Higher Education and 'Skills' in ICT Disciplines

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A Partial Review of the Literature

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SECTION ONE: MATERIALS

This report presents the findings of several influential documents on skills in the UK, as these are relevant to Higher Education (henceforth HE) and to the computing and ICT subject areas.

The documents discussed have all been produced during the past five years, from 1999 to 2003. Several, in particular the earlier ones, draw on sources from as far back as 1995, and these have, in a few cases, been included in this review. Where very 'early' materials are dealt with in detail, this is because they have had a particularly strong influence on the main work under discussion, which in turn has become well-known for the statements gleaned from its background.

The majority are concerned with the development of skills for business and industry at all educational and professional levels, and/or with skills in a range of different fields. Consequently the parts which are particularly relevant to computer science in universities are often brief, occupying only a single chapter or section, or consisting of passing references. An attempt has been made in each case to place the reports of such sections in the context of the wider interests, sources and recommendations of the document from which they are taken.

The works discussed in detail here are:
Skills 99
Skills for the information age (the 'Stevens Report')
University-Industry Interface
An assessment of skill needs in information and communication technology
Publications of e-skills UK

In section 3, I have examined several additional issues which emerge in a number of the reports: these are the nature of employer perceptions, the 'soft skills' issue, and the debate over the first destinations of IT graduates.

SECTION TWO: DISCUSSION

2.1 Skills 99

2.1.1 Background and authorship

Full title: *Skills 99: IT skills summary*

This report was produced by the Alliance for Information Systems Skills (AISS) in partnership with the Information Technology National Training Organisation, for the Department of Trade and Industry and the Department for Education and Employment (now the Department for Education and Skills). It was intended in particular to inform the work of the Information Technology, Communications and Electronics Skills Strategy Group, and aimed to provide an improved understanding of the labour market in IT, so that policy could be developed in response to 'serious skills shortages' in this area (*Skills 99*, p.3).

Skills 99 deals mostly with market conditions in 1998-9.

2.1.2 Sources

Skills 99 includes an appendix of 'References and abstracts', which lists fifty-eight works. The majority of these are surveys of employers, carried out by industry organisations, or by commercial researchers employed by these groups (e.g. the CBI). Nine of these reports deal specifically with skills issues, while a further thirteen deal with issues such as the impact of e-business and the internet on various sectors, technological change and workforce developments, Y2K compliance, rates of pay, regional issues, budgeting, and planning for the electronic age. Eleven 'regular' industry surveys (e.g. the reports of the Association of Graduate Recruiters) are listed, alongside reports by Government departments, the [then] ITNTO, independent research bodies (e.g. IDC), professional associations (e.g. IMIS), academic research groups (e.g. the National Institute for Economic and Social Research) and HEFCE. Four media reports and one item of informal communication were also used.

Only five of the sources listed appear, from the abstracts given in *Skills 99*, to have included substantial consultation with educational institutions. In most cases where the source document is based on primary research, the sample size for this is given. Sample sizes for reports dealing solely or largely with skills gaps or skills shortages are given in Figure 1.

2.1.3 Discussion of skills shortages

Skills 99 points to the very high levels of graduate employment in the ICT workforce. Using statistics from the 1998 Labour Force Survey, it is stated that 28% of IT practitioners have a first degree as their highest qualification, while a further 7% have a higher degree (*Skills 99*, p.35). Throughout, issues such as vacancies and salary levels are discussed in relation to the graduate members of the workforce. For example, the salary levels of new graduates in ICT were the second highest found in any sector in 1998, with a range of £16.2k to £18.5k. However, the mean level (£17.2k) is commensurate with science, engineering and technology, research and development, marketing, accounting, and personnel and management (*Skills 99*, p.27).

Skills 99 uses direct measures of skill shortage (employer surveys) and also indirect evidence, from levels of staff turnover, pay inflation, and apparent recruitment demand. The CCTA survey of public sector organisations (*Skills 99*, p.25) indicates that 12% of employers were unable to find sufficient IT Practitioner staff in Project Management, while 7% could not find enough staff in each of HTML and Visual Basic programming. 4% said that they had difficulties recruiting in each of network engineering, systems administration, systems operations, systems analysis and C++ programming.

In the 1998 CSSA Skills Survey (*Skills 99*, p.26), demand for specific software skills is indicated. Network and operating skills are required by 35% of the IT employers surveyed, with 47% of these needing Windows NT, 23% Windows 95, and 11% Unix. Desktop application skills were required by 31%, although the relatively 'low level' technical aspects of the packages mentioned may mean that this shortage has little to do with the quality of IT graduates.

Source document	**Date**	**Sample size**	**Respondents - number**	**Respondents - sector**
Get Fit for Business Survey, Apex Computer Recruitment	1998	Unknown	365	IT employers
The IT Impact Survey: Bridging the Gap, Benchmark Research/Information Builders	1998	Unknown	100	IT related staff: 49:51 split, industry/academia
IT Skills Survey, CCTA Foundation	1998	42	42	Public sector organisations
IT Skills Survey, CSSA (now Intellect)	1998	Unknown	1250	IT employers
Skill Needs in Britain, DfEE	1998	Unknown	4000	Employers, all sectors
UK Trends in ICT Employment, ITNTO	1998	Based on ONS data	-	-
National Resources Survey, LSE/*Computing*	1998	150,000 *Computing* readers	1300	Chief executives, IT directors and IT managers
Database of IT Labour Statistics, MCG Consulting Group	1997	Unknown	Unknown	IT Employers
IT Resourcing Trends in the Finance Sector, Metra/Keltec	1998	1 in 5 of finance/ banking companies from UK's top 2000 companies	1 in 5 of finance/ banking companies from UK's top 2000 companies	Recruitment managers Banking/Finance, Blue Chip
Supply of and demand for IT skills… Geoff Mason, National Institute for Economic and Social Research (unpublished)	1999	11 case studies and Labour Force Survey	11 case studies and Labour Force Survey	IT, Communications and Electronics
The Labour Market for Engineering, Science and IT Graduates, Geoff Mason, NIESR	1999	Unknown	515	Engineering, Science and IT graduates
IT Skills Survey, NOP/Microsoft/ITNTO	1998	Unknown	1250	IT – all sectors including HE
Achieving the Dream, PriceWaterhouseCoopers	1999	Unknown	351	Private companies
Salary Survey 4Q98, SkillMatcher	1998	Unknown	Unknown	Business/Industry
Membership Survey, Society for Information Management (USA)	1998	Unknown	350	USA IT leaders

Figure 1

The packages involved are Microsoft Word (lacking according to 44% of employers who need desktop application skills), Lotus Smartsuite (15%), Microsoft Office (14%) and Excel (12%). Database and programming/software development skills suffer smaller shortages, mentioned by 19% and 18% of employers respectively. Oracle and Visual Basic are in most demand here, with smaller problems relating to SQL Server, DB2, Cobol and C++. 15% of employers report a shortage in technology areas such as internet and intranet skills.

The NCC Salaries and Staff Issues survey for 1998 (*Skills 99*, p.30) reports that the highest *perceived* levels of shortage are found among network staff, technical support,

systems developers and systems analysts, all of which show levels of shortfall between 12% and 15%. In all of these areas, the level of perceived shortage has risen sharply between 1996-7 and 1998, which may indicate that these problems related to the introduction of new technology, although this is not suggested at this point in *Skills 99*.

Data from the ITNTO's *IT Sector Targets Challenge* (1997) is quoted (*Skills 99*, p.30), which uses the IT Industrial Training Organisation methodology for measuring required competencies against actual competencies of IT Practitioner staff. For the IT supply sector (ICT dedicated organisations), an overall shortfall of 34% in mandatory competencies was found, while in the IT user sector (non-ICT dedicated organisations with some IT Practitioner staff) the overall shortfall was 40%. This is based on a sample of 600 employees.

Frustratingly, this data relates exclusively to positions requiring qualifications up to and including NVQ level 3. According to current definitions, a first degree is understood to be equivalent to NVQ level 4, although the definition of NVQ level 3 provided for 1999 sounds as if it could include HE qualifications ('Competence which involves the application of knowledge in a broad range of varied work activities performed in a wide variety of contexts, most of which are complex and non-routine. There is considerable responsibility and autonomy, and control or guidance of others is often required', *Skills 99*, p.53).

Later, *Skills 99* reports an estimate that, in all organisations, only 22.5% of IT Practitioner staff actually require skills relating to NVQ levels 4 and 5 (*Skills 99*, p.31). 'Require' here is taken to mean 'need in order to do the job', rather than 'must hold a qualification at this level in order to *get* the job'. Alongside the statement that 35% of IT Practitioners are graduates (discussed above), the implication is that at least some of the positions requiring level 3 competencies are filled by graduates. The implications of this are not discussed.

