Report on the scoping events

of the HEFCE-funded initiative

Increasing the supply of students in higher education in IT and Computing

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and

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Executive summary

Two 'scoping events', funded by HEFCE and organised by the BCS and the CPHC, were held in Newcastle and London. The purpose of these was to identify key concerns over recruitment to IT courses and careers, and strategies address these. This project is one of a number of initiatives promoted by HEFCE to increase the number of students studying in areas of science and technology which have been identified as vital for national prosperity. This expansion of numbers will be achieved through promotion of these subjects and the career prospects which they offer alongside an expansion of the pool of potential students through widening participation activities.

The regional meetings were attended by representatives from a wide range of relevant agencies as well as practitioners in secondary, further and higher education. A series of short talks by invited speakers provided background information, and delegates then explored the matters raised during question and answer sessions and longer breakout discussions. They were also invited to email any further reflections on the proceedings to the organisers. Full reports of the scoping events are available on the BCS website. The main priorities for action are summarised below:

School ICT curriculum

- Review the school ICT curriculum to ensure that it is relevant, useful and up-to-date, capturing the excitement and challenges of modern IT research and work. Ensure that schools have access to and resources for excellent software and other materials to enhance the curriculum. Facilitate links between HEIs, industry and schools to offer opportunities such as experiential learning and input from 'role models'.
- Promote pupils' understanding that computing is a subject in its own right and not just a 'tool'. Ensure that embedded ICT teaching does not detract from this.
- Provide courses in *Computing* as well as ICT before A-level, to familiarise students with the full range of the subject. Offer a 'common' AS year for Computing and ICT.
- Produce comprehensive and up-to-date information to help ICT classroom teachers advise pupils on IT courses and careers, e.g. descriptions of the *full* range of options open to and undertaken by IT graduates, and a realistic picture of the IT job market.

Teacher training and supply

- Provide a wide range of CPD activities for teachers of ICT as a subject in schools (both CS/IT graduates and those 'drafted in' from other areas). This should include links between schools, HEIs and industry, to facilitate knowledge updating.
- Support an active and accessible national support network (possibly organised/provided by the BCS) for all ICT teachers in schools.
- Extend and support on-course schemes for IT and computing students to experience teaching as a career, such as the University Ambassadors' Scheme.

Higher Education

- Within the benchmarking process, review the range of course types and titles offered by universities (possibly as part of the current 'benchmarking' process) to improve clarity for potential applicants, and investigate the inclusion of vendor qualifications and/or exemptions from elements of these in HE curricula.
- Improve communications between universities, potential applicants, teachers and employers to promote recruitment, work experience opportunities for students, etc.

- Expand opportunities for part-time and flexible learning, which attract more women, mature learners, and non-traditional students. Increased opportunities to combine IT with other subjects at school and university levels. More foundation degrees.

Public understanding

- Devise and implement publicity campaigns to help the general public understand the nature and significance of Computing. These should be based on proven 'public understanding of science' strategies, and targeted research with school teachers and pupils to identify areas of [mis]understanding and appropriate/effective solutions.
- Explore ways to dispel the 'geek' and the 'male only' image of ICT in the media.

Gender and widening participation issues

- Collaborate with AimHigher and institutional widening participation initiatives to ensure that IT is prominent within these and that key messages, such as the excellent career prospects offered by IT, are stressed.
- Implement and support effective programmes to boost female recruitment to IT, e.g. opportunities for female role models to work with school pupils, work experience in female-friendly environments, pastoral support for females in IT education. Recognition and reward for female achievement in IT, to dispel gender stereotypes.
- Examine of trends in recruitment to IT degrees and jobs among ethnic minorities.

Activities with school pupils

- Work with established programmes such as SETPOINT to build on good practice.
- Ensure that 'interventions' with school pupils start at an early stage (e.g. age 9 – 11) and are repeated throughout the school career. Target interventions to specific groups.

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Introduction

The purpose of these events, which are funded by HEFCE and organised by the BCS and the CPHC, is to identify strategies to increase the number of students studying IT[1] at school, college and university. IT has been identified as one of the 'strategic subjects' in which a strong knowledge base and a supply of highly skilled workers are of particular national importance. This is in response to a recognition of the high importance of IT for national prosperity, at a time when fewer students are choosing to study this subject in higher education. Widening participation is an important part of this process, as courses seek to recruit more women and mature-age students to study and work in IT. Computing can also build on a strong record for ethnically diverse recruitment.

The first event was held in Newcastle-upon-Tyne in November 2005, and the second in London in February 2006. Detailed reports of the proceedings at these meetings were produced and made available via the BCS website. This amalgamated report presents the main themes to emerge from both events. It will be received at a meeting of leaders in the field, where a further action plan will be developed.

