Report on the North-East regional meeting

of the HEFCE-funded initiative

IT Professionals in Education: Increasing the Supply

Held at St James' Park, Newcastle-upon-Tyne

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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 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, described in this document, was held in Newcastle-upon-Tyne in November 2005. A further regional event will take place in London in February 2006. The reports from these discussions will be received at a meeting of leaders in the field, where the findings so far will be considered and an action plan developed.

The regional meetings are 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 are also present, as well as IT educational practitioners from schools and FE colleges.

The format of the Newcastle meeting was as follows:

Phase One: Setting the scene. A panel of invited speakers gave brief presentations designed to introduce attendees to the full range of issues. The panel presentations were followed by a short question and answer session.

Phase Two: Breakout sessions. Participants took part in three separate sessions, with the themes ‘higher education issues’, ‘schools issues’ and ‘widening participation issues’. Each of these aimed to probe deeper into the causes for low levels of recruitment, and to propose strategies to increase numbers.

Phase Three: Dinner discussions. Participants were arranged into six groups for discussions over dinner. Each table group was asked to discuss the strategies which they believed to be most vital, and to choose the four which they felt should be given the highest priority.

We would like to acknowledge the help we have received in organising this event: in particular, Debbie Smith of the BCS and Anke Jackson of the University of Newcastle.

Phase One: Setting the Scene

Lesley Beddie, Chair of the BCS Education and Training Forum, introduced the following speakers who gave short presentations:

John Rushforth – HEFCE – Overview of STEM subject initiatives

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

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. ICT 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 ICT 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

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

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

e-skills UK is currently engaged in delivering the Sector Skills Agreement for ICT, 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

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 any barriers which they encounter. 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 ICT, 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 – 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.*

Phase Two: Breakout Sessions

The following issues and strategies were discussed in the three breakout sessions.

Session 1 – Higher Education issues

HE recruitment
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. Others emphasise the good job prospects which are available to computing/ICT graduates.

This may be a strength, if marketing of the former type recruits students who will become the 'research scientists' of the future while the latter type recruits potential ICT users. However, it might be useful to review the 'messages' disseminated by the sector as a whole.

It was noted that there may be some resistance among schools to major involvement of HE lecturers in schools (e.g. with classes given by visiting lecturers). This could be perceived as an attempt by universities to 'take over', and it could also present practical problems alongside the need to deliver the whole of a required curriculum.

Education-industry links
The problems of encouraging companies to engage in activities with schools and universities were noted. In addition, there are a number of problems involved in providing HE curricula which respond to the needs of industry:

- Writing and validating a new HE course takes several years, while business and industrial processes move considerably more quickly. In addition, several 'business generations' may pass during the time it takes one cohort of students to complete their degrees.
- Employers may not always be certain of what they want in new graduate recruits (or, indeed, realistic).
- Employers require a wide range of skills, including critical analysis and 'core educational' abilities.

It was noted that in general, students who had undertaken a 'sandwich placement' year as part of their undergraduate course were more employable on graduation.

Role models
Several academics were sceptical about the idea that HE lecturers could act as role models for school pupils. Even those who have previously worked in industry are not likely to be the people children aspire to become. Role models currently employed in industry may be far more valuable.

Why take computing?
One lecturer, from an institution where most students who take computing do so as part of a joint honours programme, stated that the majority chose this subject because it was felt to be 'good for their CV' rather than because of subject interest. This may motivate students to *enrol* for a course but may not sustain them for its duration. It would be possible to reduce this problem by recruiting only students with a strong interest in the subject, but this would not deliver the number of ICT qualified workers required for the UK economy.

Many students enter university with little idea of what is involved in a computing/ICT course, or of the difference between computing and ICT. This can lead to a poor fit between student and course, resulting in poor student engagement and poor retention.

Several teachers stated that some university departments and lecturers had a poor understanding of the course content of ICT modules taught in secondary schools, or of the nature of certain vocational qualifications such as the BTEC or GNVQ.

Curriculum issues

Teachers felt that pupils did appear 'switched on' to ICT when they study it at KS1 and KS2. However, some topics are repeated between KS2 and KS3, leading to a perception that the subject is dull and that it is possible to have 'learnt it all' by KS3. This is not helped by the fact that ICT is often not taught at all to pupils in Years 4 – 6, during which schools concentrate heavily on SATs tests. By the time pupils return to ICT they have lost interest.