The largest shortfalls in both sectors are found in Operating IT and Networking skills, which require NVQ level 2 skills. Both of these show shortfalls of over 50%. A shortfall of 31% in skills for information systems analysis requiring NVQ level 2 is found in both sectors, but systems analysis requiring NVQ level 3 shows a shortfall of only 20% (again, for both sectors). In the ICT supply sector, installation of IT products (NVQ level 2) has a 24% shortfall, and 13% shortfalls are found in IT acquisition (level 3) and operating (level 1). The ICT user sector has, as might be expected, a high shortfall (33%) in end-user support (NVQ level 2), and notes software creation (level 2) as another problem area (13%). Small shortfalls are noted among user organisations for IT design and programming (8%) and IT acquisition (8%), both NVQ level 3.

The areas with the greatest shortfalls appear to match those where skills are in greatest demand, according to the data quoted from the CEL survey of Computer Economics for 1998 (*Skills 99*, p.19). Within IT department teams, around 22,000 people work in systems and just under 20,000 in customer support; roughly the same number are employed as analysts or programmers. These three groups also account for the highest number of IT jobs advertised in the UK press in 1997-8: 27,000 job advertisements for Analysts/Programmers appeared, alongside just under 10,000 in systems and around 5,000 for technical support (*Skills 99*, 28: the data is taken from a *Computer Weekly* survey). Newspaper and magazine advertisement do not present a very reliable picture of demand in the employment market. Some notices are duplicated between different publications, and many jobs are advertised by word of mouth, direct recruitment, or Internet services; during the period surveyed, the latter method grew enormously in popularity.

2.1.4 Comments and recommendations: Higher Education

While a great deal of statistical material relating to IT-related courses in Higher Education is presented, *Skills 99* in fact contains no direct criticism of the quality of graduates or their work-readiness. It is recognised that 'While there is considerable graduate recruitment into IT work, not all of that recruitment is of graduate from courses which are fully or even partly in IT. Resources for the remarkable growth of IT work over the last twenty years could not have supplied from that source alone, even if desired' (*Skills 99*, p.35). The problems of establishing and recruiting for degrees in a young and fast-moving

sector are also acknowledged: 'The "target" at which education and training provision must "aim" has been moving much more quickly than those in other technical areas. Educational provision could not have hoped to adequately track those developments' (*Skills 99*, p.35). The growth in HE courses in IT disciplines is noted, as is the trend for students accepted onto IT degree courses to have lower A-level scores than those studying comparable subjects such as law or engineering[1].

In the final section of *Skills 99*, entitled 'The way ahead', a model is introduced which suggests that the total net inflow to the UK IT workforce, in order to supply the growth rate observed in 1999, would have to be around 100,000 people per annum. The 'highly speculative' nature of these figures is strongly flagged (*Skills 99*, p.45). However, the proportion of these numbers which would be made up of each of the four possible categories for entrants ('Higher Education IT courses, Higher Education other course, Further Education, school leavers', *Skills 99*, p.45) is not made clear. Given the changing nature of the actual work involved, it may not be possible simply to project forward the numbers requiring each NVQ from the current figures given on p.31 of *Skills 99* (discussed above).

In the proposed 'National Information Systems Skills Framework' (*Skills 99*, p.46), a range of categories and subcategories of skills are listed. All of the categories are generic rather than specific: for example, skills such as programming and database administration are not separated. The implication of this model is that a high level of skills will be required in every area. Seven levels of skill are proposed (it is not made clear whether these correspond to NVQ levels, but as there are seven rather than five this seems unlikely), and no skill is assumed to require a 'highest' level lower than five.

[1] This is an international trend. In a study of entrants to computer science courses at universities in France, Germany, Singapore, the UK and the USA, it was discovered that 'in all countries except France and Singapore, the quality of entrants to computer science courses was below the average for all HE entrants' (Bruniaux et al 2000, 527).

2.2 Skills for the Information Age ('the Stevens Report')

2.2.1 Background and authorship

Full title: *Skills for the Information Age: Final Report from the Information Technology, Communications and Electronics Skills Strategy Group*.
This group was chaired by Alan Stevens, Managing Director of Government Accounts at Electronic Data Systems Ltd, and the report was produced at the end of 1999.

The strategy group was appointed jointly by the Secretaries of State for Education and Employment and Trade and Industry in January 1999 'to advise on the development of a national strategy to meet the skill needs of the IT, communications and electronics (ITCE) occupations' (Stevens, p.4). A commitment to produce such a strategy was made in the White Paper *Our Competitive Future – Building the Knowledge Driven Economy*.

The remit of the group include requirements to advise on current and likely future skill needs, and the extent to which they are being met, or are likely to be met. They were also asked to examine the current roles taken by employers, education and training (both public and private) in delivering skills, as well as any clarification or changes to these roles which are required in order to improve that delivery.

The group had 16 members. Nine were senior managers, Chief Executives or Chairs of companies, four represented organisations with business and educational affiliations (the NTOs for IT and e-business, the BCS and AISS), and three were involved in education, at school, further and higher levels.

2.2.2 Sources

A broad definition of ITCE industries is given in Annex C (Stevens, p.42). Alongside computer services, the manufacture of computer equipment, electronic components and electronic instrumentation, telecommunications and the digitised content industries, the manufacture of broadcast and network equipment and of consumer electronics, broadcast services, the music industry, and both print and electronic publishing were considered. These classifications were not used as the basis for any primary research, but appears to have informed the choice of background materials used.

Alongside businesses whose main work is in IT, communications or electronics, organisations which need 'high level ITCE practitioners (professionals) to manage or enable their primary role, such as financial services or the public sector' (Stevens, p.5) are examined. However, basic IT literacy skills which are required by workers who are primarily IT *users* are not considered.

Only what are described as 'the principle sources' are listed (Stevens, p.37), nine documents in all. These include *Skills 99*, *Delivering Skills for All*, and the DfEE research report on skill supply and demand in ITCE by Geoff Mason, all of which are discussed elsewhere in this report. *The Labour Market Survey of the Engineering Industry* for 1998 was also used, as well as a US Department of Commerce report on the challenges of building skills at the rate of innovation in the IT industries.

Three sources are earlier reports commissioned by the ITCE Skills Strategy group, on 'Occupations in Informatics', 'Best Practice in Organisational level Training Policy and Practice in the UK ITEC Sector and Education' and 'Training Relationships between UK Academic Institutions and ITEC Companies'. The latter two were prepared by Host Consultancy (a group which specialises in training policy), and the former by Cambridge Professional Development and Q West. None of these reports is available. I have not dealt in detail with the final source, which was another report to the ITCE Skills Strategy group, this time looking at 'Women in Information Technology'.

2.2.3 Discussion of skills shortages

The report states that 'our research suggests that there are genuine skill shortages and that recruitment and retention problems have become increasingly acute over the past 2 years' (Stevens, p.10). Various forecasts of future skills needs are reported, and despite repeated cautions as to their speculative nature, a substantial rise in demand for technical specialists is predicted. For example, IBM Global Services suggested that the employment of technical specialists could rise by over 40% (to a total of 348,000) between 1998 and 2000 (Stevens, p.10), while a similar figure Cambridge Econometrics suggest that employment in computing services could rise to 421,000 by 2010 (Stevens, p.11). Research by the Institute of Employment Research at Warwick University suggests that even more people will be needed to fill senior management and administrative roles as well as technical professional ones.

In 1998, across all sectors of industry, 'Nearly 1 million people are employed in skilled ITCE occupations' (Stevens, p.9). At the same date, the Labour Force Survey estimated that the UK workforce included just over 100,000 single-subject graduates in computer science, 160,000 with combined degrees, and around 83,000 electronic engineering graduates (Stevens, p.11). It is argued that publicly funded education will not be able to meet the current demand, and its likely increase, for technical skills in ICTE 'unless more able young people – and particularly young women – can be encouraged to take up ITCE courses' (Stevens, p. 15). Later, work-based training is advanced as an important way of providing both new workers, and skills updates for those already in post (Stevens, p. 15-17).

2.2.4 Comments and recommendations: HE

Language

While the Stevens Report does contain direct criticism of Higher Education (and also Further Education), in both its comments on educational provision and its discussion of skills shortage, the language used to discuss universities and, to some extent, FE institutions is frequently negative in tone even where no particular deficiency or recommendation is being stated. This tendency, extended throughout a report of some 36 pages, is bound to influence interpretation of the document, and thus the impression gained of the committee's findings.

One example is the following criticism of FE, taken from the opening paragraph of the section entitled 'Where does the industry get skilled people from?'. The reader is told that 'Although there is a wide range of provision offered in FE, insufficient numbers of students with the skills and knowledge required to work in the ITCE industries are emerging' (p.11). From the wording of this sentence, the reader cannot tell whether the range of provision is good but that the *numbers* of people who use it to acquire appropriate 'skills and knowledge' are unsatisfactory, or whether the provision is poor [in places], so that the cohorts of students who emerge are of a reasonable size, but that the numbers with adequate 'skills and knowledge' are insufficient, or whether provision is adequate but take-up is poor.

