

Computing in schools: time to move beyond ICT?

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Abstract

This article aims to consider the relative virtues of ICT and/or computing in schools, and present the findings from some research conducted in April/May 2011, with Postgraduate Certificate of Education (PGCE) and Graduate Teacher Programme (GTP) ICT students and ICT teacher colleagues in a sample of the University of East London's partner secondary schools (educating children from the ages of 11 to 16 and, if a sixth form exists, 11 to 18). The research was to discover what subject knowledge capacity East London ICT teacher contemporaries had to develop and deliver a more computing-based curriculum, and thus perhaps move their pupils beyond a more traditional ICT curriculum.

Keywords: computing; computer science; ICT; curriculum; East London.

Introduction

Information communication technology (ICT) and computing are not the same thing. Whereas ICT predominantly focuses on how to use a computer and its applications, computing is the study of how they are designed, built and programmed to work. There is a strong argument at present suggesting that what is being taught in an ICT curriculum in schools is not sufficiently developing our pupils to meet future industry, economic and scientific need in the UK. Indeed, Michael Gove, the Secretary of State for Education, has (in a speech given at the British Education and Training Technology (BETT) trade fair in London on 11 January 2012) announced his intention to overhaul the current ICT curriculum. The contention is that a greater existence of computing or computer science in schools is needed to give increased presence and understanding of the principles of programming and computing (for example) and thus allow our interested, capable and talented pupils the opportunity to confidently engage with the learning

and challenges required to meet and progress future industry need.

ICT has been an established subject in UK schools for the past 20 years, but is the current curriculum content and crop of ICT qualifications still appropriate for modern-day needs? Is it working for industry and also for our pupils? Arguably it is not, or at least it is not for *all* pupils and certainly not for an industry where an information technology (IT) skills shortage is predicted in the UK over the coming years. The Council of Professors and Heads of Computing (CPHC) (2008: 2) argues that 'the number of IT professionals with a computing degree will decline by 11%' by 2016 (on the back of an already significant decline) and 'as a result, in order to meet the existing requirements for IT professionals, without any development or growth of the technical base, this would require employers to be able to bring in an additional 59,610 HE Computing graduates from other sources'. Partly because of this, computing concepts perhaps need to feature more prolifically in our schools' ICT provision, particularly for the more gifted and talented ICT student who has a considerable wealth of IT skills already – often more than their teachers'. 'Undoubtedly IT skills are important, and every student should learn them' (www.computingatschool.org.uk), but opportunities to learn the discipline of computing, or at the very least do something to keep pupils challenged and enthralled by their ICT, need to be significantly enhanced potentially.

Over the past decade the numbers of students studying computing at post-16 level and in higher education has fallen dramatically. Between 2003 and 2010 there has been a 60% decline in students achieving A-Level computing (Royal Society 2010). The CPHC report of June 2008 suggests applications for computing courses at university level have halved in the last ten years. This is not really surprising given that an ICT General Certificate of Secondary Education (GCSE) or equivalent vocational qualification is possibly not preparation enough for undertaking an academic A-level in computing and beyond. Equally worrying though is the decline in numbers sitting GCSE ICT: 47,128 sat a GCSE ICT examination

in 2011 compared to 109,601 in 2006).¹ This is of huge concern and certainly begs the question as to why children do not want to study ICT in as significant numbers as they once did and provides evidence to support the CPHC concerns identified above. Conceivably the current ICT provision in schools is not working and the impact of this on university applications, the IT industry and the UK economy could be substantial. This article will first explore the existing ICT offer in secondary schools and the potential argument for incorporating more computing rigour in this curriculum, before looking at how easy this will be to facilitate in our local secondary schools, with current ICT teacher skills and capability.

