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Computer Science

The Future of Computer Science in Schools

Brian Runciman

This paper was first published by **ITNOW** (Volume 53, num. 6, Winter 2011, pp. 10-11). **ITNOW**, a **UP**ENET partner, is the member magazine for the British Computer Society (**BCS**), a **CEPIS** member. It is published, in English, by Oxford University Press on behalf of the **BCS**, <http://www.bcs.org/>. The Winter 2011 issue of **ITNOW** can be accessed at <http://itnow.oxfordjournals.org/content/53/6.toc>. © Informatica, 2011

We all know that digital literacy is vital in the modern world, but are we making sure our next generation of researchers and academics, the innovators that will produce the UK's valuable digital intellectual property of the future, are being looked after too?

Keywords: Computer Science, Digital Literacy, Schools.

With so many organisations depending on computing, computer science itself should be viewed as a fundamental discipline like Maths and English. Engineering- and science-based industries require computers to simulate, calculate, emulate, model and more, yet there is a shortage in the UK of people with the requisite abilities to run these systems. And the problem begins in school.

The Next Gen report shows that 40 per cent of teachers conflate ICT with computing, not appreciating that ICT is learning to use applications but computing is learning how to make them. This is a fundamental difference that can be compared to that between reading and writing.

Children certainly need to learn about digital literacy and BCS already addresses some of these issues with qualifications like Digital Creator, ECDL, Digital Skills, eType and the like. But teaching computing as a discipline in schools will allow children to express creativity.

Disciplines learnt in even older computing courses apply because these are based on principles. It's the skills area, such as specific programming languages, that change. Of course, practical work is still need to pick up practical techniques, but an understanding of the discipline can take children right through from primary school to a university computer science course.

What about the teachers and the schools?

Unfortunately teaching computing seems to have gone backwards in schools. In the 1980s children using BBC Micros had the opportunity to learn programming and wanted to create something using digital building blocks. But at a certain point that disappeared and schools took to teaching ICT – how to use word processors, spreadsheets and the like. Whilst these skills are useful you can't forge a career in a creative industry with them.

The qualification network has been set up in such a way that the main motivation for schools is to climb the league tables, so they go for ICT qualifications that are based around using software. The teachers available have often done a great job teaching ICT, but there aren't enough of them. So those two things together have actually lowered standards and don't create the environment where head teachers want to teach computer science-related syllabuses.

This means fighting the ethos of many head teachers that they go for a qualification because they can get a very high pass rate in it rather than getting children involved in a more demanding qualification that would lead to our next generation of innovators.

This also affects the motivation of

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> "Computer cience itself should be viewed as a fundamental discipline like Maths and English"

> “Teaching computing as a discipline in schools will allow children to express creativity”

the teachers who could teach computer science-related areas, because ICT teaching has been seen as something that can be done by anyone who has those basic IT skills.

Strange approaches

Strangely, the new English Baccalaureate doesn't have computer science, or even ICT, included in it. Even art isn't included, so this could have knock-on effects in, for example, games development, which is a coming together of art of technology.

A way of thinking of this is seeing the teaching of computing as three-layered: firstly the basic digital literacy, which most people come out of the womb with now; then the next level of the intelligent user, perhaps in architecture or the like; then there is the top layer: those who are specialists in computing and are creating new technologies and applications. These ones keep us at the forefront of the creative economy.

An interesting example of skewed viewpoints was demonstrated recently when Michael Gove spoke of Mark Zuckerberg, surely an excellent computer science role model as founder of Facebook, as having studied Latin in school. Gove didn't mention that he had also studied computer science, surely much more relevant. This shows the traditional emphasis on the classics, but computer science should also be part of the curriculum.

"*For me computer science is the new Latin*", said Ian Livingstone at this point in the discussion.

Another example of the difficulties faced in changing approaches is shown in games development as promoted by universities. There are 144 games courses at universities, but only 10 of those have been approved as fit for purpose by Skillset. Most are really updated versions of media studies, showing context and impact, but not teaching how to create games.

The codes used by universities to grade courses are also viewed as not really doing the job. The universities could help more by labeling courses more accurately.

How do we get young people excited about computer science in schools?

A drawback to the current curriculums means that a child could be taught the use of Excel spreadsheets three times over their time at school, when most could probably master it in a week. It's no wonder many of them find ICT so boring.

Parents, guardians and teachers need to be aware of the opportunities computer science can offer. What IT can do in the creative areas is exciting for children. For children in secondary education seeing the application of computer science in, for example, robotics, such as Lego Mindstorms, can show them that through a computer you can build and animate an entire world.

If they see the creative potential while they are young they will stay engaged later.

There are also exciting possibilities in the games industry – despite the bad press, 97 per cent of what is produced is family friendly – and very innovative. It's true in the financial industry too, which uses advanced modeling techniques. Many physics PHDs wind up in the city of London doing computer science activities. Computer modeling in engineering is vibrant; pharmaceutical companies are dependent on modeling too. There are huge opportunities for those with programming talent.

We could also make better use of role models. If you stopped the average child in the street they would be hard pushed to name an IT role model. Possibly they would think of Sir Tim Berners-Lee, but we need to champion these more too.

What progress is being made and what can be done?

"*This is where BCS and the Computing at Schools group have a very important role, because they can bring together the academic community, grow it and help others get involved,*" commented Andrew Herbert.

This needs to include a partnership between the universities and schools. Until recently the government was happy that there were plenty of ICT qualifications and a curriculum in place, but with the national curriculum review, it seems that the DFE now recognise not only the importance of digital literacy, but the core academic discipline of computing.

The UK needs to take this seriously when in China there are a million graduates with computer science, engineering and software engineering degrees. Some of the best intellectual property in technology is coming out of Israel, where computer science is taught in schools nationally.

Industry can help too, perhaps encouraging the young to program on new mobile platforms through competitions and the like. This is being done, but more is always helpful.

What next?

The panel agreed that computer science should be an option in the science part of STEM and that education

> “The new English Baccalaureate doesn't have computer science, or even ICT, included in it”

> “Parents, guardians and teachers need to be aware of the opportunities computer science can offer”

needs to be reformed in schools and universities. Computer science needs to be seen as an essential discipline and on the school curriculum from early stages.

Bill Mitchell concluded: "*Every child should be experiencing computing throughout their school life, starting at primary school, through to age 16, even 18.*"

Note: This article is based on a video round table discussion produced by BCS, The Chartered Institute for IT, on behalf of the BCS Academy of Computing. It was attended by BCS Academy of Computing Director Bill Mitchell; Andrew Herbert, former Chairman of Microsoft Research Europe and a key player in setting up the Computing at Schools Working Group; and Ian Livingstone of EIDOS, coauthor of the recent NESTA report, ‘Next gen’. Brian Runciman MBCS chaired.

The full video is at <http://www.bcs.org/video>.

The NESTA report is at <http://www.nesta.org.uk/publications/assets/features/next_gen>.