

## **Agents of Change for Tomorrow's Technology -Dearing and SARTOR influences.**

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### **Abstract**

This paper describes the changes being encouraged by external agencies, such as the Dearing Report [1] and SARTOR (Standards and Routes to Registration) [2] as well as other pressures such as the Government imposed top-up fees and the increasing skills shortage, to the professional, undergraduate and post graduate technology courses. These external influences are expected to encourage only those students with better standard entry qualifications, and those willing to study for a further year to upgrade from an undergraduate degree to a Master's level. Alternative options for those establishments that do not usually attract the top calibre students are discussed, including a foundation year culminating in students sitting Engineering Council examinations, prior to commencing their normal undergraduate course. The need to provide additional post graduate education to top-up traditional degree courses, possibly company based, is discussed. The effect of these proposals on accepting the increasing number of non-standard mature students on technical courses and the affect of the proposed additional top-up fee, which is expected to potentially affect the middle-class students, are also considered.

### **1 Higher Education in the Learning Society**

The Dearing report, Higher Education in the Learning Society [2], published in 1997 addressed the future of higher education and the need for continuous learning over the next 20 years. This report ranged from funding, whereby students would be expected to take a greater responsibility for the cost of the courses, quality assurance within Higher Education by the establishment of a new Quality Assurance Agency for granting degree-awarding powers, and to the need to establish a closer link between industry and academia and within the courses, between training and academic study.

#### **1.1 Technology**

The report supported the use of information technology both in the management of higher education establishments and as a means of course delivery. It indicated that a more flexible approach could be offered, so making available the university experience to a wider range of the population. Recommendations were included that all students by 2000/01 should have open access to network desk top computers and that by 2005/06, all students in higher education would be required to have access to their own portable computer. At Southampton Institute, we have had considerable experience in providing a multi-mode approach to courses like the British Computer Society Examination course which is offered by day-release, evening, remote learning or a combination of these. We, like most establishments of Higher Education the UK, give open access to networked desk top computers and we also offer a loan service of portable laptop computers to our students. We have been working towards increased participation by students from non-standard backgrounds, by encouraging students with GNVQ(General National Vocational Qualification for 18 year olds) qualifications and the use of APEL(Accreditation of Prior Experiential Learning) to exempt students with prior knowledge and providing a efficient entry procedure for mature students with an appropriate background.

## **1.2 Professionalism**

The report stresses the need for a professional approach to lecturing at university level and the need for staff development and the establishment of an Institution for Learning and Teaching in Higher Education. The purpose of the latter is to establish the concept of Higher Education teaching as a profession in its own right and it also would be concerned with the management of learning at this level. It would encourage the use of alternative modes of delivery, supported by appropriate research. Southampton Institute has a strong commitment, like many other academic establishments, to encouraging the professional approach of its lecturers. It has, for many years, used an appraisal scheme and participates in the Government backed Investors in People scheme. Academics without previous teaching experience would normally take our Post-Graduate Certificate in Teaching and Learning. To promote effective research, staff can join our MA/MSc Research course and staff are actively encouraged to participate in conferences. They are also encouraged to become members of their appropriate professional institutions and to take an active part in those institutions, as a means of maintaining an up-to-date awareness of their specialist fields and to develop links with other academic establishments and industry.

## **1.3 Research**

The report recommends that research at Centres of Excellence should be encouraged. Those academic establishments with a lower level of research should be encouraged to apply for a non-competitive research funding to underpin their degree courses rather than to enter for the competitive research exercise for potentially higher funding. It was proposed that an Industrial Partnership Development Fund would be established by the Government to attract matched funds from industry to promote research and that the Government should establish a revolving loan fund of between four and five hundred million pounds to support the infrastructure for a number of top university research departments which would be funded by public and private sponsors of their research.