This analysis may seem pedantic, but the issue is a genuine – and important – one. It is not resolved in the remainder of the report, and so the only effect of this comment is to colour the reader's view of what the committee found after a long, hard look at the educational system.

Elsewhere, the priority given to graduates at recruitment is reported to occur because 'Businesses value the analytical and conceptual abilities which attainment of a degree is *taken to certify*' (Stevens, p. 12: my italics). The implication is that this is *not*, in fact, a 'given'. Yet the assessment by the same businesses that *some* technical graduates lack 'generic' skills is reported without qualification. Employers interviewed in other studies confirm that graduates do, in fact, bring a number of advantages as recruits[2].

[2] For example: '"The advantages to me of a graduate would be that he or she would probably have a broader range of thinking, rather than someone who has not been a graduate. He or she ought to be able to assimilate things quicker and, in many cases, that is the case… Wider and more strategically

The HE/FE relationship

In a strand of argumentation strongly influenced by Mason's work, the relationship between FE and HE is examined at some length, with the recurring theme that high HE participation is reducing the number of students entering FE ('the rise in HE participation has contributed to a decline in the target population for higher intermediate skills training', (Stevens, p. 13)).

FE colleges are said to 'have a substantial role in the application of [intermediate] skills through courses in business computing, graphic design etc.' (Stevens, p. 13), although all of these, of course, are also taught at university level. Low participation in HND and HNC courses is noted, along with the fact that 'at intermediate level, there do not appear to be large numbers of students who could be regarded as well advanced towards the level of skills and knowledge sought by ITCE businesses seeking to fill specialist positions' (Stevens, p. 13). The issue of 'upskilling', i.e. recruitment of graduates to previously non-graduate jobs, is not addressed here.

Later, the 'modest' participation rates for modern apprenticeships in IT are also attributed partly to HE: 'the relatively low numbers involved appear to reflect a combination of employer preference for graduates and the high participation rates in higher education by the most academically able young people' (Stevens, p. 14)[3]. The poor completion rate on modern apprenticeships (56% of students leave MAs in IT, as opposed to 45% across all programmes) is also mentioned, although it is noted that 'little is known about the next destinations of those leaving MA programmes in the IT field or their reasons for departing' (Stevens, p. 14)[4].

Work experience, placements and training

Stevens, like most writers, finds that 'IT companies prefer to recruit people who already have the specific job skills required by the business' (Stevens, p. 14). This is echoed throughout the studies discussed here: the *University-Industry Interface* study discovered that 'significant numbers of employers (some 350 out of the over 580 approached…) do not recruit graduates straight from university for IT Practitioner positions (preferring to seek

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thinking from time-to-time as well. And I'm not sure there are any down sides" (area manager, large financial institution)' (Harvey et al, 1997). Later on in the same document, it is stated that: 'Non-graduates were seen as having an advantage in a limited number of areas. For example, a few managers suggested that as they recruited non-graduates from other organisations, they tended to have more experience… A couple of managers thought that non-graduates are less likely to get bored, have lower expectations and [be] prepared to do mundane tasks… Only one respondent considered that non-graduates had an advantage over graduates because they were cheaper'. The only consistent criticism of graduates came from managers or employees who were themselves non-graduates; however, even among this group there was a general sense that taking a degree conferred an advantage in terms of one's quality as an employee. Overall, the finding was that 'Strategic and line managers overwhelmingly considered graduate as having advantages over non-graduates'. Mason (2002, 434-5) found similar opinions of graduate quality in the IT workforce, as discussed in 3.1.

[3] Given difficulties with recruitment to the modern apprenticeship programme, it seems rather unlikely that there will be a great deal of overlap between the potential cohorts for entry into this programme rather than HE. In 2002, employers attempting to recruit to modern apprenticeships found shortfalls in the levels of skill necessary for undertaking the programmes. Insufficient levels of literacy were found for 14% of foundation modern apprenticeships (henceforth FMAs), insufficient levels of numeracy for 13% of FMAs, insufficient levels of communication skills for 11% of FMAs, and insufficient levels of IT skill for 23% of FMAs (Anderson and Metcalf, 2003: p.32). Overall, only 70% of FMAs were able to fill all of the available places in 2002, although advanced modern apprenticeships did considerably better, filling 92% of available places.

[4] It is unclear whether Stevens is referring here to students who leave the job to which their MA is attached, or who stay in employment but fail to complete the qualification. Anderson and Metcalf (2003: p.72) state that employers in IT tend to attach less importance to formal completion of the qualification than those in other sectors, so the picture may not be as bleak as these figures initially suggest.

people with experience)' (AISS/ITNTO, 1999: p.2). The logic of requiring new graduates to have work experience will be discussed later on.

Recommendations for HE

This section is based on eight recommendations, three of which have serious implications for HEIs[5]. These recommendations are:

- Recommendation 8: There should be national co-ordination between employers of ITCE practitioners and HE and FE institutions. This should include promotion of work experience placements for ITCE students, a forum for industry input to discussion about the curriculum at national level and stronger involvement of ITCE employers in the Graduate Apprenticeship scheme.
- Recommendation 9: Graduate Apprenticeship frameworks should be developed across the ITCE industries
- Recommendation 10: HE institutions should consider how the use of proprietary software for illustrative and other learning purposes can be aligned with and support businesses' short-term needs without compromising course objectives. The more widespread use of collaborative ventures between HE and IT suppliers might also be explored to assure access to current equipment and practices.

Recommendation 8 is also endorsed by the *University-Industry Interface* report. Several examples of 'best practice' are quoted, but it is stated that neither HE nor business currently takes collaboration sufficiently seriously, and that national co-ordination would both encourage and facilitate activities in this area. No qualitative or quantitative data on actual attitudes or rates of collaboration are presented, but the tone of the section implies that businesses will in general be willing to expand their links with HE, and it appears to be written from a business perspective. For example, it is opened with the statement that 'Collaboration with the education sector is not seen by enough businesses as a key part of their skills strategy…' (Stevens, p. 26), and that 'Businesses acknowledge that there is a cost in setting up and supporting these initiatives, but that the outcome… does repay the investment' (Stevens, p. 26).

By contrast, the willingness of HEIs to become involved is not stressed, aside from a handful of excellent local examples. The business perspective on HE enthusiasm is reported as follows: 'Some businesses pointed out that the willingness of education institutions to work with them varied enormously. It was reported that the newer universities and colleges were likely to be more receptive'.

The implication that HE is unreceptive to links with industry contrasts findings of the most comprehensive survey available at the time when the Stevens report was written, the HEFCE overview report for Computer Science (based on the Quality Assessment exercise carried out in 1994). In this document it was stated that: 'Most former PCFC institutions have established good local links with employers which have led to successful student placements, industry-based group projects and industrial case studies…' (HEFCE 1995, p.9). Even in 'old' universities, this document found placement schemes or other collaborations with industry in about half of the institutions assessed. The extent of collaboration revealed in the HEFCE work could well be used as an argument for the national co-ordination (and increased funding) which is proposed by the Stevens report, but it hardly indicates an unwillingness on the part of anything like the majority of universities to get involved with business.

The Roberts Review (Roberts 2002, p.97) estimates that over 40% of undergraduate students on Computer Science courses undertook a 'sandwich' placement year[6]. In fact, a

[5] The other five relate to the way in which FE modules are accredited for use in work-based training, the establishment of centres of excellence at FE colleges, Career Development and Small Firms Training Loans, the QCA position on non-degree qualifications, and bursaries for electronic engineering students.

slight decline in the numbers who do so was observed, from around 47% in 1994-5 to around 42% in 1999-2000, the latest year for which figures are available. Roberts is cautious about the reasons for this trend, which 'may be due to businesses and HEIs not collaborating effectively' (Roberts 2002, p.96), but alternatively may reflect students' unwillingness to add an extra year to their course or to pay tuition fees while on placement.

In general, while arguing for a very similar position on university/industry collaboration, the Roberts report uses rather more balanced language than the Stevens Report. While noting the failure to implement the links between business and HE which were recommended in the Dearing Report of 1997, there is no implication that one side is *more* to blame than the other: '… there is little evidence of the outcome of [the Dearing] recommendations and/or (where they have been applied) their usefulness. Much work remains to be done to improve communication of skills needs and provision between both higher education institutions and companies of all sizes' (Roberts, p.97).