The regional meetings were attended by participants from secondary, further and higher education, Local Education Authorities, Learning and Skills Councils and careers services, as well as industry and the Regional Development Agencies. Representatives from the BCS, the CPHC, the DfES, e-skills UK, BECTA, TTA, ITTE and QCA were also present, as well as IT educational practitioners from schools and FE colleges.

The two regional meetings were similar in format. Following a welcome and introduction by Lesley Beddie of the BCS Education and Training Forum, invited speakers gave brief presentations to introduce attendees to the full range of issues. These panel sessions were followed by brief opportunities for questions from the floor, and then by longer breakout discussions. In the evening, participants were arranged into groups for discussions over dinner, during which they were asked to identify the issues which they felt were most vital, and to propose strategies to address these. Participants were also invited to email any further reflections on the proceedings to the organisers.

[1] The acronym ‘IT’ is used as a shorthand in this document to refer to the broad subject of ICT/IS/IT/Computing/Computer Science, *except* in cases where specific reference is being made to secondary school curricula entitled ‘ICT’. In HE, the courses in this field are often known as ‘Computing and IT-related’. In schools, the subject is referred to as ‘ICT’ in the pre-GCSE curriculum. Both ‘Computing’ and ‘ICT’ are available at AS and A level.

Panel Presentations

The following presentations were made by the invited speakers:

John Rushforth – HEFCE – Overview of STEM subject initiatives (Newcastle and London)

The aim of the initiative is to increase the number of students choosing to study STEM subjects in HE by helping market mechanisms to work more efficiently. An holistic approach to outreach activities, student recruitment and student progression is required, building robust, evidence-based business cases for specific strategies. Collaboration between subjects and with existing structures, such as those provided by AimHigher, SetPoint, the HEA and the CETLs, is encouraged. A number of projects are already in place for disciplines such as Chemistry, Engineering and Physics.

Peter Slee – Northumbria University – Widening participation issues (Newcastle only)

Every HEI and secondary school in the North East of England is currently involved in the AimHigher initiative. Since 1999, when this was introduced, the percentage of 18 – 30 year olds in the region who entered HE has risen by 5%, and the percentage of students from low-participation groups such as LPN dwellers, students with disabilities and students from ethnic minorities has also risen, although at a slower rate. IT and Computing enjoy a particularly high rate of recruitment from these groups, in particular students from lower social classes, and this has been maintained despite falling IT recruitment overall. However, current research suggests that the likelihood of university participation among young people is determined at a very early stage, perhaps even before entry to primary school, and certainly before the stage of most HE recruitment activities.

Keith Mander – CPHC – HE issues (Newcastle and London)

The number of applications to Computing courses in the UK rose steeply during the late 1990s, peaking in 2001, but it has since fallen to its lowest rate since 1998. Computing is offered in almost all universities in the UK. Alongside the rise in the number of Computing students and graduates, the demand for qualified IT and Computing professionals in the UK economy has also risen, and it is unlikely that this can be met given current rates of recruitment to HE courses in the subject. Computing graduates have high rates of relevant employment, and they are required in an increasing range of 'high value added' areas, such as systems design, security, healthcare etc. Because this is a fast-moving field, the employment market itself is dynamic and volatile.

Thomas Ng – BCS Schools Expert Panel – School curriculum (Newcastle and London)

Computing is not taught during the compulsory stages of education, although it is available at AS and A-level. There has been a sharp fall in the number of candidates for Computing in recent years, and a smaller fall in the number taking ICT at AS or A-level. ICT is part of the curriculum for pupils aged 5 – 16, and the national curriculum requires pupils at KS3 to have at least one hour a week of classes in ICT. At the lowest level (KS1), pupils are introduced to packages. At KS2 and KS3 they learn to use these to solve problems, and at KS4 they are introduced to concepts which will help them create systems. This final stage is designed to prepare pupils for A-level CS and ICT. However, there is considerable variation between schools in the way ICT is taught.

Michael Trees – e-skills UK – Skills Council perspective (Newcastle and London)

e-skills UK is currently engaged in delivering the Sector Skills Agreement for IT, which offers a 10-year vision of skills provision in this area. This falls into four sections; research on labour market requirements, reviewing current provision, identifying gaps and formulating an action plan. The research phase, carried out in consultation with organisations such as Gartner, has identified key trends in IT employment and skills needs. These include:

- Changes in the required mix of IT professional skills and a need for greater integration with business skills, for example in systems architecture and security.
- A shift in the type of IT user skills needed from a predominance of basic/intermediate skills to a preponderance of intermediate/advanced skills
- A need to re-educate managers to recognise how they can use IT for business benefit

e-skills UK is involved in a number of initiatives, such as the ITMB degree course, IT diplomas, Higher Apprenticeships, and widening participation initiatives such as Computer Clubs for Girls. It may be difficult to promote new routes into IT professional employment to employers who are used to graduates as their main source of highly qualified workers.