## **1.4 Quality Assurance Agency**

The report recommended that a Quality Assurance Agency should specify the criteria for franchise courses from one establishment to another. It recommended that the franchise establishment should normally only have one Higher Education Partner and there should be periodic checks on the arrangement by the Quality Assurance Agency. It was proposed that no franchising should take place within or beyond the UK after 2001 unless the arrangements had been agreed by the Quality Assurance Agency. The report was concerned about the confusion between Conversion Masters courses, for those with different first degrees and those Masters programmes which continued within the same subject discipline. The report proposed the title Higher Honours for advanced undergraduate programmes such as the present MEng.

## **1.5 Credit Transfer**

The report identified the need for a consistent set of Awards across all disciplines which would be well understood within industry as well as education and would include the provision for Credit Accumulation and the transfer of credits between institutions. The proposed national framework of qualifications is welcomed by Southampton Institute particularly the importance of a diversity of routes including work-based study. Transfer of students from HND(Higher National Diploma)

courses as direct entry to the second year of a degree course is currently practised in the UK as well as by ourselves. The clarification of the HNC(Higher National Certificate) which is nominally studied via a part-time mode and HND which is usually studied full-time, is viewed as a good

proposal. At Southampton Institute we are concerned about the HNC and HND courses being encouraged to be taught at Colleges of Further Education, together with "A" levels, normally for the aged 16 to 18 year old pupils of a more academic bent, as well as the National Certificate and National Diploma usually aimed at the same age group. The report indicated a reference for increased growth in the sub-degree level of Higher and National Certificates and Diplomas but there should be no growth in degree qualifications offered by Further Education Colleges.

### **1.6 Student Contributions**

The report wished to introduce a student support system which would encourage broadly based participation although requiring a fair contribution to the cost of higher education. It supported the concept of lifelong learning and wished to reduce barriers between part-time and full-time study and for discontinued study arrangements. The report recommended that institutions should waive tuition fees from 1998/99 for part-time students who receive the Job Seekers Allowance or certain family benefits. It also recommended that the eligibility for Access Fund Payments to part-time students, from 1998/99, should be extended and additional funds should be made available for this. The report considered alternatives for graduate contributions to the cost of the Higher Education. These were an introduction of a Graduate Tax whereby graduates could be liable to pay an income tax supplement; a deferred contribution scheme which would involve students agreeing to contribute a percentage of their future income which would be limited to the cost of higher education or a stated percentage of it, which in practice was expected to be around a quarter of the true cost. The report also considered the existing Student Loan Scheme could be extended. The report recommended that the student's contribution should be a flat rate and not varied by the subject studied, although disciplines such as medicine and teacher education, with longer courses, should receive proportionately additional funding. The report suggested that a discount for up-front payment or the introduction of a modest rate of interest on loans could be introduced. The report recommended that full-time students could again receive certain Social Security Benefits, in particular, those who had temporarily withdrawn from Higher Education due to ill-health and those with dependent children. The report recommended that funding should be provided for institutions to enable them to provide learning support for students with disabilities. It also recommended that the Disabled Students Allowance should be extended so that a parental means test is not required, that it can be applied to part-time students, to post graduate students and to those students, who having become disabled, wish to obtain a second higher education qualification. At Southampton Institute this situation has been encountered several times, when students, following a severe accident or illness, undertook successfully a computing degree as a prelude to a new career direction. The report recommended, over the medium term, that a framework should be established to maintain data about lifelong learning using a unique student record number. It also recommended, over the medium term, that Careers Services should be more fully integrated with academic affairs and that the provision of careers education and guidance would be periodically reviewed by the Quality Assurance Agency. It also recommended, in the medium to long term, that careers advice for lifelong learning should be a complementary service based inside higher education establishments. The report also recommended, both to the Students' Union and the institutions, that the services offered to the students, in particular the part-time students, should be regularly reviewed.