By contrast, in the Stevens report, all of the 'proposals' are for action on the part of the universities: 'HE institutions should be encouraged to include appropriate work experience as an integral part of their courses' (Stevens, p. 26), 'Universities should consider how the fund might be used to create or improve their capacity to offer meaningful experience to students of ITCE disciplines' (Stevens, p. 26). Businesses are not presented as *unwilling* to become involved in QAA activities or discussions over course content: rather, responsibility is placed with the universities who should be *getting* them to take part: 'We understand that it can be difficult to get businesses to take part in these panels' (Stevens, p. 27). The contribution of universities to the placement experience is downplayed: 'Many businesses contribute to the "work-readiness" of students, and at the same time offer an insight into what industry has to offer, by providing work placements for FE and HE students' (Stevens, p. 26). In practice, of course, universities have considerable input to the organisation, supervision and allocation of placements – but this is not mentioned.

Practical mechanisms for 'national co-ordination' are not explored in this section.

Course Content

Details of the actual input which employers might have to the curriculum are not explored in this report. One suggestion is that industrial involvement might encourage universities to provide more IT conversion courses at MSc level, which are described as enjoying 'considerable success in terms of student employment prospects' (Stevens, p. 13). Surprisingly, no recommendations relating to these courses are included in the 'Action Plan' at the end of the report (Stevens, p. 40)[7], although it is suggested that academic staff shortages or the inclination of some university departments on research could constrain their development. Background to these warnings is not provided.

Presumably Recommendation 10 is one of the areas in which business input would be especially important. The issue of using proprietary software addressing 'businesses' short-term needs without compromising course objectives' (Stevens, p. 27) is a complex one. In particular, the pace of technological change and changes in employer demand for competence in *specific* software packages may be at odds with legal and institutional requirements for the accreditation and advertisement of university courses. In 2002, Philip Virgo estimated that 'the increasing rate of change is such that the "half life" of IT skills is down to little more than two years… But the time taken to approve new technical degree

[6] Roberts' figures relate only to students who undertake a sandwich placement *year*, and do not take into account those who go on placement during vacations or take part in collaborative projects with industry during their taught course.

[7] I am not sure when the decision to withdraw EPSRC funding from students taking these courses was made: however, it would appear that this has acted as a substantial deterrent to the uptake of places by home or EU students (e-skills UK 2003a: 'The loss of EPSRC grants for students in 2000 had a major impact on all the higher education institutions visited in England… The loss of EPSRC funding had at best caused the number of UK applicants for MSc IT Conversion Courses to plateau; any growth appeared to be due to an increasing proportion of places taken by overseas students', pp. 41-2).

courses or qualifications in most parts of Europe is at least three years' (Virgo 2002, p.4). He suggests that employers may in fact benefit from a greater degree of fundamental training which will facilitate a quick grasp of specific tools: 'Short order retraining commonly requires that trainees already have learning skills from their previous education. It may also require a grounding in relevant vocational/professional disciplines. Thus IT professionals can be rapidly "cross-trained" to use C++ or JAVA, but only if they already have experience of similarly structured languages and methodologies. It is learning and practicing the *structured approach* which takes the time. Similar analogies can be found in most technology-related professional and vocational areas' (Virgo 2002, p.4).

A similar position is taken in the *University-Industry Interface* Report, which included a survey of employers. Here, it is noted that 'developments in *proprietary software* are a reality that all IT departments have been aware of – and have had to take a view on – over recent years' (AISS/ITNTO 1999, p. 23). However, primary research indicated that 'employers' needs appear to be – on balance – considerably more for the broader "strategic thinking" type competencies than fluency with the latest version of particular software tools' (AISS/ITNTO 1999, p. 23).

This theme returns throughout discussions of graduate skills and abilities: the *ability to learn*, and to learn quickly, is enormously valuable in a workforce which needs to adapt and reskill again and again in order to match the pace of technological change. The Labour Market Intelligence project, which examined the experience of employers across a range of industries including ICT, found that '… the positive and lasting impact of graduates' participation in Higher Education is that they are plugged into a lifelong learning culture. Graduates were adapting to a changing labour market where career progression is not linear by continually reflecting on their skill development and engaging in formal and informal training and development activities to maintain their competitive edge' (Young and Morris 2000, p.14). This will be increasingly important if the trend continues towards 'individual responsibility for career development' (Virgo 1999, p.8).

Graduate Apprenticeships

This section is extremely brief, and contains little more than an endorsement of the GA programme as it is envisaged by the skills councils.

2.3 UNIVERSITY – INDUSTRY INTERFACE

2.3.1 Background and authorship

Full title: University – Industry Interface. Final Report on Project. DTI ref. YAE/08/05/1205

This is the report of a large-scale project. The focus is on the work carried out between September and November 1999, but earlier work is also reported in an annexe. The project was carried out under the auspices of the Alliance for Information Systems Skills, under the guidance of a steering group comprising representatives from the CPHC and UKAIS (representing academia), the BCS and IMIS (representing professional associations), and the CSSA and the FEI (representing trade associations). This 'task force' was chaired by the Chairman of AISS.

Two key themes were identified. The first was a 'review of the classification of IT related courses' (AISS/ITNTO 1999, p.4), which was subcontracted to Professor Gordon Bull, a former Chairman of the BCS Academic Accreditation and Exemptions Committee and Dean of Computing at Brighton University. The second was 'a review of the recruitment and "initial professional development of IT practitioners' (AISS/ITNTO 1999, p. 4). This was subcontracted to IFF research, specialists in employment and training policy, with a Project Manager recruited from the ITNTO (Dr Matthew Dixon) and the secretary of AISS (John O'Sullivan) as director. In this phase, a survey of employers was carried out to investigate their recruitment, training and development practices. In addition, graduate training/development schemes, and IT conversion courses were reviewed.

2.3.2 Sources

The importance of clear and accurate labour market data is identified as a priority at the beginning of this report (AISS/ITNTO 1999, p. 7). The statistical materials used in the preparation of *Skills 99* are also employed here, along with HESA figures on graduate first destinations for 1997-8, which were not yet available when *Skills 99* was published.

In the review of course classification, written materials from universities was examined in a process of 'desk research'. On the basis of this, liaison with external bodies such as UCAS, HESA and the QAA was followed by the design of a proposed framework which was piloted in a small number of HEI departments, in consultation with the academic bodies represented on the project task force[8]. Recommendations were based on the outcomes of this process.

For the second phase, a questionnaire of 44 items was devised. This is a relatively long document, but the large number of questions invites a rich outcome in terms of the information gleaned. This was administered by telephone to 138 employers (out of a total of 580) approached by IFF. In addition, paper copies were distributed to a number of companies which fell within the 'constituencies' of the AISS partner organisations represented on the Task Force. This resulted in an additional 65 responses (out of about 420) from employers associated with the CSSA, the BCS ELITE group, the PDS scheme administered by the BCS, CERTUS, the CPHC and the IT directors forum of Cranfield University (the latter was not represented on the Task Force). Questionnaires were completed in October and November 1999. It is estimated that around 1000 employers, in both the IT supply and user sectors were approached. Just over 200 responded. Because this group included some very large employers, it is estimated that the questionnaire respondents employed, between them, a total of some 95,000 IT practitioners. This represents 'probably significantly more' (AISS/ITNTO 1999, p. 17) than 10% of the total IT practitioner workforce in the UK during 1999. A significant number of employers (350 of those approached for the telephone survey) seek only experienced graduates and do not recruit 'fresh' graduates.

[8] Details taken from minutes of the Task Force meeting, Monday 25th October 1999.

2.3.3 Comments and recommendations

These employers were generally satisfied with the technical abilities of their intake. 55% rated 'General IT competence/knowledge' as the main strength shown by the IT graduates whom they recruited. Perhaps surprisingly, despite the fact that their responses relate only to 'fresh' graduates, the greatest strength of non-IT specialists was judged to be 'Business knowledge/awareness' by 20% of employers (AISS/ITNTO 1999, p. 17). Among IT graduates, 75% felt that IT graduates' knowledge of current industry-standard hardware was 'better than *generally poor*', and 80% felt that IT graduates knowledge of industry standard software was 'better than *generally poor*'(AISS/ITNTO 1999, p.18). Given the situation with respect to technology change discussed in 2.2.4 above, this is a reasonable rate of satisfaction, given that these graduates can be presumed to enter employment with the more general theoretical knowledge which can be used as the basis for specific training.

Almost 90% of these employers provide some 'technical training and development' to non-IT graduates, while there are formal programmes for IT graduates, lasting just over a month on average, in 53% of organisations. This is more common in 'large and very large' organisations, with an average budget for each graduate of £4,500, with a significantly greater investment by 'large and very large' companies than by small or medium ones (AISS/ITNTO 1999, p. 18).