The problem of 'log in, log out' lessons was raised; this occurs when pupils perceive the lesson as a period in which they simply 'sit in front of the computer' but are generally passive and do not learn anything or develop their skills.

The need for CPD for schoolteachers was noted. This would provide opportunities to update their knowledge of industrial and research developments in computing and ICT, improve their general ICT knowledge and skills, and find out more about career options for their pupils. However, in order to provide useful and meaningful CPD, a substantial block of time and resource is needed as teachers have little or no spare time.

The 'ubiquity' of computers was identified as a factor which leads pupils to lose interest, as the computer is perceived as another 'white good' in the household rather than the focus of a scientific discipline or a set of professional skills.

Careers advice

ICT teachers, to whom many students turn for careers advice, may be very poorly placed to offer this because they have not worked in industry and may not themselves have an ICT degree. Better information for school teachers about careers would help to address this problem.

Visits to schools by ICT professionals working in industry and lecturers from HEIs would also help to focus students on the real career potential of computing and ICT. Careers information could also feature more strongly in subject-specific university open days.

The way in which school pupils choose courses was identified as a problem. Some will read only topic *headings* but fail to understand the depth in which subjects are taught in university. Consequently they may decide to avoid subjects which they believe they have 'done already'.

Image

Teachers and others were aware that ICT is believed by many pupils and parents to be 'unchallenging'. The 'brighter' school pupils (i.e. potential HE candidates) may feel that they already know enough computing/ICT. In addition, the subject is sometimes seen as being a 'low prestige' option by comparison with, for example, mathematics and the physical sciences.

Session 2 – Schools issues

ICT teaching in primary schools
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.

Curriculum
Many pupils may not be aware of the careers for which a computing degree would equip them. This may be especially true of *computing* rather than ICT. With the shift away from computing towards ICT in schools, pupils are likely to be more aware of the use of software applications rather than the more abstract computing. There is a big leap from using software applications to building a computer system; students need to perform a 'conceptual leap' to understand how the 'little programmes' which they write fit into the real world. Perhaps the problem is that computers work too well, and students simply see the computer as a tool to solve problems rather than as a process in its own right.

Pupil knowledge of ICT/computing professions
It is difficult to find a 'simple language' in which to explain ICT/computing professions to laypeople, including potential students. It is, in fact, relatively difficult to provide a clear definition of what 'IT work' actually *is*, compared to, say, engineering or medicine. In addition to the inherent complexity, different institutions or individuals may be inconsistent.

In addition to the diversity within IT work, pupils need to be aware of the potential for using ICT within other careers, such as architecture, design, law or medicine. This may be the inevitable situation of a 'maturing' professional field.

The question of whether employers regard the teaching offered in university departments as 'relevant' to their needs was raised. One employer reported that instead of graduates, his firm preferred to recruit 'super-users'. Pupil awareness of these attitudes may deter applications to study computing/ICT in HE.

Image
The 'geeky' image of computing and computer scientists persists, and negative images (e.g. of cyber-criminals) are widespread in the press. It is possible that the buoyant recruitment observed five years ago was boosted not only by subject interest but also by another 'media image', that of high salaries in the IT and dot com industries. The subject and the profession are no longer regarded as 'glamorous'.

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.

'Role models' who could visit schools and speak directly to pupils would challenge the poor image of the subject. They would have to be inspiring individuals who work in, or use, ICT in their professional lives. ICT teachers themselves contribute to the image of the subject. In addition, influencing the presentation of computing/ICT in the mainstream media would be useful, but the practical mechanisms of doing so are difficult.

Recruitment
The downturn in applications and recruitment to computing/ICT courses is a global phenomenon, and the potential for addressing this through changes in the UK school curriculum or school/HE relationship may be limited.

Pupils may be more willing to apply to interdisciplinary degree courses than to single-subject computing/ICT programmes. Decisions about what to study at university, or about what modules to take, may be quite 'volatile' for many young people, and allowing flexibility and multiple combinations may increase the numbers of students studying some aspect of Computing/ICT.

HE staff often believe that many students embark on Computing Programmes without a clear idea of the course content which they will encounter. However, this is not a 'new' problem, and cannot be blamed for the fall in student numbers.

Possible solutions
Encourage current students to visit schools and talk to school pupils
Help students to develop skills which will increase their employability
Ensure that pupils see how useful ICT is as a support to other careers and skills (e.g. 'if I want to succeed in marketing I need to be competent in ICT')
Recognise that pupils choices about whether to enter HE and what to study are strongly influenced by their families, who may have little or no accurate perception of ICT.
Recognise the influence of subject teachers on university entry decisions, coupled with the fact that very few teachers have training post-qualification in ICT.