The current UK ICT curriculum provision

ICT has been part of the National Curriculum (England and Wales) since its launch in 1988. It was originally part of the technology programme of study and was taught under this technology 'banner', often as a unit in a lower-school curriculum alongside textiles, food, resistant materials and business studies based modules. In 1995 IT became an established National Curriculum subject in its own right. Indeed ICT over the past number of years has been viewed as extremely important in a child's learning. The current ICT programme of study (2007) (<http://curriculum.qca.org.uk>) states, for example, that 'ICT capability is fundamental to participation and engagement in modern society' (p. 2), and its perceived importance in our children's education is clear.

Since 1995, ICT has enjoyed considerable growth in status in schools, with the significance of ICT learning, and technology's benefits in enhancing learning experiences, attainment and achievement, becoming an area of major focus (and investment) in most schools. This notion was supported extensively by the previous government, which invested heavily in schools' ICT infrastructure. As a consequence of this investment, the ICT curriculum also received considerable development through the introduction of the Key Stage 3 (KS3) strategy, for example, which provided a set of ICT projects to be taught throughout Years 7, 8 and 9.

These investments and developments have led to ICT becoming an established and successful subject area at KS4 (ages 14–16) and 5 (ages 16–19), with a crop of varying vocational and academic qualifications being offered over the years, thus catering for a variety of pupil needs. Most schools offer their pupils the opportunity to study something from this collection of formal qualifications, with considerable achievement by many pupils. This has often meant ICT being used

as a means of achievement for children who struggle to access more traditional subjects on the curriculum. These successes may well be one reason why future (potentially radical) ICT curriculum change could prove difficult for schools to adopt and buy into.

However, it is very reasonable to suggest that over the past years the ICT national curriculum (and the qualifications available beyond the National Curriculum provision) have been fundamental in the learning needs of our children: as one teacher colleague suggests, 'it has offered them an experience of ICT that is not, in their words, boring or technical!'. Thus a discrete ICT curriculum has ensured confidence, competence and proficiency in the main ICT areas for progression into further education and work.

Is there a need for change in our ICT curriculum?

Despite the apparent successes that the current ICT curriculum and qualification offer has brought to schools and their pupils, there is a strong argument for change. This is reinforced by the recent Ofsted report (14 December 2011) which suggests ICT teaching is inadequate in a fifth of secondary schools in England and that, in these schools, 'nearly half of students reached the age of 16 without adequate foundation for further study or training in ICT and related subjects' (p. 6).

The ICT national curriculum key processes have never really changed to any great extent over the years, and arguably have not been adopted by schools in as inventive and creative a way as is possible in terms of the way they are taught and learnt. The Royal Society (2010), for example, states that the 'design and delivery of ICT and computer science curricula in schools is so poor that students' understanding and enjoyment of the subjects is severely limited'. ICT has arguably become repetitive and boring to pupils, teaching similar content over and over again; with new and challenging learning arguably limited, our pupils (particularly our gifted and talented) become disillusioned with the subject. The innovative and inspiring developments in technology that our children are continually exposed to nowadays are not transferring themselves into school life and the curriculum as rapidly as they could or in reality should.

Also, ICT national curriculum (and KS4 qualifications born out of this) interpretation has tended to involve an over-reliance on teaching administrative-style 'skills' related to common application software. The

National Endowment for Science Technology and the Arts (NESTA) underlines this by stating in its Next Gen. report (2011: 5) that there exists 'a school curriculum that focuses in ICT on office skills rather than the more rigorous computer science and programming skills which high-tech industries like video games and visual effects need'. Therefore the current ICT curriculum has possibly grown stale. Fewer children appear to want to study ICT as a subject, and their learning needs are arguably not being met. Something needs to change to reinvigorate the interest and the challenge. Also ICT is not meeting our current and future industry requirement, leading to a potential shortage of appropriate skills and capability. This uncertainty about the effectiveness of the current UK ICT curriculum has led a number of organisations such as Computing at Schools and the British Computer Society (Chartered Institute for IT) to call for significant change to the way that ICT is taught, viewed and used in schools.

Could or should a move to computing be part of this change?