Alongside a general satisfaction with technical skills, and acceptance of the need to provide training in specific packages, these employers identified a number of strengths brought to their companies by recruitment from HE. For both technical and non-technical graduates, 37% of employers felt that 'enthusiasm' was a major strength, 33% appreciated their input of 'fresh blood and new ideas', and 23% their 'technical knowledge' (AISS/ITNTO 1999, p. 19). The relatively low number (still almost one quarter) who value the technical abilities of graduates above their other attributes may reflect the fact that the survey requested information about both IT and non-IT graduates. It may also be that 'enthusiasm' encompasses the willingness and ability of IT graduates, who have a good 'fundamental' knowledge of computing, to embrace the specific training offered once they are in employment.

Interestingly, only 11% cite 'lack of IT skills' as a problem with their graduate recruits (again, this may reflect the problems of filling IT roles with non-IT graduates). The need for greater business awareness (identified by 47% of employers) is in keeping with the observations discussed in 3.3 below. More worrying, perhaps, is the identification of a need to improve the 'Key Skills' of graduate recruits. This was stated by 46% of employers in the survey (AISS/ITNTO 1999, p. 19).

2.4 An Assessment of Skill Needs in Information and Communication Technology

2.4.1 Background and authorship

Full title – *An Assessment of Skill Needs in Information and Communication Technology*. Skills Dialogues: Listening to Employers, No.5

The Skills Dialogues were a series of consultations with business and industry in order to assess the skills needs of the major sectors. The project was developed on the basis of recommendations in *Delivering Skills for All*, and were intended to inform both sector employers and the relevant NTOs.

An Assessment of Skill Needs in Information and Communication Technology (henceforth *An Assessment...*) was produced as part of the ICT Skills Dialogue, in which three organisations representing the broad Information and Communication Technology sector took part (the e-skills NTO, Skillset and EMTA). The report itself was prepared by the Institute for Employment Studies, an independent policy research unit.

2.4.2 Sources

The bibliography of *An Assessment.…* contains 113 items. These include the majority of policy documents and government reports on relevant issues, surveys by the various NTOs, documents on skills supply and skills shortage within the ICT industry and in the workforce as a whole, research from academic institutions and commercial bodies, reports and surveys by professional organisations and commercial groupings, and some scholarly and press articles. The range is wide, from regional skills surveys to international comparisons.

A survey of employers, *IT and Communications Professionals in the UK*, was commissioned by the e-skills NTO with support from the DfES and the DTI. This was used as the basis for much of the identification of skills needs in *An Assessment.…*. Both ICT-dedicated and non-ICT-dedicated companies employing some ICT practitioners were surveyed.

2.4.3 Skills shortages

An Assessment... does not include in its remit 'ICT user skills', or 'first level technical support'. In addition, technical ('hard') skills are separated from generic ('soft') skills (*An Assessment...*, p.28). In the discussion which follows, the skills issues relate to the whole IT practitioner workforce rather than to graduates in particular, although of course, a large number of ICT practitioners will be graduates.

In the first category, four main areas of skill demand are identified: product development, external IT/Telecoms customer services, sales and marketing and internal IT/Telecoms operations. Across all of these areas, there is a high demand for skills in the Windows/NT field, with Microsoft applications featuring highly in the majority (*An Assessment...*, p.31). MS Access is cited frequently, as are MS Office and MS Publisher. The Unix operating system is also important to various different roles, as are C and C++ (*An Assessment...*, p.29). In addition, interviews with employers revealed growing demand for skills in Java, Perl, XML and Lynx, which are particularly important in some areas such as financial services.

A mismatch emerged between publicised demand and actual feedback from employers: 'While internet related skills (eg HTML and Javascript) are given a lot of publicity, it appears, from our interviews, that the highest demand is at the design end rather than the user/technical (ie web maintenance) and also in developing e-business strategy, and systems integration. Security specialists at various levels were also identified… an area of skill need [for] the vast majority of public sector organisations surveyed' (*An Assessment...*, p.29). This is in agreement with the findings of Virgo 2001 (pp.6-7), itself one of the sources of *An Assessment...*

As far as generic skills are concerned, the most important were problem solving (both in customer or service roles and in adapting to the rapidly changing technical environment),

oral communication, general IT user skills (in particular for administrators, support workers and helpdesk operators), team working skills and general numeracy. Management skills were also in high demand. A survey on the skill implications of e-commerce discovered that two additional skill-sets were required for this field. The first is the much-discussed 'general business awareness' (see also below), while the second is the less tangible (and probably less teachable) 'entrepreneurship'. This is described as: '… "thinking outside the box", and… the ability to develop creative yet practical solutions to problems, coupled with positive "can do" attitudes and a high level of personal commitment' (*An Assessment...*, p.33).

Alongside these areas of demand, *An Assessment...* notes that overall, skills problems appear to have eased at the time of writing, although there continue to be 'hot spots' (*An Assessment...*, p.52). In agreement with the *University-Industry Interface* report, it was found that 'the vast majority of ICT professionals are thought to be fully proficient at their job' (*An Assessment...*, p.52). *An Assessment...* is inclined to play down the idea of a 'crisis' in skills, noting that 'many of the surveys that tend to hit the headlines are often based on partial information, e.g. a survey of recruitment advertising or a small, unrepresentative sample' (*An Assessment...*, p.52), and that the distinction between skills 'gaps' and problems with recruitment is often blurred.

In *IT and Communications Professionals in the UK*, 11% of UK companies which employ ICT professionals had unfilled vacancies for these workers in early 2001. The majority of vacancies were in ICT-dedicated firms, 25% of which were seeking new staff at the time of interview, and just under half of these were experiencing difficulties in finding suitable new employees.

The technical skills related to 'hard to fill vacancies' are similar to those which are generally in high demand, e.g. Windows/NT operating systems and C/C++ programming languages. Internet-related technical skills and Microsoft applications (among sales professionals, account managers and help-desk operators) were also needed. Network and channel integration skills, as well as other e-business skills are in demand, and there are also problems in filling some vacancies in software and web development, technician and engineering work and helpdesk support. The highest number of hard-to-fill vacancies is found among software development, technician, engineer and operations manager roles, but the vacancies which take longest to fill are among ICT sales and account managers (*An Assessment...*, p.54).

The causes of these difficulties are stated to be a low number of applications, especially from applicants with the right skills, and the fact that applicants displayed insufficient interest in the job. Although some concerns were expressed about the lack of people with specific technical skills in new technological areas, a more important theme was the lack of 'knowledge of the fundamentals of computing and technology', and 'an inability to apply technical skills in the modern business environment through a lack of generic skills' (*An Assessment...*, p.55). The relation of the first of these issues to recruitment of non-IT graduates to roles in which they receive a brief period of intensive training before working as IT practitioners is not made clear, if indeed it exists. The second, however, relates to the much wider issue of generic skills.

Another important issue raised here is the requirement by employers that recruits must have a high level of work experience. Where specific technical skills were sought, 'employers in the survey were mainly looking for a minimum of two years or more experience, an obvious problem in some of the newer (eg internet related) areas' (*An Assessment...*, p.53)[9]. This also contributes to the perception of 'hard to fill vacancies', which often arise because 'applicants [lack] the required level of work experience. There is some qualitative evidence… that the nature of the experience employers are looking for is not purely technical but relates more to the application of technical skills in a business environment' (*An Assessment...*, p.55).

Skills gaps, which are defined here as 'deficiencies within the existing workforce' (*An Assessment...*, p.56), appear to be a much smaller problem. *IT and Communications*

[9] See discussion of this issue in section 3.1

Professionals in the UK indicated that the vast majority of the workforce are judged to be fully proficient, a finding which is said to be in line with other surveys of the ICT workforce and across other sectors.

Where technical skills are lacking, these relate, once again, to Windows/NT, Microsoft applications, and networking, and arise because employees find it difficult to keep up with technological change. In some cases, *IT and Communications Professionals in the UK* found that this resulted from a failure by employers to train and develop their staff.

Perhaps more surprisingly, there are generic skills gaps among those already in work (although these were identified by fewer than 15% of employers). Again, the list is similar to that noted for new recruits: communication skills, written and oral, problem-solving, and general awareness of developments in ICT (*An Assessment...*, p.57), which may relate to the lack of training or personal professional development which leads to technical skills gaps. In addition, project management, and the *combination* of a high level of technical ability with advanced management and communication skills.

2.4.4 Comments and recommendations for HE

It is noted that 'Employers have expressed considerable concern about the quality of output from higher education, which is not restricted to criticisms of IT courses and their graduates' (*An Assessment...*, p.43). The Stevens report, the *University-Industry Interface* report, and the silicon.com (see 3.1) surveys are all quoted, as well as Mason's work (see 3.1, 3.2) and the conclusion drawn here is that non-technical skills and 'personal qualities' are the greatest area of concern. The 'personal qualities' issue is perhaps more relevant to recruitment *into* HE than its output: it is related here, for example, to Stevens' quotation of the lower entry qualifications accepted across ICT courses in universities, and to the small proportion of women within the ICT workforce.