Jill Dickinson – Connexions – Careers advice (Newcastle only)

There are 47 Connexions partnerships in the UK, which support people aged 13 – 19, their parents and their teachers. The aim is to help individuals achieve their potential and overcome barriers. It is recognised that successful transitions between education stages and education and employment rely on high-quality advice. This is now delivered within a national framework of careers education and guidance. The work of Connexions was initially concentrated on pupils in years 9 – 11, but has now been rolled out to include those in years 7 and 8. Careers advisors have access to three 'files' relating to IT, one of which describes the subjects of Computing and ICT, one of which deals with professions using these skills, and one of which presents local opportunities to students in particular schools. However, electronic resources are relatively limited, and many pupils lack the 'information literacy' to make good use of internet resources. Some of the most valuable careers resources are visits to universities and workplaces, and experiential learning. However, pupils often rely on less helpful sources of information. Subject teachers, who may not be very well informed on careers issues, are often consulted (and trusted) more readily than careers specialists. In addition, parents and friends are influential but frequently unreliable.

Gillian Lovegrove – BCS (Newcastle)/*Reena Pau – Southampton University* (London)
Gender and ethnicity issues

The proportion of IT professionals in the UK who are female has fallen dramatically since the beginning of the 1980s. This is despite numerous initiatives and interventions to increase the number of women. Research indicates that, while girls can achieve just as well in these areas and are happy to use computers, many do not want to enter university courses in this area. The image of the subject and the workplace as unattractive to women and/or sexist may contribute to this effect. It is possible that lifelong learning may help to boost numbers of women, as 'conversion' MSc courses, offered to graduates from other disciplines, attract a higher proportion of women students than many undergraduate programmes. Computing appears to recruit a higher proportion of its undergraduates from ethnic minorities than many other subject disciplines and than UK HE as a whole; in particular, certain under-represented ethnic groups such as Black, Pakistani and Bangladeshi males are relatively well-represented on courses in this area. However, there is some evidence that these numbers may be falling a little in recent years. In addition, students from ethnic minorities seem to be less attracted to IT *jobs* than to IT *courses.*

Anna Round – CPHC – Perceptions of Computing and ICT among school pupils
(London only)

In connection with the initiative *IT Professionals in Education: Increasing the Supply*, a small-scale research project on attitudes among school pupils to Computing/ICT courses and careers has been undertaken. This paper presented preliminary findings based on questionnaire returns from 300 of the planned 850 participants, and two of a proposed ten focus group interviews. The data so far indicates a wide range of different attitudes and levels of knowledge among pupils. Those who are taking Computing and/or ICT at A-level are generally enjoying the subject, although enjoyment is considerably higher among students studying Computing. A reasonable number of these students are open to the possibility of studying Computing/ICT in higher education, although many students have already chosen their preferred subject for university study (and in some cases this choice has been made before taking GCSEs). Parents and teachers emerged as the strongest influences on post-GCSE education choices overall. When attitudes to Computing/ICT were examined, it appeared that around one-third of students regard the subject as 'exciting', but that many feel that IT professionals receive less respect, and lower pay, than those in other fields. Some pupils are confident about job prospects in Computing/ICT, while others believe that there are too many IT graduates chasing too few jobs. Knowledge gaps appear to be a problem, with many students unaware of the difference between Computing and ICT and/or of the status of IT as a 'subject rather than a skill'. In addition, many pupils have a poor knowledge of the range of IT applications and of the nature of IT jobs. The 'geeky and anti-social' image of IT work persists.

Key Themes

1 School ICT Curriculum

The school ICT curriculum was a source of concern for participants in both regional events. The main strands of discussion under this topic are as follows:

1:1 *Delivery and content*

Because many school pupils appear to believe that ICT is 'boring' or 'mundane', it was proposed that more demanding and creative material (e.g. game writing and website design) should be introduced into the school curriculum. There was some sense that the primary school ICT curriculum, and other ICT work at lower school levels, can often be more stimulating than the secondary one.

In addition, Computing is often regarded as a 'determinist', 'passionless' and 'uncreative' subject. Communicating to pupils that there are 'in reality… no right answers' in Computing might break down this stereotype. In addition, curricula which demonstrate links between ICT and other areas, such as creative skills (e.g. music, graphics) or everyday applications of Computing can help to engage pupils with the subject. Many school teachers felt that QCA curriculum KS3 lacks 'excitement', 'mystery' and 'imagination', which may lead to pupils' unwillingness to consider ICT courses in HE. Anecdotal evidence suggests that many 'good' teachers side-step the prescriptive curriculum and introduce elements to recapture the 'thrill factor'. The CPHC or BCS could produce a list of high-quality literature and other materials designed to stimulate interest and excitement in the subject.