Session 3 – Widening participation issues

Social class
Participants felt that increased spending in schools would not on its own bridge the social gaps which may exclude some pupils from participation. Those who have access to a computer in the home are at an advantage in finding out about ICT and building skills. However, teachers felt that students from disadvantaged backgrounds were no less likely to be interested in ICT and motivated to do well in this area, despite practical barriers.

Students from lower socio-economic classes may be less likely than their contemporaries from professional or managerial backgrounds to consider entering HE or FE. However, this is already being addressed by general widening participation programmes, such as the 'Students into School' initiative in the North-East of England. Participants were curious about the stage of secondary education at which widening participation efforts are first introduced.

Demand for places on ICT courses has *not* declined among certain 'widening participation' groups at the rate observed for the general student population. The factors which prompt this relatively high demand should be identified so that it can be sustained. In addition, initiatives to increase participation should address individual aspirations, and be designed to maximise long-term interest and career plans.

General curriculum issues
Teachers felt that the current school curriculum in ICT was putting pupils off the subject because it is highly prescriptive, and insufficiently challenging. One teacher at a school in an affluent area stated that their students had good ICT skills before taking the course and were already familiar with much of the material in the syllabus.

Another teacher stated that at their school the full strategy had *not* been implemented in order to better maintain the interest of students. Teachers felt that more information about ICT in HE, including contact with current students, would be very valuable.

It was noted that pupil needs in ICT vary very widely, from those of 'self starters' who have a strong personal interest in the subject to those of pupils who need only generic skills to support their learning in other areas. Finding a curriculum which will suit everyone is a major challenge. Good teachers can motivate and stimulate all students, but the supply of good, fully-trained teachers in IT is limited, although improving.

Several participants felt that the 'mystery', which would inspire and motivate students, is missing from the ICT curriculum. It was proposed that university departments could provide more 'exciting' material to feed into the school syllabus, following the example of other subjects such as Chemistry. Pupils – and the general public – should be made more aware of the 'big challenges' facing computing as a field.

Image and perception

Pupils may be aware that the employment market in ICT slumped following the 'dot com boom', and may also believe that many IT jobs are going overseas. By contrast, many school pupils now want to go into plumbing because they have heard there is money in it. In addition, the range of jobs available is extremely diverse and complex. Pupils may not be aware of the links between the computing/ICT which they themselves can do and career options. It was suggested that, while school ICT is 'very academic', some 'non-academic types can be good at IT'.

Phase Three: Dinner discussions

The following themes emerged from the dinner discussions:

Theme 1: Training and resources for teachers

1:1 Continuing professional development in ICT as a subject for school teachers.

This should include advanced and 'updating' materials for teachers with ICT qualifications, for whom very little appropriate CPD is currently available. Training could be delivered in a range of modes and from diverse sources, e.g. University Departments, self-help groups, networking organisations etc.

Programmes of this sort must be properly resourced (e.g. with adequate supply cover, easily accessible materials, etc) in recognition that teachers already have heavy workloads.

When contacting/emailing schools always try to contact the IT teachers themselves - information often gets lost if its sent to the Head/Deputy Head Teacher or their secretary. Information about CPD in ICT should be addressed directly to ICT teachers (rather than Headteachers or – in error – ICT support departments).

1:2 Provide ICT teachers with comprehensive, up-to-date information on IT careers

One specific area where improved CPD for schoolteachers is needed is careers advice. Pupils are often more willing to take career advice from their subject teachers than from specialist careers teachers or advisers (of whom they may be 'sceptical'). Easy access for subject teachers to current and accurate information on actual graduate destinations and opportunities would improve the quality of advice they can offer to pupils.

1:3 IT professional 'role models' and opportunities for experiential learning

'Role models' from the world of ICT, similar to those employed in SETPOINT activities, can demonstrate the range of ICT jobs which are available, and the possibilities offered by the subject. They can help pupils to understand the reality of ICT as a profession and to view it as something exciting and enjoyable; their input will also diminish the image of ICT as 'mundane'. This is especially important as people are increasingly being encouraged to aim for careers which they will enjoy. Students need strong role models of success.

Experiential learning creates a very strong impact on students at all levels, and opportunities for relevant work experience are also valuable.

1:4 Involvement of HE and industry in schools ICT teaching and careers.