The position over graduates' knowledge of particular software and hardware systems is reported as being 'mixed' at worst, and while the initiatives proposed in the Stephens report and the e-skills NTO *Strategic Plan* are reported, no additional, or more specific, initiatives are advanced here. The Gemini Project, which was designed to attract graduate from a wide range of disciplines into IT practitioner work, is mentioned as a possible solution to the shortfalls in generic skills and 'personal qualities' (*An Assessment...*, p.43).

Widening of the 'recruitment pool' is a major concern of *An Assessment...* in its recommendations for action. Using careers education and changes in working practice to make the ICT field a more attractive place to work in general, and for women in particular, is a priority (*An Assessment...*, p.83). The need for an increase in ICT qualifications at intermediate levels is also stressed, as is the importance of easily-accessed and appropriate training for those already in the workforce.

A general recommendation that the links between business and education/training should be 'improved' is made (*An Assessment...*, p.84), but apart from endorsement of the Skills Framework for the Information Ages as a helpful 'common language' (*An Assessment...*, p.83), specific mechanisms are not proposed. The use of local Learning and Skills Councils, Regional Development Agencies, NTOs and Local Authority facilities are all recommended, as are secondments from employer to education and vice versa.

The end result of all this is to be a situation in which '… providers are kept continually up to date and… developments in curriculum design, qualifications, frameworks, etc. are relevant to business needs, at all levels, both in initial education and lifelong learning, throughout people's careers' (*An Assessment...*, p.84). Work experience within education in general and HE in particular is endorsed, and ways of ensuring that HE stays up to date with new technology are proposed: 'exchanges of staff, shared use of equipment, joint project development etc' (*An Assessment...*, p.85).

The development of workplace training is given equal weight, and in general the tone is neutral towards education and industry. It is noted that employers are often unwilling to use 'publicly funded educational establishments' for this, unless the training is associated with gaining a vocational qualification. *An Assessment...* is careful to clarify that this unwillingness may itself be the result of prejudice towards educational institutions: '… this

may be because of perceptions among employers that they are less up-to-date technologically (because of resource constraints) and less 'hands on' and that they give an over-emphasis to theory ('which gets out of date quickly) … however this is an area where research evidence is weak' (*An Assessment...*, p.49). In general the tone of *An Assessment...* is neutral in its discussion of education and commerce.

2.4.5 Recent developments

e-skills UK, formerly the e-skills NTO, has since produced a number of documents which develop the proposals set out in *An Assessment...*, and which preserve its even-handed approach to higher education and industry. In the document *IT Professionals … Workforce Development Plan*, the need for a pro-active and realistic approach on the part of business is a clear theme throughout. The need for partnership is restated, as is the necessity for clear articulation of employer needs discussed in 3.1 below: '… employers need to specify their requirements at an industry-wide level, and work in partnership with both education and training organisations.' (e-skills UK 2003b, p.18). Employers are advised to '… engage with educators to refresh curricula in preparation for IT related careers, including increasingly sophisticated business and personal skills development alongside relevant technical foundations.' (e-skills UK 2003b, p.26).

There is also a realistic acknowledgement of the difficulties of recruitment within universities, as well as the problems posed for universities by the nature of IT employment: '… training institutions and educational establishments … face common issues. It is a challenge to establish and maintain links with a highly diverse and rapidly changing sector, and there are significant difficulties in attracting the necessary quantity of suitably qualified lecturers … [particularly] given the disparities between typical salaries in education and training, and those available in industry for IT-skilled people.' (e-skills UK 2003, p.21)

The drive towards precise clarification of needs and standards is also an important element of the e-skills UK *Primary Projects Backgrounder*. This states that one of the central aims of the newly-created Employers' Curriculum Forum should be to clarify 'the requirements for graduates entering the workforce and works with educators to develop curricula and qualifications that will address technical, interpersonal and business skills in equal measure' (e-skills UK 2003c). Both in tone and in content, these statements represent a significant attempt to avoid some of the 'popular' images of university-industry relations.

SECTION THREE: GENERAL ISSUES

3.1 Employer perceptions of skills shortages and gaps

The 'headline' statements about skills shortages invariably focus on the views of *employers* about the extent to which they experience skills gaps among their current workforce, are unable to recruit candidates of a sufficient quality to posts in their organisations, or perceive that their new recruits are lacking in essential abilities to do the jobs required of them. Most surveys of skills issues involve the administration of questionnaires or interviews to employers.

Simply *asking* the employers, recruiters and colleagues of new graduates entering the IT workforce about the abilities and qualities of the new employees makes perfect sense. However, the results of these investigations, and the methodology employed, should not be treated uncritically. As in most areas where 'common sense' answers seem to provide an easy source of information, it is in fact the case that 'everybody has his [sic.] own ideas about what is sensible'[10]. The value and implications of a survey's outcome depend, among other things, on the size of the survey, the way in which respondents were selected (or self-selected), the nature of the questions asked, and the particular group of employers surveyed.

For example, in *An Assessment...* the Silicon.com European Survey for 1999 is quoted as reporting that '70% of employers *"claimed computer science degrees do not provide the skills needed to succeed in the workplace"*' (*An Assessment...*, p.43)[11], although it is noted that 'the size and nature of this survey sample are unknown'. Silicon.com surveys are administered via the silicon.com website. Respondents are not, in fact, limited to IT employers (see footnote 11), but include IT professionals of all grades. In the 2003 survey 20% were IT managers and almost 14% were Board or IT directors, but 17.3% were IT consultants, and 30.5% gave their job title as 'other'[12].

The majority of questions are multiple-choice questions, including a list of statements to which respondents assign a numeral from 1 ('strongly agree') to 5 ('strongly disagree'), with 3 representing neutrality. The statement 'computer science course turn out high-quality IT Graduates' in the 2003 survey received some degree of agreement form 21.8% of respondents and neutrality from almost 50%. Only 8.2% disagreed strongly. In response to the statement 'Organisations need to devote more time to in-house IT training', 77.3% registered some degree of agreement (Hallett, 2003).

There are two major problems with this data. The first is enormous range of possible respondents, many of whom may not be employers at all. Are unemployed consultants in their mid-forties bemoaning the quality of skills displayed by 'kids these days' (and answering '5'), or wishing that they had access to innovative teaching and sandwich placement years (and answering '1')? If managers are answering this question, are they recruiting to blue chip firms with thousands of employees, or local ones with fewer than 25?

The other difficulty lies in the definition of a 'high quality' IT Graduate. Does this mean someone with an excellent knowledge of the basics of IT who will adapt quickly to new technologies, or someone with sound knowledge of a few specific software packages, or someone who has excellent interpersonal and business skills as well as strong technical abilities, or someone who is able to slot straight into a job with little or no additional training? If 'all of them' is the answer, this needs to be considered alongside the realities of a higher education system in which students attend university for a total of perhaps one hundred and

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[10] From an interview with the linguist Larry Trask, *The Guardian*, Thursday 26th June 2003.

[11] In fact, this reporting of the silicon.com survey may be inaccurate. The survey can be completed by *any* reader of silicon.com, and in fact the two respondents quoted in the article about this report (at http://www.silicon.com/news/500020/1/1008265.html?et=search) are university lecturers. In the yearly silicon.com Skills Survey, respondents range from CIOs and Board Directors to independent contractors and unemployed IT workers. The number of respondents to the silicon.com Skills Survey is rising sharply, from 1000 in 2000 to nearly 4000 in 2003.

[12] This category includes education professionals.

eight weeks (and may be working in a completely unrelated job for around twelve hours in each of those weeks).

The use of very 'open-ended' questions of this sort, followed by an implication that universities are evidently failing employers and should therefore listen meekly and follow the leads dictated by business, is challenged by a number of works. The report *Enhancing employability, recognising diversity* (Harvey and Morey, 2002) contains recommendations for both HEIs and employers, as well as the careers service and government funding bodies. In a speech introducing this report, Professor Roderick Floud argued that 'Universities aren't dragging their feet; it isn't their sole responsibility… both the responsibilities and the solutions are shared… in accepting a shared responsibility, we also have to ask employers to bear their share of the responsibility too' (Floud, 2002).