Several participants offered examples of HE/school collaborations designed to enrich the secondary curriculum. For example, the Princeton and MIT Computing websites offer 'nuggets' of information on subjects such as encryption, Turing machines, Human Genome, Google etc, which offer both subject interest and valuable cross-curriculum opportunities. UK university departments might provide similar materials suitable for KS3 and KS4, concentrating on people and inventors, ideas and concepts, and applications of Computing in everyday life (e.g. 'how your mobile phone works', 'how Google works', etc). It was also suggested that certain subdisciplines may offer particular opportunities for building pupil interest; for example, AI has a 'human aspect' which catches the imagination of students in areas such as genetics. Alternatively, established resources such as the New Zealand-based *Computer Science Unplugged* might be acquired for use in UK schools. It was felt that both HE and industry can contribute to building an exciting and involving ICT curriculum.

High-quality e-learning resources for use in schools are in short supply. Where these have been developed locally they may not fit in well with the national curriculum, and specialists who have developed them may not have the time to support other teachers who use them in the classroom. In addition, schools may not have the resources to purchase excellent e-learning and/or software materials, especially if institutional focus is on the acquisition of computer hardware.

A major review of the new A-level and AS qualifications will be carried out by the QCA in December 2005. The importance of informing this dialogue was noted.

Several teachers noted that KS4 qualifications entitled 'Diploma' or 'Certificate' provide flexible and challenging opportunities which are popular with some students. However, these titles may be regarded as 'low prestige' by other parents and pupils. Employers may be inconvenienced by the introduction of a further range of qualification titles.

1:2 *ICT as a subject*

Many teachers and other stakeholders felt that a number of students perceive ICT as 'dull', 'repetitive', and 'not a proper subject'. 'Embedded' ICT, where computers are used to support other subjects, may contribute to this, especially where tools such as spreadsheets are used repeatedly in different lessons with little attention to the underlying Computing and/or potentially interesting applications.

It is certainly the case that some pupils regard ICT as a 'skill rather than a subject', or an area of knowledge which is so ubiquitous that skills can be 'picked up as you go along'. Where this happens, both their engagement with the subject and their understanding of its career potential will be diminished. The 'ubiquity' of computers in homes and offices, and a sense that they are 'mundane', may contribute to this effect. Some parents may feel that ICT lacks prestige because they do not associate it with a career path (such as medicine or law), or because more 'traditional' disciplines (such as mathematics or physics) are believed to be more prestigious or challenging. Promoting an accurate awareness of the nature of Computing and IT technology and the range of applications and careers where these are relevant may help to challenge these problems.

It was secondary schools may 'use' ICT as an 'easy' subject in which GCSE pass numbers can be maximised. If ICT is taught with this end in mind, students may be left bored and poorly informed. However, where it is well-taught ICT does *not* constitute an easy option.

1:3 *The Computing/ICT distinction and understanding of the field*

Relatively few pupils understand the distinction between 'Computing' and 'ICT', and there may also be confusion over the borderline between 'embedded' ICT and ICT as a subject, as discussed above. Currently, no opportunity exists for students to study *Computing*, rather than ICT, before A-level. This may reinforce the attitudes described in 1:1, and also prevent students gaining a proper understanding of the importance of Computing and the range of employment available in this area. It also requires a large 'leap' for students who choose to take Computing at A-level. The development of a 'common' AS year for Computing and ICT might help to solve this problem. It might also be possible to liaise with the QCA regarding the possibility of providing specific courses in *Computing* rather than ICT before A-level. This might, in practice, involve revising the ICT curriculum or options within this.

With the shift away from Computing towards ICT in schools, pupils may be more aware of software *applications* than of the more abstract Computing. There is a substantial difference between using software applications and actually building a computer system. It was noted that students need to perform a 'conceptual leap' to understand how the 'little programmes' which they write fit into the real world. Some participants suggested that the problem may be that computers work too well, leading students to see the computer as a tool to solve problems rather than as a process in its own right. ICT presents particular challenges because it is a fast-moving field and the school curriculum needs to deliver both generic IT skills to all students, and a foundation for specialist HE or training for those who choose IT careers.

Students need to become engaged with the subject at an early stage, ideally around KS2, in order to ensure that a higher number choose Computing/ICT in HE or at A level. However, only 2% of Primary school teachers are qualified to a professional level in Computing, and anecdotal evidence suggests that some older primary school teachers feel 'intimidated' by computers. This is at a time when ICT is increasingly being used across the curriculum, and primary schools are also delivering specific lessons in ICT. Some learners may find it difficult to transfer ICT skills to other areas and to understand its wider relevance.