## **2 Registration of Chartered Engineers**

During 1997 the Engineering Council in the UK, after consultation with the Professional Engineering Institutions, published the 3rd edition of SARTOR(Standards and Routes to Registration) for Chartered Engineers (CEng), Incorporated Engineers (IEng) and Engineering

Technicians (Eng Tech). The basic requirements for registration are a satisfactory educational base, initial professional development and finally a professional review. The latest edition of SARTOR became necessary because of changes to both national and international circumstances, including; the need for internationally recognised qualifications for operation in a global market; a reduction in the mathematical ability of students entering Engineering Degree courses; the development over the last ten years of a mass higher education system and consequent broadening of provision; doubt about the equivalence of output standards from different universities and the increasing use of “occupational standards” by employers.

### **2.1 Educational Base**

The main changes include; four years academic study for Chartered Engineers instead of three provided by four year accredited MEng degrees or by three year accredited BEng(Hons) degrees plus a “matching” section; three years academic study for Incorporated Engineers instead of two provided by a three year accredited BEng degree or a two year HND plus a matching section; the introduction of entry standards into the criteria for accreditation to ensure a cohort of sufficient intellectual capability for the high standards of the course content. From the 1998/99 academic year the minimum entry requirement for accredited MEng courses will be the equivalent of 24 “A” level points for 80% of the intake (typically three relevant subjects studied up to the age of 18 with an average score in each subject of over 70%). For BEng(Hons) courses the minimum entry requirement will be 18 “A” level points (an average over three relevant subjects of 60%) and for BEng courses the minimum entry requirement will be 10 “A” level points (an average over three “A” level subjects of 50%). At Southampton Institute one of the main entry routes to an accredited Engineering Degree is from a Foundation Programme designed to allow students with the wrong subjects, right subjects but wrong grades and mature students to enter the first year. Students entering the first year of an accredited Engineering course with equivalent grades lower than those described above will have the opportunity of sitting a Nationally set examination called Engineering Council Part 1 at the end of the first year. A pass in this examination will enable them to progress on the accredited route and upon successful completion of the programme be able to claim exemption from the academic requirements of the appropriate professional institution.

### **2.2 Matching Sections**

For students on the three year BEng(Hons) route, graduates must complete one further year of broadening academic study to achieve equivalence with the MEng graduates. Typically this can be a one year MSc course at postgraduate level, a one year course in a different field of study at undergraduate level or some form of approved employer led graduate learning and development programme. Students on the HNC/D route to IEng status must complete a further one or two years of study depending on the type of Higher National award obtained. Acceptable additional qualifications include the final year of a BEng course, Open University modules or other appropriate business or information technology courses.

### **2.3 Initial Professional Development**

An expansion of the initial professional development is proposed to improve the acquisition and development of the skills, specialist knowledge and competence needed to practice in a specific area of engineering and should be recorded by the trainee and certified by a supervisor or mentor to provide evidence for the Professional Review. Training is normally provided by the employer and is designed to complement and build on the educational base. A training programme will include a period of induction, introduce a broad range of techniques, skills and practices that will ensure a sound understanding of the engineering approach to the solution of problems and is

unlikely to be accomplished in less than two to three years. It is advised that such work based training schemes are accredited by the appropriate professional institution. For those graduates who are unable to access an accredited training scheme a period of self-managed learning will be assessed on an individual basis to ensure that each of the objectives of an accredited training scheme has been met. For the Chartered Engineer the training programme should extend beyond a chosen specialist area to provide a broad appreciation of the organisations business needs and encourage effective communication with associated disciplines. It must include the exercise of independent technical judgement, involve some direct responsibility for human and physical resources and take account of financial, commercial, safety, statutory and national considerations during the design, development, manufacture, operation or maintenance of products, systems or services. For Incorporated Engineers the principles of appropriate training are the same as for Chartered Engineers but with the emphasis on engineering practice to help them understand how available techniques, both practical and analytical, can best be applied in practice. Appropriate responsible experience should concentrate on the application of existing technology and management systems. For Engineering Technicians the training should be similar to the Incorporated Engineer and the responsible experience directed towards accountability for their own work with regard to safe working practices, effective communication, use of equipment and industrial relations.