The above aims can all be delivered more easily through strong links and dialogue between HE, industry, and schools.

1:5 A support network for ICT teachers, possibly organised/provided by the BCS

This would facilitate the spread 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 the curriculum changes proposed under Theme 2 below.

Theme 2: School Curriculum

2:1 Address the school ICT curriculum – is it relevant, useful and up-to-date?

CPD for ICT teachers, as proposed in 1:1, would help to ensure that course content keeps pace with developments in industry and research. ICT presents particular challenges because it is a fast-moving field and the school curriculum needs to deliver both generic ICT skills to all students, and a foundation for specialist HE or training for those who choose ICT careers.

In some schools ICT is regarded as an 'easy' subject in which GCSE pass numbers can be maximised. If taught to this end it is likely to leave students bored and poorly informed; however, if well-taught it does *not* constitute an easy option.

Demonstrating 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.

2:2 Help pupils understand that ICT has its own subject content and is not just a 'tool' to support other subjects

Some pupils regard ICT as a 'skill rather than a subject', and this damages both their engagement with the subject and their understanding of its career potential. The 'ubiquity' of computers in homes and offices, and a sense that they are 'mundane', may contribute to this. Some parents may feel that ICT is less prestigious than other subjects because they do not associate it with a career path (such as medicine or law), or because it is perceived that more 'traditional' disciplines (such as mathematics or physics) are more challenging.

2:3 Demonstrate the 'mysterious' or 'thrilling' aspects of computing and ICT

Many school teachers feel 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 Princeton and MIT 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.

Both HE and industry can contribute to building an exciting and involving ICT curriculum.

2:4 Influence policy on the ICT curriculum

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.

Theme 3: Widening participation – social diversity

3:1 Help make ICT technology available to lower socio-economic groups

It was noted that rates of computer ownership and other facilities such as broadband connection decrease with household income. Consequently students from less affluent families may not have the opportunity to explore or practice ICT skills and techniques, or to find out whether computing and ICT are subjects which appeal to them.

3:2 Promote activities which engage pupils from lower socio-economic groups.

A school teacher delegate proposed that the National LEGO League competition (in which competitors build robots with embedded microprocessors) and other contests, organised by groups such as the IEE, could serve as models. Competitions were described as a useful format because 'a winning school goes on winning'.

Other areas of good practice include the outreach work at the University of Teesside ('The Meteor Programme'), which involves teachers, pupils and also parents. This simulates the university career, offering experience of lectures, student life and graduation ceremonies, with a theme of 'celebrating being a university'. It is offered first to pupils aged 11 – 13, who are then tracked through their school career until they reach the stage of applying to HE.

Theme 4: Dialogue between HE and Schools

4:1 Inform HE lecturers about the school curriculum in ICT and CS.

Many university lecturers are unaware of the nature of current school curricula in ICT and computing. This may influence a variety of issues, such as the ways in which university courses are promoted to potential entrants, the provision of 'foundation' studies in the first year of an HE course and possibly even admissions policies.

4:2 Inform school teachers about HE courses in ICT and CS

As well as the diversity of ICT careers, school teachers need to know about the diversity of university courses in computing and ICT (e.g. the range of course titles and content, the A-level subjects which will best prepare pupils for HE study, entry requirements etc).

As more pupils choose, for financial reasons, to attend a university close to their home, links between particular schools and their local universities may well become more important in recruiting students and informing their decisions.

4:3 HE recruitment activities

University Open Days should include the opportunity for pupils to meet enthusiastic academic staff and current students. The impression given 'on the day' through personal content is vital. If pupils can be offered some 'hands on' experience of university computing, this may also help to build their understanding of and enthusiasm for the subject.

It would be helpful to identify the universities which have been most successful in recruiting undergraduates and find mechanisms to share their good practice across the sector.

4:4 Early and repeated interventions with school children

'One off' initiatives to inform children about particular career or study areas may be effective in the short term, but their long-term impact is limited or negligible. Efforts to increase participation in ICT courses and careers need to be sustained and consistent, and to be monitored to identify their effectiveness over a period of time. Starting with very young children (at primary rather than secondary school) may be the best long-term strategy.

The following issues also emerged as important:

Public understanding of computing and ICT

General public understanding of computing and ICT was felt to be in need of improvement. This is key to increasing the supply of ICT professionals. Most school pupils and their parents will have their perceptions of ICT work and study shaped by the prevailing culture. Initiatives such as the EPSRC website set up at Leeds University can contribute to a wider and better understanding of these issues.