2 Teacher training and supply

Delegates at both meetings felt that poor teaching at school contributes to pupil dissatisfaction with ICT as a subject, and to poor understanding of IT courses and careers. The following issues were identified under this heading:

2:1 *Teacher training and CPD opportunities*

Relatively few of the staff who teach ICT in secondary schools hold an IT or Computing degree. This may lead to a number of problems, including a lack of confidence and/or enthusiasm in delivering the curriculum, a lack of innovative, creative or additional materials in teaching, difficulties in updating the content and practice of teaching in pace with developments in the wider field of IT, and poor knowledge of IT as a subject and/or a career.

Extensive CPD for school teachers was proposed as a remedy. This should address the problems experienced by non-IT qualified staff, and also include advanced and 'updating' materials for teachers with IT qualifications, for whom very little appropriate CPD is currently available. Additional training for staff who teach 'embedded' Computing in other subject areas would also be valuable. CPD could be delivered in a range of modes and from diverse sources, e.g. University Departments, self-help groups, networking organisations etc. It is essential that programmes of this sort be properly resourced (e.g. with adequate supply cover, easily accessible materials, etc) in recognition that teachers already have heavy workloads.

Resource issues were mentioned by several participants. It was noted that where new materials are introduced into the curriculum, teachers may not have the time financial resources to undertake CPD independently, e.g. by following 'vendor' courses. Arrangements between IT vendors/training providers and educational institutions might be set up to facilitate activities of this sort.

Several participants had experienced situations in which qualified ICT teachers were required to undertake tasks outside the classroom such as running school Computing systems and supporting embedded ICT. More training opportunities for specialists in running school IT systems and managing technical resources in education would prevent this time being taken away from core teaching activities.

2:2 *Encouraging Computing/IT graduates into school teaching*

As noted in 2:1, relatively few ICT teachers in schools have a degree in Computing/IT and the tendency to 'draft in' staff from other fields. Where new and more challenging curricula are introduced, there may not be sufficient staff to teach them (or teach them well). Even IT-qualified teachers may be unaware of developments in research and industry which occurred after they themselves graduated.

The extension of on-course schemes for IT and Computing students to experience teaching as a career, such as the University Ambassadors' Scheme and Students into Schools, would be valuable. In addition, a wider and more flexible range of PGCE routes into IT teaching would broaden the pool of specialist, enthusiastic teachers.

2:4 *Support network for teachers*

A national network which facilitates support and communication for individual ICT teachers was proposed by several participants. This would allow the dissemination of information and good practice, as well as 'early alerts' to curricular issues and trends in pupil choices or attitudes. It could also be used to support other initiatives, such as the curriculum changes proposed under Theme 2 below.

One proposal was for the establishment of a school teachers' network within the BCS.

2:5 *Teachers' role in career advice*

Many pupils are inclined to seek careers advice from their subject teachers rather than from careers specialists. This may arise where access to careers specialists is limited, or because pupils are in closer contact with subject teachers and therefore more inclined to trust their advice. In addition, the delivery of a curriculum such as ICT provides ongoing opportunities for careers advice in the course of subject teaching.

However, classroom teachers may be unaware of trends in Computing/IT employment opportunities and the relationships between these and HE or FE qualifications. Teachers who are Computing/IT graduates may be unaware of trends since they left university, and those who are not qualified in the field may lack broad knowledge.

Providing easy access for subject teachers to current and accurate information on graduate destinations and on the full range options available to Computing/IT graduates would improve the quality of advice they can offer to pupils. In addition, teachers should have information which can help them to dispel some of the more common 'myths' about IT jobs, e.g. illustrations of the fact that IT professionals do not just 'write code all day', IT has applications in an enormous range of fields, most Computing jobs have a human element, there are certain skills which cannot be 'offshored', etc. Materials which will help teachers to dispel stereotypes of IT professionals and IT work would also be helpful.

3 Higher Education Issues

3:1 *University curricula*

The university curriculum in Computing was not identified as a source of strong concern. Participants noted that UK plc needs different *kinds* of IT professional, and that it is important that technical Computing and research are protected in universities and in the school curricula, alongside the introduction of more business-focussed courses and opportunities to combine Computing with other subjects. The curriculum must be sufficiently diverse to supply people with skills *across* the IT workforce, including those which will support a UK workforce capable of innovating and sustaining design as well as applications.

However, a wider range of combined studies courses (e.g. Computing with health, social sciences, psychology and other subjects) would undoubtedly attract more students. It might also offset the tendency in British education for individuals to be 'branded' at an early stage as 'arts people' or 'science people', and could have an effect on the current gender balance in Computing/IT (see below). In addition, the availability of these courses would help to 'flag' the wide range of relevance of Computing and its applications.

