Credit accumulation and transfer schemes — the European and company dimensions
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What are credit accumulation and transfer schemes (CATS)?
To emphasize the points already made today, I will repeat that CATS are strategies that have opened up the capacity to receive credits for successful learning whether it is achieved at home, in the workplace, at college, or some combination of all of these. There are schemes available that give flexibility of place of study, some examples of which enable a student to obtain a degree by accumulating credits obtained at universities in different European countries; others involve a combination of credits obtained in the workplace and at college. Additionally most of these schemes allow the combination of subject areas that more specifically, than is possible in conventional schemes, meet the needs of the individual. Finally there is the addition of the extra degree of freedom provided by flexibility of the time and pace of study.

The key word in all these examples is flexibility; flexibility in response to meeting the legitimate needs of the individual; but not flexibility of standards of achievement which are at least as high, and some would say higher, than those obtained in other modes of study.

What is wrong with conventional modes of study?
The answer for many people and in some circumstances is nothing. The three-year degree in Biochemistry taken at a U.K. Polytechnic or University gives an excellent career start for many. This is particularly true for those who obtained good ‘A’ levels in the right subjects at school, and whose personal circumstances allow them to study full-time, or in some restricted part-time situations. But it is essential that all students on a course study very similar combinations of subjects, in the same place, at the same time and at the same pace. In other words your requirements have to fit the production line and you can have any colour as long as it is black!

The changing needs of society and of industry
The general need of society and of industry is for many more people to be brought to a higher level of education than is currently attained. Industry needs a greater supply of well-educated manpower; and the general population need to be better educated to provide chances of employment and to be equipped to enjoy leisure and take an informed part in the political process.

Industry in general, and that part which depends on the application of biochemistry in particular, has a severe and growing shortage of personnel at all levels including the qualified professional and all types of support staff. The need is for an increase, both in the total number of personnel having appropriate skills, and also for all staff to enhance, extend, and maintain competence throughout their careers. An additional need is for individuals and companies to be able to demonstrate formally their continuing competence to the satisfaction of accreditation and other regulatory bodies.

The professional biochemist of today must develop skills and maintain competence across a wide range of subject areas; typically to include business and supervisory skills, information management, biotechnology, and analytical sciences. The demands of maintaining these skills are rapidly increasing in line with the rapid pace of technological change.

Flexibility to the rescue!
The pool of future potential students who will be leaving school with three good scientific/mathematical ‘A’ levels cannot be expected to provide for the required expansion of skilled personnel entering industry. Additional skilled recruits will only be found from other sources to include, (a) women returning to work after having looked after young children, (b) mature staff who show potential late in life, and (c) those who were unable to take advantage of educational opportunities when younger.

Attracting recruits from these sources requires initiatives which (a) give confidence to those who are unsure of their abilities, and (b) overcomes the logistical difficulties faced by those who
try to study while at the same time discharging family and work responsibilities.

Three-year full-time degree courses have little to contribute to these solutions. Part of the answer is the use of open learning systems to facilitate learning away from the lecture theatre; the other essential part is the use of CATS to award credit for such learning and to allow the accumulation of credits leading to academic awards. CATS involve the award of credit to prior learning, work experience, in-company courses and at the same time allows students the choice of a wider range of subject options and places of study.

BIOTOL (Biotechnology by Open Learning) is an example of a European-wide initiative which seeks to utilize these concepts. It is a joint project between the Open University of the Netherlands and Thames Polytechnic which, in addition to preparing a resource base of open learning materials in Biotechnology, is establishing a delivery network on a credit accumulation basis. Open learning material is provided in the form of texts, videos, and computer software; allowing learning to take place away from the lecture theatre while appropriate assessment and credit accumulation structures make full use of the flexibility thus provided. BIOTOL provides the tools for colleges to develop their own initiatives and a coordinating structure to support credit transfer arrangements.