The relative 'invisibility' of many ICT jobs and of much crucial computing technology contribute to the sense that computing/ICT is mundane, unimportant or irrelevant. Media images of ICT professionals are often absent or negative (e.g. 'computer nerds' in film and TV drama, the figure of the criminal 'hacker', 'spammer' or internet fraudster, and the lack of documentaries focussing on computer technology).

Diversity issues – mature-age students

The provision of conversion MSc courses offers a valuable opportunity for ensuring the supply of experienced ICT professionals with a good skills range, as well as encouraging more women and mature-age students into ICT work.

Diversity issues – ethnicity

The ethnic profile of the student population in CS/ICT departments in different areas of the UK and different types of university may well vary very widely. It was felt that the issue of ethnic diversity and recruitment to ICT work has not really been addressed, possibly because of the sensitivity of the subject and potential legal issues.

Professional recognition of ICT

The 'professional model' for ICT is important. It was felt that the BCS can provide a leading role as a unifying body across different sectors. Specifically, the notion of the 'ICT professional' in the modern world should be addressed. The relationship between careers in which computing is applied to a vocation and those which involve specialist computing should be reviewed. It is important to ensure that students who enter ICT courses will emerge as graduates with the skills on which they can build careers which will last a working lifetime, and to ensure that they understand how they can best achieve this.

Some delegates felt that the BCS may not 'legislate sufficiently' in relation to the qualifications required to become an IT professional. For example, students and their parents may feel that qualifications in fields such as medicine and law are more highly regulated, and therefore more prestigious, valid, up-to-date or challenging.

Summary of Identified Issues and Possible Strategies

Training and resources for school teachers, supported by strong links and dialogue between schools, HE and industry, were mentioned in several group discussions. Enhanced CPD opportunities for teachers are required, including advanced materials which allow teachers with an IT qualification to update their skills and knowledge. Teacher participation in these needs to be properly resourced so that it can be integrated with already heavy workloads. A support network for teachers, possibly managed through the BCS, would enhance this and other proposals. In addition to information relating to teaching the subject itself, IT teachers need up-to-date and comprehensive information on careers in the field. This is because many pupils prefer to seek careers advice from their subject teachers than from careers specialists, and may be more inclined to trust advice from this source. 'Role models' from IT industry, and opportunities for experiential learning, are crucial in helping school pupils to understand the true nature of IT employment and encouraging them to consider this as a career option.

The school ICT curriculum is another area which needs to be addressed. Ensuring that it is 'relevant, useful and up-to-date' is essential if pupils are to engage with the subject. Demonstrating the links with other subjects (e.g. creative arts) and with computing in everyday life can contribute to this. In addition, the trend in some schools to regard ICT as an 'easy' subject in which to boost GCSE pass numbers must be halted, as this will lead students bored and ill-informed. The 'ubiquity' of computers in everyday life may lead to the perception among some pupils that IT is a 'skill rather than a subject', and also to a sense among pupils and parents that it is less challenging and/or prestigious than other disciplines. Introducing elements into the curriculum which reinforce the 'mysterious' and 'thrilling' aspects of computing/ICT can address this. Again, HE and industry can both contribute.

Widening participation and improving social diversity are important in IT as throughout higher education, not least because this field has a relatively strong basis on which to build. Raising aspirations from an early age, and also helping less affluent families to access technology, are both important. Competitions and activities aimed at schools with large numbers of widening participation target groups can all help. Older students, and more female students, could be encouraged into IT by the provision of more opportunities to take 'conversion' MSc courses in IT. In addition, the discrepancy between the number of IT graduates from ethnic minorities and the number of IT workers from these social groups should be examined and addressed.

A strong dialogue between HE and Schools is essential to implementing other strategies, and to ensuring that students have high-quality advice before entering university and a good experience once there. Including opportunities to meet current students and gain 'hands on' experience of university computing would enhance university open days. Universities with a good track record in recruitment could communicate good practice across the sector. It is also very important that HE initiatives to increase enthusiasm and recruitment among school pupils involve early and repeated interventions.

The public understanding of computing and ICT is generally poor. Strategies to improve this are needed, not least because potential students and their parents may be basing their view of IT careers on erroneous information. Strategies to raise the 'visibility' of IT jobs and of much crucial computing technology, and to improve the media image of IT jobs and workers are required. It is also possible that publicising and strengthening the 'professional model' for IT will help improve the understanding and prestige of careers in this field.