3:2 *Recruitment and marketing*

HEIs use a wide and occasionally contradictory range of messages to 'market' their courses. For example, some universities promote their courses as 'hard' scientific options similar to mathematics and physics, attempting to engage subject interest and use the 'thrill factor' to encourage students to apply. Others emphasise the good job prospects which are available to Computing/IT graduates. In addition, a great many different course titles are used by different institutions.

This diversity is useful in that it will attract potential IT professionals across the full range of employment in the field. However, it might be useful to review the 'messages' disseminated by the sector as a whole, keeping in mind the observation of several participants that this very wide range of course titles and structures can confuse potential applicants and their advisors. Courses with the same title at different universities can have very different content, while similar programmes may have different names. This issue could be reviewed as part of the 'benchmarking' exercise for HE Computing/IT courses.

The use of 'trendy' course titles (e.g. 'Computer Games) was discussed. It was noted that students who enter a course because of a 'trendy' title (e.g. computer games) may move into a different or more 'core' area of the subject once they have some experience of study, and that these courses will include a substantial element of 'core' Computing which will be useful in many different areas of IT work and study.

Several participants were aware that a relatively high proportion of Computing/IT students enter university with little idea of what is involved in their course. This may stem from the confusion among school pupils of the distinction between Computing and ICT. Alternatively, students may believe that Computing/IT courses are 'good bets' for future employment and choose them for this reason, with little research into course content. These trends can cause a poor fit between student and course, resulting in poor student engagement and/or retention.

It was noted that the current downturn in applications to Computing/IT courses is observed in many other western countries, and may relate to wider social trends rather than to specific features of the UK education system.

3:3 *Perceived employability and course content*

Job prospects and employability are of central importance to most students at the point of HE choice. Many applicants are attracted towards sandwich courses rather than 'traditionally' structured programmes because these are perceived as enhancing employability. However, provision of these depends on employer engagement. Some potential students (and possibly some employers) might welcome the possibility of integrating vendor qualifications into degree programmes, although there are strong educational arguments against this. Options for including vendor qualifications and/or exemptions from elements of these in HE curricula could be explored, possibly within the benchmarking process.

3:4 *Flexible programmes and routes into HE*

A wider range of routes into and through higher education would boost recruitment, especially from adult learners and non-traditional students. For example, an expanded range of foundation degrees and opportunities for flexible and part-time learning would be valuable to those already in work and/or attempting to fit their studies around caring or family responsibilities. Where educational opportunities of this type are available they often attract more female and mature-age students than do traditional university courses.

3:5 *Prestige of IT*

There was an awareness that IT is believed by many pupils and parents to be 'unchallenging', especially in comparison with 'hard science' subjects at school such as Mathematics, Physics and Chemistry, or with degree programmes such as Medicine. Some 'brighter' school pupils (i.e. potential HE candidates) may feel that they already know enough Computing/IT through their private use of computers and the use of IT to support learning in other areas. In addition, the subject is sometimes seen as being a 'low prestige' option at school or university. This may result from a lack of general understanding about the subject and related careers, and specifically from the confusion of professional Computing/IT with 'user skills'. Computing professionals are regarded by many pupils and their parents as having 'lower status' (and quite possibly lower pay) than traditional professionals such as doctors or lawyers.

4 Public understanding and 'image' issues

4:1 *Public understanding of Computing/IT*

General public understanding of Computing and IT was felt to be poor. This is essential if the supply of IT professionals is to be increased, because the aspirations of many pupils will be shaped by prevailing knowledge and beliefs of the wider society in which they live. The strong influence of parents on career decisions is important here.

An increased focus on the public understanding of Computing, including campaigns to help the general public understand 'what Computing does', would be valuable. This could include poster campaigns, advertisements, etc., which might be sponsored by IT companies and/or research organisations (e.g. projects such as the EPSRC website set up at Leeds University). The success of established 'public understanding of science' campaigns could be reviewed, and best practice from these applied to Computing/IT initiatives. Focus group research with constituencies such as school teachers and pupils and other social groups could be conducted to identify areas of [mis]understanding and appropriate/effective solutions.

The relative 'invisibility' of many IT jobs and of much crucial Computing technology contribute to the sense that Computing/IT is mundane, unimportant or irrelevant. The relative novelty of many IT jobs and job titles may mean that it is difficult for pupils and parents to appreciate the range of work available in this area.

Improved public understanding is especially important because high levels of 'informal' IT competence in the use of applications may lead to a sense that IT is commonplace and unexciting, and that it has 'all been done'. An understanding of the importance and challenge of IT jobs might also lead to their gaining a higher prestige in society as a whole.

4:2 *Media image*

The media image of Computing is very poor indeed. Delegates suggested that the Computing/IT professions are viewed as being 'far from cool', 'geeky', 'nerdy', 'anti-social', 'boring' and that the typical image of an IT professional is 'someone sitting at a desk programming all day'.