A further example of systems which allow students to combine study at different universities across Europe is provided by ERASMUS (European Action Scheme for the Mobility of University Students). This scheme is aiding the development of numerous collaborative arrangements which allow students to spend periods of study at universities in more than one European Community country. The vast majority of these schemes derive from the initiative of groups of universities entering into collaborative arrangements with the help of funding from ERASMUS. Additionally, a central initiative of ERASMUS has established a pilot European-wide credit transfer scheme in six initial subject areas including chemistry, with participating universities in each European Community country. U.K. members are the Universities of Kent and Strathclyde and Thames Polytechnic. A typical student might choose to spend the first and third year of a BSc degree in chemistry at Thames Polytechnic with the second year spent at say the Université de Paris X. A further example might involve a Dutch student who, knowing English and German, begins to study in the Netherlands, passes the first year examination and then moves to Germany to take the Diplom-vorprüfung, or Zwischenprüfung, after a further year's study. A third year's study may either be undertaken in the U.K. leading to the award of a BSc, or in France leading to the award of the Maitrise.

**Development of in-company learning**

Most companies have mature employees who are unqualified, but may have significant potential and who, at their own level, are doing a good job. These employees usually have family and work commitments that make it difficult for them to attend conventional courses; also they may lack confidence and have significant doubts about their own potential. In these circumstances CATS allow for a number of strategies to assist such people to make the most of their potential.

To start with, it is possible for credit to be given for relevant prior learning. This is important as, not only does it recognize the fact that all of us do a lot of informal learning, but it gives confidence to the learner and provides part of the necessary process to establish to others, and also to him or herself, that an individual really does have potential. Early confidence building is of importance; credit mechanisms allow for early credits to be obtained in relatively small steps thus potential can be examined and established without the need for an initial long-term commitment to a particular course.

An important part of future collaboration between academia and industry, is the formation of CATS which allow employees to link in-college and in-company learning. By such mechanisms companies are enabled to make the most of the latent potential of their staff. Many staff are developed and enabled to move up the career ladder by obtaining new qualifications, and all are encouraged to maintain competence and obtain new skills as the demands of new technology change.

There is a large and increasing volume of in-company training with no involvement of educational institutions; this may involve specific short courses or the use of open-learning materials with tutorial support provided by local management. This activity is usually of a very high standard and is increasingly receiving academic credit enabling it to form part of degree programmes. Additionally there are new examples of companies being accredited to make their own academic awards.

Frequently, the only way a graduate can obtain a postgraduate award is by undertaking a specialist course focused on one particular subject area, yet more often than not, the real career...
development needs of an individual call for a much wider range of studies. Very few postgraduate courses recognize this fact, one that does is the MSc (Brewery Business Management) developed as a joint venture by Thames Polytechnic and the Brewers Society and designed to meet the career development needs of scientists and technologists employed in the brewing industry. Credits may be obtained in a wide range of technical and managerial subjects which may be undertaken at institutions within a nationwide network. This scheme enables individual students to gain credits, both for learning achieved prior to entering the scheme, and also for learning undertaken during a registration period at one or more of the participating universities and polytechnics. The award has three components each contributing one-third to the overall programme: a technical study, a management study, and a substantial project. The project has the important function of bringing together the technical and management elements of the course and enabling the student to relate learning achieved to work within the brewing industry. An added benefit is that the project provides a further vehicle for the assessment of student performance in the other two components of the course. Such a scheme has the twin benefits of both motivating the performance of employees in programmes of continuing professional development, and also providing certification to registration and accreditation authorities with regard to the continuing professional competence of staff.

Conclusion
In conclusion I have tried to demonstrate the power of CATS. The essence is a flexible approach to the provision of learning opportunities and a willingness to recognize the legitimate needs of individuals. The adoption of such a flexible philosophy is essential if Higher Education in the U.K. is to meet the challenges presented by a society based on rapidly changing and developing technologies.

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