The Royal Society (2010) study into computing in schools makes a very clear case. Computing is 'every bit as essential as the need for every child to understand and be competent with elementary mathematical algebra', and as such 'should be taught alongside Mathematics, English and Humanities' (<http://www.royalsociety.org>). This goes beyond the need to potentially just transform the current ICT curriculum but champions the absolute need for computing to exist in schools because of its tangible academic value as well as its ability to meet and shape future UK economic need and help negate any possible IT skills shortage in the UK.

Ofsted recognised in its March 2009 report, the potential clear need now for rethinking ICT and how it is delivered in schools, where it discussed the educational value of teaching and developing ICT skills at the expense of improving students' ICT capability. In other words, the current development of ICT skills in how to use a computer is not enough. The Computing at School Working Group in its report on behalf of the UK Computing Research Committee (2010: 8) strongly suggests that 'treating computing as a discipline, on a par with maths and science, rather than merely as a useful skill (and one which many students now acquire early, or even at home), directly addresses these concerns'. It goes on to analyse how and why computing can engage pupils over and above a more traditional ICT approach. There is a latent challenge and excitement, for example, to

computing and programming that goes beyond the ICT our children access every day. It would seem relevant and appropriate therefore that computing perhaps should figure to a greater extent in an IT curriculum in our schools, both to reinvigorate the challenge and rationale of studying ICT (particularly in our more able pupils perhaps) and to meet the needs of industry. It is also worth noting that A-level ICT is perhaps deemed one of a number of 'soft' or 'non-preferred' subjects by top universities for degree course preparation (Policy Exchange Report 2008). Our brighter students perhaps need the option of computing to keep them on the appropriate pathway for a place at their university of choice.

Scope and possible problems in successfully delivering a more computing-focused curriculum and facilitating change

Research conducted for this article suggests that there will be problems for many existing (and beginning) ICT teachers to successfully shift from teaching ICT and also deliver a more enhanced computer science based curriculum. This will require a substantial amount of re-skilling (see Table 1). The research was conducted through the University of East London (UEL) partner schools where PGCE and GTP ICT student teachers were placed. Thirteen partner schools responded to the audit (22 colleagues in total). All PGCE and GTP ICT students (again 22 in total) were also surveyed. The purpose of the research was to discover current perceived computer science skill levels held by partner school ICT colleagues and current student ICT teachers. This allowed for a short training programme (funded through a small Training and Development Agency for Schools (TDA) computing research grant) to be created to begin to meet any skills shortage needs and support schools through any change.

The evidence is fairly compelling and suggests strongly that the successful delivery of a more computing-focused curriculum is going to prove challenging for a good number of ICT colleagues. The key (and most complex) facets of computing are proving weak in terms of subject knowledge capability in both current ICT colleagues and, even more so, the immediate future cohort of ICT teachers. As part of this research, colleagues were also questioned about their views regarding the transition to a more academic ICT curriculum. Teacher X reaffirms the possible problems that may exist in facilitating such a move: 'the challenges that my school faces when ICT moves into the academic field, is the training needed for staff in order to teach with confidence. Many teachers of ICT

Table 1 – Computing audit summary of results 2011

	Partner school colleagues – computer science subject knowledge levels of confidence	Current ICT student teachers – computer science subject knowledge levels of confidence
Fundamentals of a computer system (Hardware and software)	88%	87%
Computing consequences and implications (Economic, social, legal, ethical considerations, etc.)	84%	77%
Databases	68%	54%
Computer communication and networking (internet and networks)	62%	53%
Data representation	49%	31%
Programming	17%	13%
Problem-solving	9%	4%
Overall average computing capability	54%	45%

are not from a technical background so it will be a challenge for many teachers, especially as they can't find the time!

So the results of the research are not really surprising. There has been a lack of need to teach computing in most secondary schools, where ICT and vocational-based ICT qualifications have figured far more predominantly over the years. ICT attracts multidisciplinary undergraduates onto the PGCE and GTP teacher education courses (see Table 2).

Computing, as a discipline, forms only a proportion of the first degrees of our student teachers. In 2011 there were applications from over 31 different first-degree disciplines. Within UEL's Secondary PGCE/GTP ICT programme this year (2011), 22% of those offered a place have a computing-based first-degree background.