Employer dissatisfaction is still found: the Universities UK report is reacting against a real trend. The *Skills in England* researchers found that '… many employers remain sceptical about whether the increase in participation in higher education and, in particular, the growth in numbers with degrees, really meets their needs. There is an apparent contradiction here. There has been an unprecedented increase in the average levels of qualifications held by the workforce. Despite this, employers continue to complain that they are not able to find the skills they require' (LSC/DfES, 2003, p.10)

However, there is a small but growing body of research that attempts to uncover the extent to which employer dissatisfaction with graduates is *real*, and the extent to which it is the result of skewed perceptions, prejudice, or unrealistic expectations. Mason's influential report to the DfEE (Mason 1999a) points out that while 'the great majority of mismatches between supply and demand for technical graduate are attributable to quality problems rather than any overall shortage in quantity', graduate employees appear to be of a thoroughly acceptable quality. 'The great majority of employers expressed satisfaction on a range of criteria with all or nearly all of the new graduates they had recruited. Most managers who made criticisms of graduate quality were referring to applicants they had rejected rather than graduates they had decided to take on' (Mason 1999a, p.3). Mason (2002) found that graduate were favoured because of their confidence, logical thinking, problem-solving abilities, motivation, career-hunger and learning-readiness, and that employers felt '… a computing degree gives a kickstart for the infrastructure' (Mason 2002, p.437).

In a review of investigations into employers' assessments of their workforce, A.J. Hesketh finds that: '… research gives, at the very worst, a mixed picture. In what remains the most comprehensive survey of graduate employer satisfaction to date, Harvey and Green (1994) suggested that in relation to the skills they most highly prize, the majority of employers are "moderately satisfied" with the quality of graduates they recruit' (Hesketh, 2000, p.247). And the Dearing Report found that '…only 10 per cent of [employers] are dissatisfied with the level of practical/vocational skills of their employees with higher educational qualifications' (Dearing 1997, p.32).

Lucia Baillie (City University of London) has investigated this issue during the planning of an innovative workplace-based degree pathway. She notes that the methodology of employer questionnaires is a key factor: '… if employers are questioned in their views, they will set high standards, but when probed further, these standards are difficult to quantify' (Baillie, 2001, p.5). She asks: 'If an employer cannot articulate at what level they desire certain skills other than basing them on an intuitive form of assessment, how can HEIs adequately ensure any work done with students is of a required level?' (Baillie 2001, p.4). Both Hesketh and Baillie point out that training in the workplace is essential, not to remedy deficiencies in university provision, but to allow graduates coming from courses broad enough to satisfy a wide range of potential employers to learn 'the way we do things here' (Hesketh 2000, p.264) for their particular company.

In the much wider-ranging (and more influential) Roberts Report, a similar picture emerged. Roberts notes that businesses may both be unclear about what they actually want, and unrealistic about the nature of the university's task (or, if you like, the university's 'business'): 'In too many cases, businesses have an inadequate grasp of their own skill requirements, and believe that HEIs should alter courses to meet their needs without

reference to other fields that graduates might work in ... more coherent skills messages are needed in order for HEIs to respond effectively' (Roberts, p.177).

An example of the kind of confused message which can come from employers is found in one of the LMI case studies. Here, an employer at an SME, himself a recent graduate, criticizes university education in ICT as follows: '…a lot of the time you are taught very general skills to use in industry and also, very specific skills in certain computer languages, which are just the ones that your department likes' (Docherty 2000, p.6). Quite what universities are supposed to teach if general skills are regarded as impractical and specific tools are seen as the expression of personal quirks by eccentric academic staff, is unclear.

Other evidence for a lack of realism emerges from close study of job advertisements for ICT positions. *Computer Weekly* examined the specifications of skills required for a number of posts which might be filled by recent graduates, and discovered that these are impossible in practical terms (Woolnough 2002). In some cases this is for reasons which are patently ridiculous ('you see adverts asking for x number of years' experience in a skill, but it has only been out for six months'), but more frequently an 'ideal' employee is envisaged, with little regard for the real time which it would take to acquire his/her range of expertise.

One experienced contractor was quoted as saying that: '… employers might as well be asking for the moon…. you often see adverts where they want someone with eight skills. It is a wish list, because people can only really be expert in one or two skills and very good in another couple, with bits and pieces of other languages and techniques'. Another veteran notes that: 'there are numerous job adverts asking for entry-level graduates that require them to have knowledge of several skills and proof that they have successfully used those skills in the business environment… there is no way a graduate will come through from university with all those skills'.

Recruitment practices can also distort the picture if too narrow a range of recruitment practices. Mason (1999) criticises the 'narrow' approach to both recruitment and training which is taken by many employers, finding that the level of applications for a post was '… associated with considerable diversity between companies in the extent of advertising and the range of recruitment methods used as well as in the specificity of job advertisements' (Mason 1999a, p.2). And Harvey and Morey point out that a preference among employers for graduates from 'prestigious' universities may cause them to miss out on students who have taken advantage of the collaborations with industry which are more common in post-1992 institutions: '… those institutions at the forefront of employability development may be ignored by the larger graduate employers' (Harvey and Morey 2002, executive summary).

An additional problem may occur because of the 'market' in Higher Education, where students must be attracted onto degree courses, and 'retained' once they are there. Hogarth and Wilson raise the issue of whether universities should provide courses which 'serve' the desires of students or of their potential employers: '…it is apparent that students' choices of subject area are not always congruent with employers' requirements. Whether HE provision remains primarily determined by university provision and students' choices (rather than being more market driven, responding to employer pressures) remains an important question for those concerned with delivering education and training programmes.' (Hogarth and Wilson 2001, p.10).

They call for a greater awareness of employer demands and practical preparation for employment: '… there is clearly a need for both students and providers to be better informed about employers' needs… more emphasis needs to be placed on vocational preparation and providing the requisite generic skills, while maintaining academic standards' (Hogarth and Wilson 2001, p.10). They do not refer specifically to ICT, but it is easy to see how their warnings apply both to the entry of students into this field, and to the design of ICT courses. A folklore operates among some ICT students that courses addressing 'generic' or 'soft' skills, such as communication or information systems management, are somehow 'unimportant' and 'take away time from proper subjects', yet this directly contradicts the demand by employers for ability in these areas.

Blatant evidence of employer prejudice against universities and graduates is rare, but there are indications of the attitudes which are 'out there'. An article on a website devoted to discussion of education and related matters which styles itself as a place where everyone is 'listening to experience' carries the headline: 'Golden rule for IT managers: "Never hire the graduate"' (faxfn.org 1999). The writer goes on to justify his position, referring extensively to his own (abortive) university experience in the 1970s. The same article contains quotations from David Taylor of Certus ('… I know some IT directors who say they would not touch IT graduates with a barge-pole') and David Burrows of Microsoft UK ('There is a significant shortfall between what universities and what employers would like').

I have been unable to find primary sources for either of these quotations, and there is a possibility that they are inaccurate. Even if this is the case, however, it is significant that this is the kind of view which can be attributed, with a relative degree of plausibility, to senior members of staff in the ICT industry.

In smaller firms, prejudice against graduates may arise because of lack of knowledge of, or contact with, HE. Among SMEs, '… there remain a high proportion of managers who have low qualification levels' (LSC 2003, p.25). In addition, few graduates are likely to have 'worked their way up through the ranks, because: 'Traditionally, graduates do not perceive SMEs as a potential career choice and SMEs tend to underestimate the value that a graduate could be to the company' (Docherty 2000, p.24). Consequently, 'both small companies and graduates have a misconception of how they can help to improve each other' (Docherty 2002, p.24). Other LMI studies '… identified a graduate culture within companies – those companies who have a graduate in a senior position are more likely to employ other graduates' (Young and Morris 2000, p.21). Hesketh states that '… some SMEs may even be chary of recruiting graduates in the first place' (Hesketh 2000, p.249).

3.2 The 'soft skills' issue

Since the Stevens report drew attention to frequent complaint among employers that graduates in technical disciplines lacked a number of 'soft' or 'generic' skills, this issue has returned again and again in discussions of the quality and employability of ICT graduates[13]. Stevens seems to be heavily influenced by Mason's 1999 report for the DfEE, which states that: 'the main concerns about graduate quality expressed by employers relate to some job applicants' lack of relevant work experience, followed by a 'lack of commercial understanding/awareness' and 'weak communication and presentation skills'' (Mason 1999a, p.1). Elsewhere, he notes that new graduate entrants are criticised for 'lack of business understanding', 'lack of work experience', 'interpersonal and communication skills, accuracy in documentation and practical lab skills' (Mason 1999b, p.11).

There are several issues here. Perhaps the most striking is the fact that new graduates are being criticised for their 'lack of work experience', when this is surely an unreasonable expectation of someone who has just completed three years at university. Even more worrying, only 38% of the employers interviewed by Mason were willing to offer work placements, which are, presumably, the only way in which this quality can be obtained. SMEs were noted as being especially unwilling to offer work placements, which may have a particular impact on regional skills gaps.