#### **2.4 Professional Review**

For Chartered and Incorporated Engineers the professional review is the third and final stage towards registration where the candidate is required to demonstrate achievement of the required competence and commitment to the profession. The professional review will include a report and an interview by two suitably qualified, experienced and registered engineers. The report should give details of the candidates educational base, initial professional development and training, areas of accountability for engineering and technical judgement as applied to the analysis and solution of engineering problems as appropriate. Evidence should be provided to demonstrate understanding of the technical, financial, social and environmental implications of decisions taken. The interview, lasting about one hour, can take place anywhere in the world and may be preceded by a written examination or a practical test. For Engineering Technicians the interview is not obligatory but if required by the Nominated Body the associated paperwork should contain information to support and demonstrate that the candidate has achieved a satisfactory educational base, competence through appropriate training and commitment to professional standards.

### **3 Conclusions**

The provision for higher education over the next 20 years, proposed by the Dearing Report, has been welcomed by the Higher Education sector and Southampton Institute. The vision of the report, which proposes considerable changes in terms of the participants, the duration and modes of study, the breakdown of boundaries between vocational and academic education, the proposed funding and the recognition of the need for professionalism of staff in higher education, is felt to be beneficial and complements the direction in which Southampton Institute is already moving.

SARTOR will undoubtedly improve the standards of undergraduate engineering courses by means

of raising the entry standards, duration of courses and exit standards but will have an adverse effects on a number of Higher Education establishments. At Southampton Institute it is expected that with the combination of the Dearing Report's proposals on tuition fees coupled with SARTORS proposals on raised entry standards, the number of applications for places will diminish to such an extent that traditional engineering courses will no longer be viable even with

the provision of a Foundation Year and the Engineering Council Part 1 examinations at the end of year 1. However initiatives for the provision of wider access to higher education from the more disadvantaged social groups and the recommended broader based provision in all branches of higher education, including engineering, will undoubtedly encourage new courses such as joint honours with a variety of attendance modes. Legislation concerning higher education in a learning society is expected in January 1998 and will undoubtedly lead to a paradigm shift in the way courses are designed, delivered and assessed in the UK well into the next millennium.

#### **4 References.**

1. Higher Education in the Learning Society, Sir Ron Dearing. Ref: NCIHE/97/849, HMSO, UK.
2. Standards and Routes to Registration (SARTOR). Engineering Council, UK.

#### **Richard Penson**

Richard Penson graduated from Loughborough University in 1967, with an Honours Degree in Mechanical Engineering. He read for an M Phil at Southampton University (in Control Systems) in 1970 whilst employed by Plessey Aerospace in Hampshire UK. From 1976 he was employed in various industries concerned with aerospace controls and environmental control in both England and Scotland. In 1976 he entered education first at Napier University in Scotland and in 1984 at Southampton Institute where he has held the posts of Principal Lecturer, Deputy Head of Engineering, Assistant Director of the Technology School and Currently is Head of Manufacturing Engineering in the Systems Engineering Faculty. His research interests include control systems, signal processing and their applications to medical condition monitoring.

#### **Margaret Ross**

Margaret Ross is a Principal Lecturer in computing in the Systems Engineering Faculty at Southampton Institute UK. She is Chairperson of the Hampshire Branch of the British Computer Society which has a membership of over 1500 in Hampshire. She is also the Chairperson of the British Computer Society Software Quality Management specialist group for the Southern Region and a member of the UK National committee for the same group and other National Computing committees. Margaret's research interests are improving the quality of software, education for technologists and the application of computers to engineering problems, in particular to condition monitoring in the manufacturing industry. She has always taken a keen interest in public policy in Engineering Education and is active in promoting women into engineering by involvement in National initiatives such as YES (Year of Engineering Success).