Table 2 – UEL PGCE/GTP ICT applicants' first-degree backgrounds 2011

First degree	% of PGCE/GTP ICT applicants
ICT-based/related	46%
Computer science	26%
Media-based	6%
Other	22%

ICT initial teacher training, sector-wide recruitment figures can be seen in Table 3. These figures clearly appear to support the notion that ICT attracts many first-degree disciplines onto its teacher training programmes. However, UEL compares very favourably with the sector and the alternative London providers, in recruiting applicants with a direct/related first-degree specialism.

Table 3 – ICT ITT sector 2009/10 figures taken from TDA providers' analysis website – <https://dataprovision.tda.gov.uk/>

Provider	Direct match	Related match	No match, National Curriculum subject	No match, not National Curriculum subject
UEL	21.05%	73.68%	0.00%	5.26%
London providers	11.54%	72.31%	1.54%	14.62%
Sector	21.95%	53.28%	3.62%	21.15%

Therefore there is considerable work to be done to attract capable computing graduates into teaching, in East London and beyond, if we are to successfully develop computing in our schools and facilitate change in the ICT curriculum area. However, in a declining world of computer science in higher education, this seems a difficult proposition, particularly when you consider the figures for the 2011 intake as identified above, where only a quarter of UEL applications are from a computing discipline. It would appear that teachers may not be entering the teacher training programmes equipped with computing subject knowledge capability and are therefore entering the profession with the capacity to teach ICT successfully but not computing. In turn and in time this means the likelihood of a school's ICT department successfully undertaking any A-level or GCSE in computing is slight, simply because their skill base just is not there – through no fault of their own. They are ICT-trained teachers not computing teachers – a product of what schools and education have demanded (and offered) over the past 20 years.

The research conducted for this article has identified a clear need to offer re-skilling opportunities to equip current ICT teacher colleagues (and new ones) in our East London area with the computing subject knowledge they require. These opportunities will support schools and colleagues in overcoming any issues they may face in moving towards a different focus in their IT provision. There is an exposed niche market and enriched collaboration that can be developed, nurtured and supported through university links and input; not to mention increased computer science applications at undergraduate level due to the reinvigorated offer and take-up at secondary school level. In order to facilitate this, the Cass School of Education and Communities in collaboration with UEL's School of Architecture, Computing and Engineering

have started to offer some continuing professional development (CPD) training in aspects of computing. As previously stated, this has initially been funded through a small TDA computing research grant, with two full-day sessions run with partner schools and current ICT student teachers in one or two of the more complex areas of computing. However, in order to further facilitate need and support any change within partner schools the aim is to create some short certificated (and maybe accredited) computing courses that ICT colleagues can undertake as part of their CPD need.

Conclusion

ICT has done what it has needed to do historically, but the argument for change is perhaps persuasive. Pupils appear to want it. Industry needs it. The ICT curriculum in schools is in need of a makeover in terms of what is taught and also (significantly) how it is taught. But should this mean a large-scale shift to computing? The evidence in this article suggests that this could be difficult for the immediate future. It is also unnecessary. ICT and computing can both sit comfortably within an IT curriculum. After all, how computers work and how they are used are interdisciplinary. However, we must recognise that they are different and separate subject areas. Our current and new teachers can be trained in enough 'small incremental steps' computing (with significant support from the university in the provision of suitable professional development opportunities). This will allow them to confidently deliver more rigorous computing topics over time, and therefore reshape and evolve an IT curriculum that needs some more 'awe and wonder' injected into it. Future recruitment into teaching needs to look more closely at computer science as a discipline for teaching IT and at ways of attracting high-calibre computer scientists who have the capacity to teach and inspire successful learning, into the profession.

