mike Coles

It was agreed that there were many avenues down which post 16 education could go, for example modularisation, different kinds of chemistry, different qualifications and a mixture of qualifications and perhaps even a more integrated curriculum. The discussion then focused on the desirability of breadth. After exploring the different needs of society, students and industry, it was agreed that overall breadth was to be encouraged, whilst retaining the opportunity to study in depth.

It was agreed that all students should be encouraged to study science beyond 16, but that courses which were more about public understanding of science and the environment should be promoted and taught to students unlikely to pursue science subjects beyond school. That is, a range of courses should be available to meet the needs of different students.

Key skills are essential. They need to be taught in the context of assessed courses. Assessment of key skills needs very careful consideration to avoid over-assessment and bureaucracy that could 'kill' students' enthusiasm to develop these skills. Time must be built into the assessed courses so that through the academic/vocational subjects students practice and develop their skills and at the same time 'enjoy' their courses through enhancement materials and activities.

Group 3

Chair Philip Evans

There was some debate as to how the 'extra' AS might be viewed by admissions tutors – it may be that tutors look to the A2s for the academic aspects, whilst the 'extra' AS is used as evidence of a broader range of interests. There was concern that the extra examination load post-16 might eat into the valuable extra-curricular activities of students, such as voluntary work and sport.

There was general agreement that the present structure did not really encourage broadening of the curriculum. Few students would take more than 4 AS-levels and as a result there would not be a genuine broadening of the post-16 curriculum. A hope was expressed that industry might put pressure on the universities to actively encourage students to broaden their studies post-16.

Another factor that should be taken account in future developments is the different requirements of subjects. From the morning's discussion it seemed likely that the greatest time pressure in science would be during the A2, where as in History it might be the AS.

Delegates hoped that the curriculum would evolve to encourage a flexible, broader curriculum. Young people need a guarantee that choosing what was good for them would not hinder them – progression should take account of the needs of individuals. A key factor would be to equip students to take account of a future where there was likely to be much greater career mobility.

The skills that were thought most important for chemistry were dexterity and manipulation, creativity and intellectual curiosity.

A well taught chemistry course should lead to scientific and vocational literacy. At present students studying A-level chemistry are likely to continue with their chemistry in one form or another. If the AS does lead to more students studying chemistry there may then be a significant number of students for whom vocational effectiveness is not the prime objective. It may then be necessary to offer different types of courses reflecting the needs of the students.

The AS for Public Understanding of Science has been well received although there are issues about who will teach the course. One concern was that non-science teachers, who lack the necessary knowledge to ensure that the discussion is meaningful, frequently tackle some areas of discussion about scientific issues.

The group believed that there was a need to look at career guidance, as there did not appear to be anyone taking responsibility for telling students about the value of science as part of a general education.

Daniel Sandford-Smith
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2000