Media portrayals of IT professionals are often stereotyped or negative (e.g. 'computer nerds' in film and TV drama, or the figure of the criminal 'hacker', 'spammer' or internet fraudster). Compared with other areas of science and technology, Computing/IT is the subject of relatively few documentaries or articles in the general media. News stories tend to concentrate on the 'downside', such as IT failure or computer crime, and the contribution of Computing/IT to positive stories elsewhere is often pushed into the background or ignored altogether. This is in contrast to fields such as forensic science, which has enjoyed excellent publicity in documentaries and drama.

4:3 *Professional recognition of IT*

If IT is to gain parity with other professions, it needs a strong 'professional model'. The leading role which the BCS can provide here was cited as a crucial factor in establishing the notion of the IT professional. For example, strong regulation of qualifications may lead to these being viewed as prestigious, valid, up-to-date and challenging by potential recruits and their parents.

5 Gender and widening participation issues

5:1 *Role models and perceptions of gender in IT*

Most delegates, in particular those involved in education, felt that gender stereotyping remains pervasive, and that stereotypes of the IT profession may in turn be particularly off-putting to girls and women. Female students need positive role models, e.g. women working in IT who confound the image of the 'nerd', or women involved in the application of IT to other fields (e.g. healthcare, the creative arts, fashion etc). Programmes in which such female role models have the opportunity to work with school pupils would be valuable for both male and female students. These activities could work alongside initiatives to dispel stereotypes of the 'male-dominated, geeky, anti-social' IT workplace.

It is important to disseminate the message that girls *can* and *do* achieve highly at GCSE and A-level in Computing/ICT. The belief that they are 'inherently' less good at, or interested in, these subjects is still strong. Supporting and publicising awards for high-achieving females in Computing/ICT would be a useful part of this and would help to boost the confidence of girls.

5:2 *Females in the IT workplace*

Work experience opportunities aimed specifically at girls and organised within workplaces with a 'woman-friendly' approach and/or a relatively high representation of women among their staff would be useful. It was noted that in general, better pastoral care for women in IT education and work is needed. This is especially important where female students and professionals find themselves confronted by 'covert' sexism and/or stereotyping.

5:3 *Students from lower socio-economic groups*

Rates of ownership of computers and other facilities such as broadband decrease with household income. Consequently students from less affluent backgrounds will often have fewer opportunities to use IT, and may therefore lack confidence and/or be unaware of which activities in this area interest them. It was felt that increased spending in schools will not, on its own, bridge social gaps of this sort.

IT qualifications offer excellent job opportunities, and are therefore likely to appeal strongly to students from lower social class groups. In fact, demand for places on Computing/IT courses has *not* declined among these applicants at the rate observed for the general student population. The factors driving this demand should be identified so that it can be sustained. In addition, initiatives to increase participation should address individual aspirations as closely as possible, so that long-term interest can be built and career plans focussed.

Partnerships should be built with general 'outreach' and widening participation initiatives so that these can include a strong Computing/IT and STEM element.

5:4 *Ethnic diversity*

Despite relatively high rates of recruitment into Computing/IT from ethnic groups which are generally poorly represented in higher education, these students are strongly concentrated in certain types of institution and geographical areas. Some research also indicates that the number of non-white students entering the IT workforce is lower than would be predicted from their participation in Computing/IT courses in HE. These issues require further investigation and targeted activities.

6 'Interventions' with School Pupils

6:1 *Activities*

Both industry and universities can provide a wide range of materials and activities which demonstrate the 'thrill factor' and the range of applications of IT. Experiential learning creates a very strong impact on students at all levels, and opportunities for activities of this sort should be identified and developed.

Role models are also very important in forming positive perceptions and career choices. Schemes such as those employed in SETPOINT can demonstrate the range of IT jobs which are available, and the possibilities offered by the subject. They can help pupils to understand the reality of IT as a profession and to view it as exciting and enjoyable. Strong role models also help to dispel the image of IT as 'mundane', a factor which is especially important as people are increasingly being encouraged to aim for careers which they will enjoy.

A diverse range of 'role models' is needed, e.g. both men and women, people from diverse ethnic backgrounds and age groups and IT professionals who work in a wide range of IT user organisations.

6:2 *Frequency and timing of interventions*

Several delegates pointed out that 'one off' activities to inform school pupils about particular career or study areas may be effective in the short term only. In other words, they may lead to a high positive response in 'change of attitude' surveys but have limited or negligible effect on long-term education and career choices. Interventions with school pupils to increase participation in IT courses and careers need to be sustained and consistent. In addition, their effectiveness should be monitored over a period of time. Starting with very young children (at primary rather than secondary school) may be the best long-term strategy, as it appears that the most influential attitudes are formed at a relatively early stage.