It would, however, be foolhardy not to offer some ICT provision in schools. Cross-curricular only approaches are unlikely to work well, with the pupil experience likely to be very variable in developing ICT capability. Yes, children are far more confident and autonomous users of technology now, but this confidence is not necessarily channelled into the right media, meaning that they cannot become competent and proficient ICT users without the necessary focused input in schools through a dedicated ICT provision. There is still a need to teach spreadsheet system construction, for example, and there is still a need to spend time in improving capability in other software areas too. Industry and the economy need capable ICT users and practitioners not just programmers. If ICT is not delivered in schools then where will this capability come from? However, there is also a need to allow more into the curriculum, such as programming, real web design, networking and other 'under the bonnet' topics. Think about the excitement of designing an application for a mobile phone, for example. Schools must embrace technology with less hesitation and fear. Thus, over time, schools should be able to provide greater computing preparation at KS2 (ages 7–11) and 3 (ages 11–14), perhaps, and offer GCSE computing as an option at KS4 alongside more traditional ICT options. This would provide the grounding for a pupil to progress to the increased complexities of A-level (and beyond) with greater ease and provide greater challenge and excitement to an IT curriculum, while also catering for others' ICT needs where computing is not an appropriate area of study for them. The repetitiveness of the current ICT curriculum is in need of change. There must be a shift from teaching the 'skills' to establishing clear ICT and computing capability and creativity in the child's learning; enabling our next generation of pupils to have the equipped capacity to want to study ICT and computing-based courses and allowing the UK to become the leading IT talent it should be. As long as ICT is a curriculum subject then some change is probably needed. As ICT teachers we should not fear this change but engage with it and support its facilitation into our curriculum.

'When one door closes another door opens; but we so often look so long and so regretfully upon the closed door, that we do not see the ones which open for us.' (Alexander Graham Bell)

Notes

¹Figures derived from the Joint Council for Qualifications (JCQ) collated examination results, statistics and data – <http://www.jcq.org.uk> [last accessed December 2011].

References

- Computing at Schools Group (2008) '*Rationale for a GCSE in Computing*'. Online: http://www.computingatschool.org.uk/data/uploads/GCSE_Rationale.pdf, V2.1, Published August 2008 [accessed 30 June 2011]
- Council of Professors and Heads of Computing (CPHC) (2008) '*The Decline in Computing Graduates: A Threat to the Knowledge Economy and Global Competitiveness*'. Online: <http://www.cphc.ac.uk/docs/cphc-computinggraduates-june08.pdf> [accessed June 2011]
- Fazackerley A. and Chant J. (2008) '*The hard truth about "soft" subjects: Improving transparency about the implications of A-level subject choice*'. Online: www.policyexchange.org.uk [last accessed 19 December 2011]
- Livingstone, I. and Hope, A. (2011). '*NESTA Next Gen: Transforming the UK into the world's leading talent hub for the video games and visual effects industries*'. Online: <http://www.nesta.org.uk/library/documents/NextGenV32.pdf> [accessed June 2011]
- Ofsted (2009) '*The importance of ICT: information and communication technology in primary and secondary schools, 2005/2008*'. Published March 2009, Reference no: 070035.
- Ofsted (2011) '*ICT in Schools 2008 – 2011, an evaluation of information and communication technology education in schools in England 2008–11*'. Published December 2011, Reference no: 110134.
- Qualifications and Curriculum Authority (2007) '*ICT Programme of study for key stage 3 and attainment target*'. The National Curriculum 2007, DfEE/QCA.
- Royal Society (2010) '*Current ICT and Computer Science in schools – damaging to UK's future economic prospects?*'. 05 August 2010. Online: <http://royalsociety.org/Current-ICT-and-Computer-Science-in-schools/> [accessed 30 June 2011]
- Training and Development Agency for Schools 'TDA data provision'. Online: <https://dataprovision.tda.gov.uk/> [last accessed 19 December 2011]
- UK Computing Research Committee (2010) '*Computing at School: the state of the nation, a report of the Computing at School Working Group for the UK Computing Research Committee*'. V7. Published January 2010. Online: www.ukcrg.org.uk/resources/briefings/computing.cfm?type=pdf [accessed June 2011]

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