Elsewhere (Mason 2002, p.447), Mason uses this complaint by employers to argue in favour of a greater use of non-graduates in roles such as technical support, where the 'substitution' of university-educated employees into roles which would previously have been filled by workplace trainees is occurring[14]. This is part of a wider interest in the advantages of 'intermediate level qualifications' over degrees, partly because they 'are often gained by employment-based training coupled with part-time attendance in vocational education', and those trained in this mode may have '… a headstart over full-time students in terms of work experience and problem-solving' (Mason 2001, p.8). No specific research evidence for this is quoted. However, more than 50% of employers in his study who had substituted graduates for non-graduates noted some improvement due to their more highly-qualified workforce (and only 3% noticed any decline), which suggests that they benefit from the various attributes of graduates which are listed as positive[15].

Baillie notes that university in fact provides opportunities to enhance the 'work-readiness' of graduates, and that the challenge is to integrate this into the teaching and assessment of courses. She notes that '… students can often fail to make the connection between skills that they learn at University and Business skills they will need in the workplace if these links are not made manifestly clear … perhaps it is as much as we can do to encourage students to see their academic learning from a different perspective … about two thirds of students said they learned their "business skills" in the workplace, or in previous employment, with very few reporting that any of the work undertaken at University had helped shape any business skills. It seems that they do not consider handing in assignments

[13] Graduates of other technical disciplines are criticised for the same reasons (e.g. 'engineering graduates who… may look technically OK but can't communicate with colleagues or other team members', Mason 2002, p.439. However, this may be less serious in disciplines where the technician/user interface is less central than in ICT, and where there is less team-working. For example, in the *Science, Technology and Mathematics Workforce Development Plan*, skills problems were identified in six main areas: '1. Job specific skills, 2. Other technical skills, 2. Laboratory skills, 4. Management skills and 5= Literacy skills and teamworking', while 'Generic skills' (management, teamworking and communication) were less frequently reported' (Thompson 2001, p.16).

[14] His arguments here are not altogether convincing: it may be true that 'graduates entering these jobs may need to undertake considerable amounts of training before they carry out the work' (Mason 2002, p.447), but it is difficult to see how this would not also be the case for the 'apprentice-trained technicians' who would, presumably, arrive directly from secondary education with even less technical knowledge than the graduates.

[15] Nor does he address the issue of the impact on the workplace of the period during which new 'on the job' trainees are *truly* raw recruits, gaining their very first elements of technical skill.

on time, or planning revision, or group working as a training ground for skills that can be taken into the workplace' (Baillie 2001, p.4).

As well as course reform and the expansion of placement schemes, enhancement of the generic skills of ICT graduate has been treated as an issue relating to recruitment, both before enrolment and after graduation. Project Gemini, an initiative by the e-skills NTO, conducted research which found that many firms, in particular larger employers, are prepared to recruit non-IT graduates in order to obtain high quality staff with good interpersonal and business skills: '51 IT Services employers … gave us their views on the skills that matter to them when recruiting graduates, and where they see discrepancies between what they want and what they are offered. They told us that the most important skills were in oral communications, problem solving and business awareness. Unfortunately these were also the areas where they see the biggest gaps in what graduates typically offer. The majority of larger companies, and a significant proportion of SMEs, were happy to recruit from non-IT degree subjects' (e-skills NTO 2000, p.4).

The same pattern is noted in *An Assessment...:* 'Employers recruit as many graduates from non-IT as well as from IT subjects, mainly for their personal skills, aptitude and intelligence' (*An Assessment...*, p.34), and this has also been noted as a motivation for recruiting by gender: '… one employer had been recruiting (female) psychology and humanities graduates and teaching them the required technical skills – this was reported as much easier than trying to teach soft skills to technical graduates who were relatively poor at communicating with users' (Attwell and Kamarinen 2001, p.16). A general theme running through documents on skills shortages is that the low percentage of women in ICT contributes to the lack of teamworking and communication skills. Philip Virgo (Virgo 2001) suggests that different non-ICT disciplines may bring different advantages to the field: 'Linguists and English students have always been in demand, partly because they make good programmers but more because communications problems between people is [sic] one of the most common causes of project failures. The skepticism of the historian is invaluable in checking that needs have been correctly identified and that systems meet needs and not just technical specifications. Anthropologists and social scientists bring insights into the behavior of people and organizations and how they interact with systems'.

3.3 First destinations of graduates

Estimates of the number of graduates in ICT disciplines who enter ICT careers vary enormously. This is partly because the collection of statistics on graduate destinations tends to be based on the 'Standard Occupational Classification'. Before its revision in 2000, this was 'often not sensitive enough to pick up on ICT skills issues within the various sub-sectors or specific ICT jobs' (*An Assessment...*, p.3). Even now, alongside the categories of job which relate specifically to ICT work[16], it is easy to see how many others could easily utilise the skills gained on a degree course in computing. For example, many of the 'scientific researchers' (group 2321) may be IT specialists, but they are not captured by this method; nor are those teaching ICT, at any educational level. A large number of public sector and finance workers may also be ICT specialists, and the impact of e-commerce on the personal service and sales and customer service occupations will also be considerable.

Skills 99 estimates that in 1998, around one-third of graduates from IT related courses were working as IT Practitioners, while two thirds were not (*Skills 99*, p.37). However, this is based on data from the Labour Force Survey, which uses the older SOC categories. It is also estimated that a third of the graduates who are working as IT practitioners have IT-related degrees, while two thirds to not (*Skills 99*, p.36).

The Stevens report contains an estimate that 'in a typical year, only half of all computing graduates enter jobs in the broadly defined "business services" sector (which includes IT services). In the case of electronics, just a third go into manufacturing sectors, a quarter into business services and one in ten into transport and communications sectors (including telecoms services). Therefore a considerable number of ITCE graduates are not choosing to work in the industry, or are unable to find employment within it' (Stevens, p.12). Stevens does not estimate the number of graduate IT Practitioners who do not hold an ICT degree.

The *University-Industry Interface* report uses the 1997-8 HESA statistics on graduate first destinations, which again are based on the older SOC categories. They discovered that two-thirds of IT graduates who are employed at the end of their graduation year entered IT Practitioner work. They compare figures for computing with engineering, accountancy, law and medicine, and from this it emerges that 'only medicine has a higher percentage of graduates from the "relevant" degree course going (initially) into the profession' ((AISS/ITNTO 1999, p.7). When they examined the proportion of new graduate ICT Practitioners with relevant degrees, this turned out to be about 42%.

In 2001, *An Assessment...* used a broad definition of 'Information Technology, Electronics and Communications' professions to interpret data taken from a CEL survey carried out for the DTI. This indicated that, for graduates in computer science or an ICT related subject who entered the labour market after graduation, '… in total almost 80 per cent [were] in an ITEC role' (*An Assessment...*, p.43). They quote the *University-Industry Interface* report's figures on the proportion of ICT graduates to non-ICT graduates in IT practitioner work, but also note that certain types of IT job are much more likely to be filled by an IT graduate than others. For example, 43.5% of analysts and programmers are computer science graduates, as are 39.6% of software engineers. By contrast, 22.4% of computer system managers hold degrees in a related field.

Data from the Careers Service, whose statistics are supplied by HESA and cover over 80% of 2001 first-degree graduates in IT, indicates that 71% enter in employment in the UK (1.6% are employed overseas). 9.5% enter further study or training in the UK or overseas, and around 11.9% are believed to be unemployed six months after graduation.

Of the 72.6% who are in employment of some sort, 54.9% are working as Information Technology practitioners (on a narrow definition). This is by far the largest occupational category. The second largest (9.8%) is 'clerical or secretarial occupations,

[16] These are: 1136 – Information and communication technology managers, 2131 – IT strategy and planning professionals, 2132 – software professionals, 3131 – IT operations technicians, 3132 – IT user support technicians.

excluding numerical clerks and cashiers (1.7%). In practice, those in clerical or secretarial work may include individuals working with databases, electronic retail information, or other computer systems. 7.4% have become commercial, industrial or public sector managers, and in practice it is likely that at least some of these are managers of computer or IT systems. Other categories where some of the IT graduate may well be using their degree skills for a substantial part of their job are marketing and sales (2%, which may include some e-commerce professionals), engineering (1.7%), teaching professions (1.7%), business and finance (3.5%) and media and design (1.9%).

It is not clear from these figures where employees involved in IT support or helpdesk work, or in computer sales and marketing, are included. The 'breakdown' of the IT Practitioner work done by the 54.9% of students who enter this field directly from university is as follows: Computer analyst/programmers (5.9%), Computer operations managers (2.0%), Computer programmers (10.7%), Computer/IT consultants (9.3%), Others (2.2%), Software engineers (17.5%), and Systems analysts, including analyst-programmers (7.2%). Also unspecified is the number of those entering postgraduate study who continue to study computing or IT. 0.9% of those undertaking further study or training are training to teach. Overall, the number entering further study or training is roughly the same as that found among graduates in accountancy, business and engineering.

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