Strategies

The following strategies were proposed during discussions at the scoping events.

School ICT curriculum

- Review the school curriculum to ensure that it is exciting and up-to-date, reflecting the excitement and challenge of research and work in modern IT.
- Expand opportunities for liaison between industry, HEIs and schools to promote opportunities for experiential learning and information about current research and developments which will engage the interest and understanding of pupils.
- Ensure that schools have access to and resources for better software and teaching materials, as well as computer hardware.
- Consider the development of a 'common' AS year for computing and ICT.
- Liaise with the QCA regarding the possibility of providing specific courses in *computing* rather than ICT before A-level (this might, in practice, involve revising the ICT curriculum or options within this).
- Compile a database of useful resources for teachers, including a list of high-quality supportive literature which can be used to introduce pupils to computing/ICT and stimulate their interest and understanding. Such a resource could be provided by the BCS and/or the CPHC.
- Examine the use of 'embedded computing' across the curriculum and the 'message' which pupils receive from this.

Teacher training and quality

- Support an increased range of CPD opportunities for both ICT-qualified teachers and those drafted in from other subject areas.
- Ensure that teachers have adequate time in which to undertake CPD.
- Support plans for a teachers' section within the BCS.
- Extend on-course schemes for ICT and computing students to experience teaching as a career, such as the University Ambassadors' Scheme and Students into Schools.
- Develop a wider and more flexible range of PGCE routes into ICT teaching.
- Develop opportunities for school ICT and computing teachers to spend time in HEIs (and possibly also industry) to help update their knowledge.
- Investigate support from ICT vendors for teachers who undertake courses such as the ECDL and other qualifications.
- Provide more training opportunities for specialists in running school ICT systems and managing technical resources in education.
- Provide teachers with materials which illustrate the full range of options open to and undertaken by ICT/computing graduates. Identify key points for this, e.g. IT professionals do not just 'write code all day', most computing jobs have a human element, there are certain skills which cannot be 'offshored', etc.
- Improve knowledge of ICT career options among school ICT teachers, to help them provide accurate and encouraging advice about IT careers to their pupils.
- Recruit effective 'role models' for careers publicity in schools and universities, e.g. both men and women, people from diverse ethnic backgrounds and age groups, IT professionals working in a wide range of IT user organisations.
- Explore the use of established materials, e.g. 'Computer Science Unplugged'.

Continued…

Higher Education issues

- Increase opportunities for between universities and employers/industry to increase the number of sandwich courses, work placements, work experience schemes etc which form part of degree courses.
- Increase the number of links between the school curriculum, particularly for 14 to 19 year olds, and the university curriculum.
- Examine the range of course types and titles offered by universities. This could be done as part of the current 'benchmarking' process for computing degrees.
- Examine options for including vendor qualifications and/or exemptions from elements of these in HE curricula (possibly within the benchmarking process)
- Improve communication between HEIs, potential applicants, teachers and employers.
- Increase the number of combined, flexible and part-time routes into and through higher education, especially at post-1992 institutions.
- Expand foundation degree provision.

Media image and public understanding

- Devise publicity campaigns to help the general public understand 'what computing does' and how it is involved in their everyday lives. This could include poster campaigns, advertisements etc, which might be sponsored by ICT companies.
- Investigate the success of established 'public understanding of science' campaigns and ways in which these could be emulated to improve understanding of ICT.
- Organise focus groups with teachers and pupils to identify areas of [mis]understanding and appropriate/effective solutions.
- Promote the role of the BCS in establishing IT as a profession with a rigorous framework comparable to that of Law or Medicine.

Gender and widening participation issues

- Recruit a wide range of female role models and set up programmes for them to work with school pupils.
- Support and develop programmes designed to dispel the 'geek' and the 'male only' image of ICT.
- Support and publicise awards for high-achieving females in computing/ICT.
- Raise awareness of IT opportunities outside the IT supply sector.
- Increase the number of opportunities for combinations of computing and ICT with other subjects, at both school and university levels.
- Explore the possibility of ICT work experience schemes for girls in female-friendly workplaces and/or in IT supply to industries such as health, music or fashion.
- Liaise with AimHigher and with institutional widening participation initiatives to ensure that IT is well-represented, and that key messages, such as the excellent career prospects within IT, are stressed.
- Examine recruitment to IT courses and careers of students from minority ethnic groups, and explore ways to reduce possible disparities, e.g. between recruitment in different geographical areas and between the number of students graduating in IT and the number entering IT work.

'Interventions' with school pupils

- Liaise with organisations such as SETPOINT to build on existing good practice in working with school pupils.
- Ensure that interventions with school pupils begin at an early point in the educational career, and that these are sustained throughout the school career, with appropriate targeting to the groups who will derive greatest benefit.